SOCIAL SCIENCE RESEARCH TO HELP ADVANCE REGIONAL COORDINATION AND COLLABORATION OF SEA LEVEL RISE PLANNING AND ADAPTATION ON HUMBOLDT BAY

By

Kristen Orth-Gordinier

A Thesis Presented to
The Faculty of California State Polytechnic University, Humboldt
In Partial Fulfillment of the Requirements for the Degree Master of Science in Natural Resources: Environmental Science and Management

Committee Membership
Dr. Laurie Richmond, Committee Chair
Dr. Yvonne Everett, Committee Member
Jennifer Marlow, Committee Member
Aldaron Laird, Committee Member
Dr. Erin Kelly, Graduate Coordinator

May 2022
ABSTRACT

SOCIAL SCIENCE RESEARCH TO HELP ADVANCE REGIONAL COORDINATION AND COLLABORATION OF SEA LEVEL RISE PLANNING AND ADAPTATION ON HUMBOLDT BAY

Kristen Orth-Gordinier

Humboldt Bay is experiencing the fastest rate of relative sea level rise in California and is likely to experience severe sea level rise (SLR) flooding within the next two decades. The Humboldt Bay shoreline is owned and governed by a patchwork of entities with different missions and jurisdictions so coordination of SLR planning will be critical because flooding of hydrologic areas from tidal waters can cross political boundaries. The goal of this project was to conduct social science research that can inform and advance the development of regional coordination and collaboration related to SLR in Humboldt Bay. To do this, I utilized a mixed-methods social science research approach of semi structured interviews (n=46), a survey (n=107), and document review to gather information on people’s knowledge, attitudes, perceptions, and expectations of SLR planning and adaptation.

The data indicated that coastal professionals on Humboldt Bay agreed that SLR is a near-term issue and acknowledged a need for regional coordination but did not have a clear direction for how to coordinate cross jurisdictional SLR issues. Respondents identified governance challenges to regional SLR planning and adaptation that included a lack of resources, institutional and philosophical differences, and competing priorities.
Responses indicated that environmental regulation provided both challenges and opportunities. Behavioral-related challenges and opportunities noted by study participants included leadership, trust, and personal acceptance of SLR as a phenomenon. Responses also suggested that engagement of the public by coastal professionals has been minimal and will need improvement in order to achieve more equitable adaptation strategies. This study contributes to research on the social and policy dimensions of regional planning and coordination for SLR adaptation and helps to inform local, state, and federal government of the challenges faced by coastal California communities.
ACKNOWLEDGEMENTS

This publication was prepared by Kristen Orth-Gordinier under NOAA Grant #NA18OAR4170073, California Sea Grant College Program Project #130741187, through NOAA’S National Sea Grant College Program, U.S. Dept. of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do necessarily reflect the views of California Sea Grant, state agencies, NOAA or the U.S. Dept. of Commerce.

First and foremost, I want to thank all of and those in the Humboldt Bay community that supported this work, including my research participants who shared their stories and professional networks as well as the various committees and commissions interested in listening and participating. This especially includes the careful coordination and patience by the Humboldt County Long Range Planning staff Michael Richardson, Lisa Shikany, and Sarah Wickman (Civic Spark intern). I also want to thank my adviser, Laurie Richmond, for guiding me through this process; my student research assistants, Nayre Herrera and Bente Jansen, who were instrumental in organizing and completing this data analysis; and my committee, for providing expert feedback. And last but certainly not least, thank you to Aldaron Laird, my SLR mentor, for sharing your vast knowledge and interest in this subject.
TABLE OF CONTENTS

ABSTRACT ........................................................................................................... ii

ACKNOWLEDGEMENTS .................................................................................. iv

LIST OF TABLES ............................................................................................... viii

LIST OF FIGURES ............................................................................................. ix

LIST OF APPENDICES ...................................................................................... xiii

1.0 INTRODUCTION .......................................................................................... 1

2.0 LITERATURE REVIEW .............................................................................. 4

  2.1 Frameworks for Studying SLR Adaptation Planning .............................. 6

  2.2 Challenges to Coordinated Coastal Adaptation and Planning ............. 9

3.0 METHODS .................................................................................................... 15

  3.1 Study Site: Humboldt Bay ........................................................................ 15

    3.1.1 Regulatory Environment ................................................................. 20

    3.1.2 SLR Planning .................................................................................. 22

  3.2 Document Review ..................................................................................... 24

  3.3 Semi-structured Interviews ..................................................................... 26

    3.3.1 Target Population ............................................................................ 27

    3.3.2 Interview Design and Implementation ............................................ 28

    3.3.3 Analysis ........................................................................................... 29

  3.4 Survey ....................................................................................................... 30

    3.4.1 Target Population ............................................................................ 31

    3.4.2 Survey Design and Implementation ................................................. 31

    3.4.3 Survey Response and Completion Rate ........................................... 32
3.4.4 Analysis.................................................................................................................. 33
3.4.5 Respondent Demographics and Characteristics.............................................. 34

4.0 RESULTS ......................................................................................................................... 40

4.1 Governance Barriers and Opportunities ................................................................. 40
  4.1.1 Regional Coordination and Governance Structures........................................ 41
  4.1.2 Case Study: Humboldt Bay SLR Adaptation Planning Working Group ....... 69
  4.1.3 Environmental Law and Regulation ................................................................. 73
  4.1.4 Funding and Resources .................................................................................. 83

4.2 Behavioral Barriers and Opportunities ................................................................. 93
  4.2.1 Attitudes and Job Subjectivities................................................................. 93
  4.2.2 Leadership ................................................................................................ 102
  4.2.3 Relationships and Trust ............................................................................. 105
  4.2.4 Public Engagement ...................................................................................... 109

5.0 DISCUSSION AND RECOMMENDATIONS............................................................ 123

5.1 Discussion .............................................................................................................. 123
  5.1.1 Social-Ecological Systems (SES) Framework and SLR Coordination............. 123
  5.1.2 Humboldt Bay Coordination and Governance ............................................ 124
  5.1.3 Behavior of Actors ...................................................................................... 129
  5.1.4 Public Engagement ...................................................................................... 131

5.2 Recommendations .............................................................................................. 132
  5.2.1 Recommendations for Humboldt Bay............................................................ 132
  5.2.2 Recommendations for State and Federal Agencies .................................... 138

6.0 CONCLUSION.......................................................................................................... 142
LIST OF TABLES

Table 1: Participant affiliations (some participants represented multiple stakeholder groups. Therefore, the total in this table is higher than the total number of participants interviewed). ........................................................................................................................................ 29

Table 2: Number of respondents per stakeholder category and self-identified respondent agency/organization affiliation. ........................................................................................................................................ 36

Table 3: Five potential strategies for regional coordination of SLR planning from the survey and statements of support of oppositions from the interviews. ................................................................. 47

Table 4: Statements of interest in SLR efforts from Industry and Landowner stakeholder interviewees. ........................................................................................................................................ 116

Table 5: Descriptions of the pace of SLR from interview participants. ................................. 120
LIST OF FIGURES

Figure 1: Multitier SES framework with four subsystems: resource units, resource system, governance system, and users/actors (Ostrom 2007). ......................................................... 6

Figure 2: Elements of a diagnostic framework for understanding climate change adaptation barriers (Moser & Ekstrom 2010). ................................................................. 7

Figure 3: SES framework modified for SLR adaptation (Lubell et. al. 2021). .................. 8

Figure 4: Location of Humboldt County in California, United States of America......... 16

Figure 5: Location of Humboldt Bay in Humboldt County, CA. ............................... 17

Figure 6: Natural and artificial shoreline segments around Humboldt Bay. Shoreline locations were determined using the mean monthly maximum water (MMMW) elevation of 7.7 feet (NAVD88) measured at the North Spit tidal station (data from Laird, 2013). 19

Figure 7: State Coastal Commission jurisdiction, Humboldt County Humboldt Bay Area Plan Local Coastal Program Area, and City of Arcata and City of Eureka city limits. The Coastal Commission Retained Jurisdiction (grey) shows areas of overlapping jurisdiction with local government. ................................................................. 21

Figure 8: Number of SLR-related reports and documents found that were relevant to Humboldt Bay, organized by year of publication (n=81). .................................................. 26

Figure 9: Age of respondents (n=107). ........................................................................ 35

Figure 10: Respondent level of education (n=107). .................................................... 35

Figure 11: Respondents’ frequency of involvement with SLR-related work (n=107). Frequencies were quantified as: never (no involvement), rarely (1 time or less per year), occasionally (2-11 times per year), moderately (monthly), a great deal (daily, weekly). 38

Figure 12: Respondents’ years of SLR-related professional experience (n=97). ............ 39

Figure 13: Survey respondents' level of agreement with the need to regionally coordinate SLR adaptation planning (n=103). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ......................................................... 42

Figure 14: Survey respondents’ level of priority for the creation of a regional SLR adaptation plan (n=94). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line. ......................... 43
Figure 15: Survey respondents' level of agreement that the current governmental structure is sufficient to address SLR adaptation planning (n=103). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ................................. 44

Figure 16: Survey respondents’ prioritization of the development of a governance structure for cross-jurisdictional and cross-agency coordination (n=95). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line. .................................................................................................................. 44

Figure 17: Survey respondent initial support for or opposition to various strategies for regional coordination of SLR planning (n=93-94). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ............................................. 46

Figure 18: Survey respondents’ preference for what level of government should hold the majority of the planning control and authority (n=80). ......................................................................................... 52

Figure 19: Preferred level of involvement of survey respondent’s agency/organization in regional SLR planning effort (n=89). ........................................................................................................ 53

Figure 20: Survey respondents’ level of agreement regarding the current stakeholders included in regional conversations about SLR (n=102). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ................. 55

Figure 21: Survey respondents’ preferred spatial scale to focus regional SLR coordination efforts (n=87). ............................................................................................................................................... 56

Figure 22: Survey respondent level of agreement that Humboldt Bay stakeholders generally agree on SLR risks and adaptation actions, as well as if stakeholders’ conflicting values/preferences are a barrier in selecting adaptation strategies (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.......................................................................................................................... 59

Figure 23: Percentage of respondents whose agency/organization is or is not using specific timelines and/or projections for SLR planning or advocacy (n=105). ...................... 61

Figure 24: Survey respondent level of agreement that there is clear communication between agencies/organizations about their SLR planning efforts (n=102). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.......................................................................................................................... 65

Figure 25: Survey respondents’ level of agreement that their agency/organization currently has more pressing issues that take priority over SLR planning (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.......................................................................................................................... 67
Figure 26: Survey respondents’ level of agreement that existing environmental laws and regulations present an insurmountable barrier/obstacle to SLR adaptation (n=102). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ................................................................................................................................. 74

Figure 27: Survey respondents’ level of priority for developing regulatory solutions related to wetland fill and dredge sediment reuse (n=94-95). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line. ................................................................................................................................. 76

Figure 28: Survey respondents’ level of priority for addressing planning challenges related to Coastal Commission permit jurisdictions (n=95). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line. ................................................................................................................................. 81

Figure 29: Survey respondent level of agreement with statements regarding funding of SLR planning (n=100). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ................................................................................................................................. 84

Figure 30: Survey respondents' perception of their agency/organization’s engagement over the past four years in collaborative SLR activities on Humboldt Bay (n=105-106). Non-engagement is located left of the 0 line, and engagement is located right of the 0 line. ................................................................................................................................. 85

Figure 31: Survey respondents' perception of their agency/organization’s interest in collaborative activities, if not currently engaged (n=105-106). Level of interest in engagement is located left of the 0 line, and level of interest in engagement is located right of the 0 line. ................................................................................................................................. 85

Figure 32: Survey respondent’s level of agreement regarding their agency/organization ability to begin implementing SLR adaptation plans, and activities based on their current data/information (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ................................................................................................................................. 91

Figure 33: Comparison of expectations from public (n=518) and coastal professional (n=107) respondents of when SLR might impact the Humboldt Bay region. (Public survey data from 2021 Humboldt County Planning and Building Department Public Survey). ................................................................................................................................. 95

Figure 34: Swain Slough across Elk River Road during a king tide in January 2020 (Photo Credit: Adam Canter). ................................................................................................................................. 96

Figure 35: Blue Ox Millworks and Historic Village and the Eureka Waterfront Trail during a king tide (left) in December 2020 and low tide (right) in January 2021 (Photo Credit: Kristen Orth-Gordinier). ................................................................................................................................. 96
Figure 36: View from a northern section of the Eureka Waterfront Trail during a king tide in December 2020 (Photo Credit: Kristen Orth-Gordinier). ............................................. 97

Figure 37: The Eureka Waterfront Trail during a king tide (left) in December 2020 and low tide (right) in January 2021 (Photo Credit: Kristen Orth-Gordinier). ......................... 97

Figure 38: Survey responses rating respondent level of agreement with statements about how they feel about performing SLR-related work (n=92-94). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ............... 99

Figure 39: Survey respondent level of agreement about whether leadership within their agency/organization is making SLR adaptation planning a priority (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line........................................................................................................... 103

Figure 40: Survey respondents’ level of agreement regarding their trust in the agencies/organizations they work with in order to accomplish SLR planning (n=100). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line........................................................................................................... 107

Figure 41: Survey respondents’ level of agreement with statements about SLR public engagement in the Humboldt Bay region (n=101-103). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ............. 112

Figure 42: Survey respondents' perception of their agency/organization’s engagement over the past four years in collaboratively engaging in SLR equity and environmental justice activities on Humboldt Bay (n=106). Non-engagement is located left of the 0 line, and engagement is located right of the 0 line ........................................................................................................... 113

Figure 43: Survey respondents’ perception of their agency/organization’s interest in collaborative SLR equity and environmental justice activities, if not currently engaged (n=69). Level of interest in engagement is located left of the 0 line, and level of interest in engagement is located right of the 0 line........................................................................................................... 114

Figure 44: Survey respondents’ level of agreement with a statement about SLR public engagement in the Humboldt Bay region (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line. ....................... 115

Figure 45: Survey respondents’ prioritization for various SLR public outreach efforts in the Humboldt Bay region (n=94-95). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line. .............. 117
LIST OF APPENDICES

Appendix A: Compilation of SLR Documents and References for Humboldt Bay .... 152
Appendix B: Interview Guide .............................................................................. 153
Appendix C: Interview Code List ........................................................................ 155
Appendix D: Survey Instrument ......................................................................... 161
Appendix E: Survey Results Report .................................................................... 162
1.0 INTRODUCTION

Humboldt Bay in California, USA, is the second largest estuary and bay in California, and the bay and its surrounding watersheds are home to invaluable natural resources and numerous threatened and endangered species. Humboldt Bay is also home to around 65,000 people and provides employment and recreational opportunities for thousands more. Research shows that Humboldt Bay has been experiencing one of the fastest rates of relative SLR in the entire state due to tectonic subsidence and other natural factors that cause the land to lower in elevation (Laird, 2015; Patton, Williams, Anderson, & Leroy, 2017). Members of the California Coastal Commission have described Humboldt Bay as “ground-zero for sea-level rise” (Weinreb, 2019). Due to imminent and forward-looking needs to adapt, Humboldt Bay serves as a model region, providing valuable SLR adaptation learning opportunities for other coastal communities in the state and at large.

Local studies show that with one meter of SLR, 12,167 acres of land around Humboldt Bay is vulnerable to tidal inundation (Laird, 2020). Much of this area is currently protected by natural or artificial shoreline structures, some of which are highly vulnerable to being breached or overtopped (Laird, 2013, 2020). Existing protective shoreline structures are governed by different jurisdictions and cross lands with different ownership. Because the shoreline varies in elevation and rising water can inundate large areas regardless of land ownership or jurisdictional boundaries, Humboldt Bay
stakeholders will need to consider impacts beyond their immediate control and find ways to coordinate adaptation strategies.

Research on SLR to date in the Humboldt Bay region has focused on biophysical aspects, such as how much land or development will be inundated. But SLR is just as much a social, political, and economic challenge. The Humboldt Bay community will need to address not only the biophysical impacts of SLR, but also the social, political, and economic challenges in order to make reasonable and equitable decisions. While there have been increasing calls for social science research related to SLR, this field is still developing. Most existing research has focused on the values and perceptions of residents of communities threatened by SLR (Moser, 2012; Yusuf, St. John, Covi, & Nicula, 2018). To date, there is a small, but growing, body of literature examining SLR adaptation governance in specific communities and how those communities and stakeholders are coordinating with neighboring jurisdictions affected by the same body of water.

The goal of my project is to explore context, barriers, and opportunities related to the coordination of SLR planning and adaptation in Humboldt Bay and to help inform future planning and coordination efforts. Identifying the best framework to manage and adapt to SLR must draw from the views and perspectives of the different individuals and entities involved in coastal resource management on the Bay and those who can directly influence solutions. I collected such information from coastal professionals by conducting 46 semi-structured interviews and an online survey with 107 responses to explore the following research questions:
(1) How have Humboldt Bay stakeholders experienced and perceived past and current SLR planning efforts and other collaborative efforts?

(2) What are opportunities and challenges for coordination among the diverse array of entities and stakeholders that will be affected by SLR on Humboldt Bay?

(3) How can social science research about SLR planning inform regional coordination and collaboration towards SLR adaptation and planning on Humboldt Bay as well as in other regions?

Social science research related to SLR can shed light on vulnerable communities, governance, and planning in order to help communities adapt to changing physical conditions. The successful coordination of adaptation strategies across jurisdictions on a regional basis is dependent on the interactions between individuals and communities. Social science research can help inform regional coordination efforts and highlight the importance of addressing collective impacts from SLR and SLR adaptation actions.
2.0 LITERATURE REVIEW

SLR poses many risks to ecological, economic, and social systems in much of the world, including California. The State of California has released numerous studies on the physical impacts projected to occur due to SLR, including the Ocean Protection Council’s State of California SLR Guidance in 2010, most recently updated in 2018, which outlines the State’s best available SLR science (Ocean Protection Council, 2018). In addition to information on physical impacts, these reports highlight the need to adapt to changing conditions to reduce impacts to coastal communities. Generally, adaptation is categorized into three options: protection of an asset from impact, accommodation of regular impact or disruption to an asset, or relocation of an asset to prevent impacts (Petek, 2019). State policy guidance also highlights the need to coordinate SLR planning and adaptation between state and local governments as well as between local stakeholders (California Natural Resources Agency, 2012; Petek, 2019; Cal OES, 2020; California Coastal Commission, 2018, 2020, 2021).

While there are examples of cross-jurisdictional coordination in other fields such as wildfire or watershed management, there are fewer examples or studies related to the coordination of SLR adaptation, and more specifically, information or advice for local governments on how to coordinate planning and decision making for SLR adaptation actions that could impact neighboring jurisdictions. Humboldt Bay is an ideal location to conduct a social science project about regional cross-jurisdictional coordination due to the numerous state and local entities that have overlapping or bordering jurisdiction, the
lack of topographic structural divides (e.g., mountains, bluffs, gullies) between jurisdictions that would restrict the movement of water, and the interconnectedness of infrastructure, such as transportation, water, power and telecommunications, that traverses jurisdictional boundaries to serve multiple communities.

Scholarship suggests that regional SLR in Humboldt Bay can be considered as both a cascading and a compounding risk; it is cascading because its impacts cross over to other domains/boundaries and it is compounding due to the interaction of multiple hazards (Moser, Finzi Hart, & Brown, 2018; Lawrence, Blackett, & Cradock-Henry, 2020). Regional SLR has also been described as “vulnerability interdependence,” when a local disruption creates regional impact(s), and “adaptation interdependence,” when local adaptation actions impact (beneficially or detrimentally) the adaptive capacity or vulnerability of other jurisdictions and actors within the region (Lubell, Stacey, & Hummel, 2021).

These compounding and cascading risks, or vulnerability and adaptation interdependencies, can create “collective action problems” in which actions employed or avoided by an individual jurisdiction can positively or negatively affect other jurisdictions (Lubell et al., 2021) and require cross-scale and transdisciplinary approaches to address potential social, economic, and ecological impacts (DeLorme, Kidwell, Hagen, & Stephens, 2016; Javeline, 2014). Therefore, more research on cross-jurisdictional coordination processes and governance systems is warranted to help advance SLR planning in the Humboldt Bay region.
2.1 Frameworks for Studying SLR Adaptation Planning

Researchers have developed various frameworks for studying complex, non-linear, iterative, multi-variate adaptation processes and diagnosing challenges and barriers to SLR resilience. A notable approach is the social-ecological systems (SES) framework which helps scholars identify, organize, and describe attributes of resource governance institutions that can influence collective action and the sustainability of socio-ecological systems (Ostrom, 2007, 2009; Partelow, 2018). This interdisciplinary framework allows for the consideration of interactions and outcomes related to a system’s resource units, resource system, governance system, and users/actors, as well as the effects of social, economic, and political settings within the system being studied (Figure 1).

Figure 1: Multitier SES framework with four subsystems: resource units, resource system, governance system, and users/actors (Ostrom 2007).
Researchers have adapted the SES framework to study climate change and SLR adaptation planning. For example, Moser & Ekstrom developed a systematic framework to identify barriers to climate change adaptation by focusing on interactions of actors, governance system, and the managed system, within the context of various stages of adaptation decision making and implementation (Moser & Ekstrom, 2010, Figure 2). Lubell et. al. translated the SES framework to identify governance barriers related to SLR in the San Francisco Bay Area (Lubell et al., 2021, Figure 3). They utilized semi-structured interviews, workshops, and participatory research to uncover structural governance and behavioral barriers to collective action. I used elements of Ostrom (2007), Moser & Ekstrom (2010), and Lubell et. al. (2021)’s frameworks to guide my analysis and present my results, focusing on governance, actor, and system interactions.

Figure 2: Elements of a diagnostic framework for understanding climate change adaptation barriers (Moser & Ekstrom 2010).
Figure 3: SES framework modified for SLR adaptation (Lubell et al. 2021).

“Actors,” “users,” or “stakeholders” refer to the people, or communities of people, who use a resource or could directly or indirectly influence action on that resource or resource system (Partelow, 2018; Lubell et al., 2021). Coordination of SLR adaptation planning requires interaction between various actors; interaction types can include activities such as learning, cooperating, and bargaining (Lubell et al., 2021). The behavior of actors can contribute to barriers or benefits of SLR adaptation and cross-jurisdictional coordination. Actors function within the context of a “governance system” which shapes responsibility and leadership for SLR planning and adaptation project implementation (Moser & Ekstrom, 2010; Waters, Barnett, & Puleston, 2014; Lubell et al., 2021). The governance system includes variables that can contribute to or decrease barriers to regional adaptation planning and coordination based on how it governs
coordination, decision making, and implementation within and across governments or agencies (Lubell et al., 2021).

2.2 Challenges to Coordinated Coastal Adaptation and Planning

Researchers have identified many challenges to regional coordination and adaptation planning that are related to actors and governance systems. For example, governance challenges can arise due to the level or amount of interaction and communication between actors within and across organizations (Ford & King, 2015; John & Yusuf, 2019; Moser & Ekstrom, 2010), the structure for collective decision making (Ford & King, 2015), the level of clarity around responsibility (Ford & King, 2015; Waters et al., 2014), or the types and amounts of conflicting objectives between actors (Ford & King, 2015). Other governance and actor related challenges include:

- Lacking resources and funding (Ford & King, 2015; Measham et al., 2011; Moser & Ekstrom, 2010; Moser, Finzi Hart, Newton Mann, Sadrpour, & Grifman, 2018; Picketts, 2018)
- Lacking useful or relevant science or encountering uncertainty in interpreting data (Bedsworth & Hanak, 2010; Ford & King, 2015; Lubell et al., 2021; Measham et al., 2011; Moser & Ekstrom, 2010; Waters et al., 2014)
- Lacking efficient community engagement that leads to support for adaptation (Ford & King, 2015; John & Yusuf, 2019; Lubell et al., 2021; Picketts, 2018; Waters et al., 2014)
- Conflicting policy goals (Bedsworth & Hanak, 2010; Lubell et al., 2021; Waters et al., 2014)
- Prioritizing short-term political goals (Measham et al., 2011; Moser, 2005; Moser & Ekstrom, 2010; Picketts, 2018; Waters et al., 2014)
- Lacking or inconsistent leadership (Ford & King, 2015; Lubell et al., 2021; Moser & Ekstrom, 2010)
- Conflicting attitudes/values among actors/stakeholders (John & Yusuf, 2019; Kettle & Dow, 2014b; Moser & Ekstrom, 2010; Moser, Finzi Hart, Newton Mann, et al., 2018)

According to California coastal professionals surveyed as part of California’s Fourth Climate Change Assessment, funding for planning and implementation as well as insufficient staff resources were top coastal adaptation barriers in 2011 and 2016 (Moser, Finzi Hart, Newton Mann, et al., 2018). Resource constraints can lead to longer-term problems such as focusing on short-term fixes without longevity or loss of institutional memory (Measham et al., 2011; Picketts, 2018). Another adaptation and planning resource challenge is actors lacking data or technical expertise (Lubell et al., 2021). Planners, for example, are often missing useful or relevant information needed to support climate adaptation decision making (Ford & King, 2015; Lubell, Vantaggiato, & Bostic, 2019; Measham et al., 2011) or lack the capacity to understand or translate the information (Bedsworth & Hanak, 2010; Waters et al., 2014). This data gap can also constrain public engagement due to the miscommunication or misinterpretation of information (Moser & Ekstrom, 2010). Effective communication is essential in helping
garner public trust and support and promoting a coordinated adaptation effort (John & Yusuf, 2019; Moser & Ekstrom, 2010; Picketts, 2018).

Various aspects of policy and permitting can produce barriers to SLR adaptation. In coastal California, implementation of physical adaptation projects requires coordination and permit approval from multiple agencies which can take considerable time and funding (Lubell et al., 2021). Policies can engender conflicting goals, which can cause community tension and planning delays, such as development restrictions in risk-prone areas that struggle to find balance between current economic losses and future safety concerns (Bedsworth & Hanak, 2010). Additionally, many current state and federal regulations are based on a historic status quo that cannot be maintained with climate change (Bedsworth & Hanak, 2010). If the pace of adaptation is limited by resistance to change or is subject to lengthy and costly legal battles, it may not keep up with the pace of climate change (Barnett et al., 2015; Waters et al., 2014).

Although climate change adaptation is identified by many planners as an important issue, local governments often prioritize other more immediate issues or political agendas (Measham et al., 2011; Moser, 2005; Picketts, 2018; Waters et al., 2014). In a survey conducted in California in 2011 and 2016, over 50% of coastal professionals identified that a barrier to coastal adaptation was that most of their time was spent dealing with other current pressing issues (Moser, Finzi Hart, Newton Mann, et al., 2018). Adaptation planning can be seen as a long-term issue that can be dealt with in the future to accommodate short-term pressing issues that could serve political agendas (Picketts, 2018). Although a low perceived risk of climate change events can hinder
planning (Kettle & Dow, 2014b), direct experience with those events can increase the importance of adaptation action for actors (Berrang-Ford, Ford, & Paterson, 2011; Cain, Gerber, & Hui, 2020; Ford & King, 2015).

Leadership, either political or in any other position, is another critical component of SLR adaptation (Ford & King, 2015; Lubell et al., 2021; Measham et al., 2011; Moser & Ekstrom, 2010). Without a specific dedicated job position or a mandate requiring the initiation of adaptation planning, consistent leadership becomes even more critical for maintaining momentum over the long period that planning is likely needed to occur (Moser & Ekstrom, 2010). However, informal leadership can sometimes lead to challenges if an actor does not have the resources or authority to make informed decisions or implement adaptation strategies (Barnett et al., 2015; Bedsworth & Hanak, 2010; Measham et al., 2011).

Planners and government employees working on SLR issues are in positions of leadership to directly influence policy and development decisions as well as public outreach (Kettle & Dow, 2014b). However, scholarship shows that deciding on adaptation strategies or implementing adaptation measures can be delayed due to differences in actor’s perceptions, values, and/or attitudes of the world around them (Bodin & Nohrstedt, 2016; J. Ekstrom, Moser, & Torn, 2011; Kettle & Dow, 2014b; Otto-Banaszak, Matczak, Wesseler, & Wechsung, 2011). Relationships between actors and the roles of actors can significantly facilitate or constrain cross-jurisdictional coordination in social-ecological systems (Barnes-mauthe, Arita, Allen, Gray, & Leung, 2013; Moser, Finzi Hart, Newton Mann, et al., 2018). Actors with similar beliefs are
more likely to maintain closer relationships and form coalitions (Henry, Lubell, & McCoy, 2011). On the other hand, planning may be hindered by a lack of trust between actors or perceived differences in values (Kettle & Dow, 2014b), which can lead to a lack of consensus in decision making related to adaptation strategies (John & Yusuf, 2019). Studying perceptions and mental models of local actors can inform decision making and foster consensus building (Bennett, 2016; Ford & King, 2015; Otto-Banaszak et al., 2011). Therefore, in order to advance SLR planning, incorporating processes to understand actors’ attitudes and feelings, and incorporating this information into coordinated adaptation planning, is also very important.

Successful examples of regional coordination have shown that coordinated adaptation planning requires continuous interaction of staff and networks that support the flow of information (Margerum & Robinson, 2015). Without actors to bridge jurisdictional boundaries, isolated planning could lead to maladaptation (John & Yusuf, 2019). Efficient coordination between disciplines, decision making authorities, asset owners, and vertical levels of government allows for resource and information sharing, open and transparent communication, and builds consistent leadership and trust, which would all help to overcome some of the barriers to adaptation planning and contribute to enhancing community resilience (Bizikova, Crawford, Nijnik, & Swart, 2014; Guerrero, Mcallister, & Wilson, 2015; Kettle & Dow, 2014b; Measham et al., 2011; Moser, 2005; Mukheibir, Kuruppu, Gero, & Herriman, 2013).

This study aims to provide information for Humboldt Bay and other coastal communities and to contribute to the scientific literature on cross-jurisdictional
coordination of SLR adaptation planning. Humboldt Bay’s unique landscape provides an interesting backdrop for studying SLR adaptation barriers and opportunities perceived by local coastal professionals, especially since coastal professionals in the region have been working on SLR-related work for over a decade without top-down mandates from the state or federal government. The State of California has recently devoted many resources to SLR and climate change planning and this study provides examples of the types of challenges faced by a rural northern California community with a relatively smaller economy and lower land values than other larger urban coastal California communities, such as San Francisco or San Diego. The land around Humboldt Bay is largely agricultural and natural resources, which differs from some urbanized areas, providing unique perspectives and context for natural resource planning and regulation.
3.0 METHODS

To explore the human dimensions of SLR adaptation and planning on Humboldt Bay, I conducted mixed-method social science research using document review, semi-structured interviews, and an online survey with individual coastal professionals connected to SLR on the Bay. Data were analyzed using quantitative and qualitative social science research techniques.

3.1 Study Site: Humboldt Bay

Humboldt Bay, also known as Wigi in the Wiyot Language, is located in Northern California, USA and is part of the Wiyot people’s tribal ancestral territory (Figure 4, Figure 5). Currently surrounding Humboldt Bay are the two cities of Arcata and Eureka, and unincorporated areas of Humboldt County. There are approximately 66,500 people living, and thousands more working, around Humboldt Bay (U.S. Census Bureau, 2019).
Figure 4: Location of Humboldt County in California, United States of America.
Figure 5: Location of Humboldt Bay in Humboldt County, CA.
At the start of the European invasion of Humboldt Bay, around 1850, the Wiyot people had many villages in the region, from Little River to south of Ferndale (Rohde, 2020). Through the genocide of Native people, white settlers dispossessed Native people of the land around Humboldt Bay, and between 1870 and 1910, they dramatically changed the landscape of Humboldt Bay (Rohde, 2020). Settlers constructed railroads and agricultural lands by diking, draining, and restricting tidal inundation in approximately 90% of all salt marsh habitat around Humboldt Bay (Laird, 2013). Now only 25% of the 102-mile Humboldt Bay shoreline is natural, such as a beach or marsh, while 75% of the shoreline contains artificial structures, including dikes protecting private agricultural fields, rip-rap and fortified waterfront protecting businesses of industrial areas, and a railroad prism that is no longer commercially used (Laird, 2013; Figure 6). Much of the development around Humboldt Bay, as well as most of the area’s critical infrastructure such as Highway 101, water transmission lines, gas lines, and communication and electrical transmission towers, are located in low-lying land and are protected by dike structures that were built over 100 years ago. The shoreline is also comprised of a patchwork of privately and publicly owned parcels.
Figure 6: Natural and artificial shoreline segments around Humboldt Bay. Shoreline locations were determined using the mean monthly maximum water (MMMW) elevation of 7.7 feet (NAVD88) measured at the North Spit tidal station (data from Laird, 2013).
3.1.1 Regulatory Environment

The Humboldt Bay shoreline is governed by multiple local jurisdictions. The three local coastal program (LCP) authorities are Humboldt County, City of Eureka, and City of Arcata. Additionally, the Humboldt Bay Harbor Recreation and Conservation District maintains development jurisdiction up to the mean high-water line; authority that was granted by the State Legislature. LCP authorities conduct long range land use planning, including development and resource protection. Local coastal jurisdictional authority overlaps with the state jurisdiction of the California Coastal Commission, which has appeal and retained coastal permitting jurisdiction within local planning areas (Figure 7). The Coastal Commission does not conduct long range planning or land use planning at the local level, however, does process coastal development permits within its state retained jurisdiction, which includes Humboldt Bay’s public trust lands, submerged lands, and tide lands, including diked former tide lands. LCP authorities do not have coastal development jurisdiction within state retained permit jurisdiction areas. Land within the state retained jurisdiction includes most of Humboldt Bay’s shoreline and most of the land that is vulnerable to tidal inundation (Laird, 2020). Overall, there is no single entity responsible for improvement or maintenance of Humboldt Bay’s artificial shoreline; it is a mix of public and private entities who each govern their shoreline with potentially different interests and directives.
Figure 7: State Coastal Commission jurisdiction, Humboldt County Humboldt Bay Area Plan Local Coastal Program Area, and City of Arcata and City of Eureka city limits. The Coastal Commission Retained Jurisdiction (grey) shows areas of overlapping jurisdiction with local government.
Additionally, most development, protection, or enhancement projects along the shoreline involve potential impact to sensitive coastal resources, wetlands and wildlife, which triggers the requirement for review and/or authorizations by additional state and federal permit agencies (i.e., California Department of Fish and Wildlife, Regional Water Quality Control Board, U.S. Army Corps of Engineers, National Ocean and Atmospheric Administration/National Marine Fisheries Service, and U.S. Fish and Wildlife Service). Therefore, projects along Humboldt Bay’s shoreline and areas vulnerable to SLR require consultation, coordination, and possibly compromise by multiple entities with different missions and interest.

3.1.2 SLR Planning

State emphasis and oversight of SLR planning in California generally began in 2008 with Executive Order S-13-08, which required state agencies to consider SLR in their planning and construction project. Planning for SLR by local Humboldt Bay entities generally began around 2010. Some of the earliest documented efforts I could find included the “Humboldt Bay SLR Adaptation Planning Project Phase 1: Shoreline Inventory, Mapping and SLR Vulnerability Assessment” started in 2010 by Trinity Associates, McBain Associates, and Northern Hydrology & Engineering; the “Humboldt Bay Region SLR Data Synthesis” conducted by Pacific Watershed Associates in 2011 for the Humboldt Bay Initiative; and a 2011 Humboldt State University (now Cal Poly Humboldt) Department of Environmental Science and Management undergraduate practicum project called “Implications of SLR on North Humboldt Bay” (see Appendix A for Compilation Report of SLR Documents and Reference for Humboldt Bay).
The Humboldt Bay SLR Adaptation Planning Project was a regional effort that utilized state grant funds to focus on a regional level understanding of existing bay and shoreline conditions and potential SLR impacts. Researchers found that this region is experiencing tectonic subsidence, so the relative rate of SLR is one of the highest in California (4.73 mm/yr.) (Patton et al., 2014, 2017). Additionally, approximately 40% of the artificial shoreline is equal to or less than 9.74 ft in elevation (NAVD88) and is thus vulnerable now to being overtopped with high water level events from king tides (8 ft), as well as storm surges and stormwater runoff, wind waves (0.5-1 ft), and El Niño conditions (Laird, 2013). Therefore, SLR planning not only needs to take into account future conditions, but also current vulnerabilities from the legacy of diking off former tidelands which are now low-lying areas around Humboldt Bay at risk of inundation (Laird, 2013, 2015).

A recent study estimated potential economic impacts of SLR on Humboldt Bay to include: affecting 2,686 residents in the three to four foot vulnerability area and 1,166 buildings in the eight foot vulnerability area whose structure and contents are valued at an estimated $2.3 billion (Tech, 2019). These estimates demonstrate direct impact to residents or structures in SLR vulnerable areas; however, many more people and businesses would likely be impacted by three feet of SLR due to the vulnerability interdependence of service systems and utilities around Humboldt Bay. For example, the periodic closure of critical transportation corridors due to flooding could prevent or hinder access to places of employment, public transportation services, schools and
daycares, and emergency care facilities. Therefore, the indirect impact of SLR would further exacerbate the economic impacts felt by individuals and communities.

Humboldt Bay has thousands of acres of low-lying land near the shore that hosts transportation and utility infrastructure and development. Projects in these areas (such as potential SLR adaptation projects) would require the involvement of multiple entities (local, state, federal, Tribal, public and private) with some overlapping authorities. The planners and engineers involved in the Humboldt Bay SLR Adaptation Planning Project were quick to realize that they cannot manage or protect the shoreline parcel by parcel or jurisdiction by jurisdiction, rather they needed to address entire hydrologic units and the entirety of Humboldt Bay because water will flow right over political and jurisdictional boundaries (Laird, 2015). Although the early planners recognized the essential need to coordinate SLR planning regionally, the formal large stakeholder planning group of the Humboldt Bay SLR Adaptation Planning Project dissolved when state funding ran out around 2016, and as of early 2022, no similar formal coordination body exists. As of early 2022, coordination generally occurs between a couple jurisdictions at a time as needed for specific projects or on a limited basis between a few specific local planners.

3.2 Document Review

I collected, reviewed, and collated documents and data related to SLR in Humboldt Bay to gain insights for SLR coordination. I found a total of 81 documents, which I organized into local (n=41), state (n=25), and federal (n=15) categories based on who commissioned the report or what type of agency prepared the report (Figure 8,
Appendix A: Compilation of SLR Documents and References for Humboldt Bay.

Additionally, I collected 11 sources of Humboldt Bay spatial data and identified 10 sources for interactive SLR viewers. I updated the Cal Poly Humboldt SLR Initiative Digital Commons (https://digitalcommons.humboldt.edu/hsuslri/) repository, which is publicly accessible, with the documents that I found. The repository includes a downloadable PDF of each document organized by year of publication. I continuously added documents to the repository as they became available until September 2021. These documents, which include notes/memos from relevant SLR meetings and workshops, vulnerability and risk assessments, Local Coastal Plan background information, ecological and geomorphic studies, policy guidance, and some economic analysis, help provide insight into past and current SLR planning efforts in California and Humboldt Bay.
Figure 8: Number of SLR-related reports and documents found that were relevant to Humboldt Bay, organized by year of publication (n=81).

3.3 Semi-structured Interviews

Semi-structured interviews are a common social science technique where the researcher starts with a general list of questions, but the format of the interview can shift depending on the unique interests of the respondent (Newing, Eagle, Puri, & Watson, 2010). Qualitative interviews help explore questions related to environmental management and planning, such as SLR, as they provide nuanced contextual data about the issue and social system in question (Guerrero et al., 2015; Thomas, Pidgeon, Whitmarsh, & Ballinger, 2015). I utilized semi-structured interviews in order to gain an
understanding of stakeholders’ perspectives and expectations of local SLR planning efforts.

3.3.1 Target Population

In order to identify potential interview participants, I developed a list of general stakeholder categories and specific agencies/organizations that have been or are currently involved in SLR planning, as well as those that might not be involved but have vulnerable land or infrastructure. I worked with my academic and community advisors to identify specific people from each agency or organization to recruit. We generally defined participants based on the “Coastal Professionals” definition in the 2016 California Coastal Adaptation Needs Assessment: as “…individuals involved in California coastal resource management, conservation, and protection from coastal hazards” (Moser, Finzi Hart, Newton Mann, et al., 2018). Informed by this definition, I approached professionals including public sector respondents from the local, regional, state, and federal levels, resource managers, planners, public works engineers, transportation and utility managers, elected officials, as well as representatives of environmental organizations working on coastal issues, private-sector consultants, and academia. Additionally, I also interviewed a few local landowners that lived and/or worked on vulnerable properties. My selection of potential participants was not random because participants needed to have a moderate to high relative level of knowledge in SLR planning or the local system. I recruited participants through email and asked them to voluntarily participate in this study.
3.3.2 Interview Design and Implementation

After reviewing local SLR planning documents and academic literature on SLR planning and coordination, I developed an interview protocol and a series of interview questions. Then I met with four local professionals who are familiar with local SLR planning efforts in order to receive feedback on the local relevancy and interest of questions. Once my questions were confirmed (see Appendix B Interview Guide), I submitted this project to Cal Poly Humboldt’s Institutional Review Board human subjects research and received a common rule exemption (Protocol #19-130 and Protocol #19-163) in February 2020. My interview protocol consisted of introducing myself and describing my research goals and the interview process, reviewing the consent form, and answering the any participant questions. If a participant provided their consent, I recorded audio and/or video of the interview; if not, I took notes. I asked participants a series of questions about their role and their affiliated organization’s responsibility in SLR planning, past experiences working on SLR-related work, perceived barriers and challenges to SLR planning and adaptation, ideas for conducting regional level planning, organizational needs and strengths, and perceived opportunities for the Humboldt Bay community to successfully plan for and adapt to SLR. After the interview, if requested by the participant, I emailed the quotes that I planned to use for this report to obtain their approval.

Between March-October 2020, I conducted 46 interviews with participants representing 29 organizations/individuals. I recruited participants via email and conducted interviews via Zoom or phone due to COVID-19 social distancing policies. I
only conducted one interview in person outside. Interviews averaged 1 hour 32 minutes (ranged from 13 minutes to 1 hour 56 minutes, total time 71 hours and 8 minutes).

Respondent affiliations are listed in Table 1; some were associated with more than one stakeholder group; therefore, the total number is higher than the number of participants interviewed. Approximately 11% of respondents were elected officials. I ceased data collection after I interviewed multiple people from each stakeholder group (except Tribal Government and Non-Government Organizations due to unavailability of potential representatives) and once saturation (no new information obtained) was achieved (Charnley et al., 2017).

Table 1: Participant affiliations (some participants represented multiple stakeholder groups. Therefore, the total in this table is higher than the total number of participants interviewed).

<table>
<thead>
<tr>
<th>Stakeholder Category</th>
<th>Number of Representative Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Government</td>
<td>8</td>
</tr>
<tr>
<td>County Government</td>
<td>5</td>
</tr>
<tr>
<td>State Government</td>
<td>11</td>
</tr>
<tr>
<td>Federal Government</td>
<td>4</td>
</tr>
<tr>
<td>Tribal Government</td>
<td>1</td>
</tr>
<tr>
<td>Regional District or Association or Special District</td>
<td>3</td>
</tr>
<tr>
<td>Infrastructure, Service Provider, and/or Community Services District</td>
<td>5</td>
</tr>
<tr>
<td>Non-Government Organization</td>
<td>2</td>
</tr>
<tr>
<td>Landowner</td>
<td>4</td>
</tr>
<tr>
<td>Trade/Business/Industry Group</td>
<td>6</td>
</tr>
<tr>
<td>Private Sector Consultant</td>
<td>4</td>
</tr>
</tbody>
</table>

3.3.3 Analysis

My research assistants and I utilized the audio recordings to fully transcribe each interview using Otter.ai (version Pro). To maintain participant anonymity, I randomly
assigned a number to each participant (e.g., P1, P2, P3…etc.), which is used throughout this report. I exported all transcripts to Atlas.ti (version 9.1.7.0) and analyzed them using a grounded theory approach (Martin & Turner, 1986; Newing et al., 2010). Grounded theory entails gathering data with an open mind and free of influence from other studies, in order to build theories that are “grounded in the data” (Newing et al., 2010). I created descriptive code groups/themes based on interview questions and inductively coded each transcript based on commonly noted topics and ideas by linking each code to a participant quote. As I progressed through transcript reviews, I added additional codes to capture topics and ideas noted by the participants and then briefly reviewed past transcripts to modify codes if necessary to ensure consistency between transcripts. After coding every transcript, I exported the codes and linked quotes to Excel (version 2110) for sub-theme organization and development of findings.

I developed 191 codes based on 2,234 quotations, which could be grouped by the following themes/categories: Adaptation Planning Working Group, Regional Coordination Ideas, Challenges, Opportunities, Needs, Strengths, and Miscellaneous Topics (see Appendix C for full code list).

3.4 Survey

Surveys are often used to measure stakeholder’s values or “mental models,” and are especially helpful in understanding their past experiences with and perceptions of SLR (Thomas et al., 2015). The standardization of questions can provide researchers with specific quantifiable information that can be compared across participants (Newing,
I designed the survey in coordination with the County of Humboldt Planning and Building Department’s Regional SLR Coordination and Regulatory Framework Feasibility Study, which began in late 2020, in order to directly inform the Feasibility Study. The project team chose this method to collect input from a large number of people in a short timeframe and to provide quantifiable data to review alongside qualitative interview data.

3.4.1 Target Population

Similar to our approach with the interview participants, we targeted participants who generally met the definition of “Coastal Professionals” in the 2016 California Coastal Adaptation Needs Assessment (Moser, Finzi Hart, Newton Mann, et al., 2018). Because participants needed to have a moderate-high relative level of knowledge in SLR planning and conditions on Humboldt Bay, they were not randomly recruited and selected. We recruited participants through email, requested their voluntary participation in this study and provided no incentives. Nonrandom sampling and self-selection could introduce areas of bias, but we sought to combat bias by developing broad and inclusive lists of potential participants and by sending several follow-up emails reminding and encouraging participation.

3.4.2 Survey Design and Implementation

We drew survey question inspiration from relevant literature, other climate change related surveys conducted in California, and the semi-structured interviews I conducted prior to survey development. Questions consisted of mostly Likert-scale questions and multiple choice and included sliding scales and fill in the blank/short
answers. Multiple local professionals and my academic advisors reviewed the draft surveys for relevance and clarity. Once the survey instrument was developed, we obtained Cal Poly Humboldt Institutional Review Board approval for this project (Protocol #20-148). All participants were provided a consent form at the beginning of the survey and could only participate if they consented to the terms described (see Appendix D for consent form and survey questions).

We used SurveyMonkey to distribute the survey and collect responses because an online format was suitable for the target population. In mid-May 2021 we sent an invitation to participate in the study via a SurveyMonkey email collector. If an email bounced or was blocked, we then followed up via email with a survey link. After two weeks we sent another email with the survey link to invitees who had not responded to account for any SurveyMonkey emails that were directed to spam or quarantine folders. To increase participation and reduce self-selection bias, we sent reminder emails each week either via SurveyMonkey or email and attended public meetings to introduce the survey during public comment periods. Some participants replied to our email with recommendations on additional participants and in most cases, we sent a survey link to those individuals within a couple days of the recommendation. We closed the survey after approximately one month when we felt the stakeholder representation and response rate was acceptable.

3.4.3 Survey Response and Completion Rate

We sent email invitations to 297 potential survey participants and 140 people responded. Upon closure of the survey, we deemed 33 sets of responses “incomplete” and
removed them from the dataset because the respondents completed less than 30% of the questions, which could skew the results when comparing stakeholder groups. Therefore, we utilized responses from 107 respondents for this report. The revised survey response rate was 36%.

\[
\text{response rate} = \frac{\text{total responses} - \text{responses less than 30\% complete}}{\text{total contacted}}
\]

On average, respondents answered approximately 81% of the questions. Only about 12% of respondents answered less than 60% of the questions. Those partial response rates may be due to the length of the survey considering the average completion time according to SurveyMonkey was 23 minutes and 35 seconds, or it may be due to the technical nature of the questions. Of those respondents who answered less than 60% of the questions, 50% either “never or rarely” professionally work with SLR topics, while 30% “occasionally” work with SLR topics and 20% “moderately or worked a great deal” with SLR topics. One respondent, from a stakeholder group with a low number of respondents, commented in a short answer box, “I'm probably not a great selection to contact.”

3.4.4 Analysis

We downloaded survey data from SurveyMonkey as a Microsoft Excel file. After we removed incomplete responses from the dataset, we updated response affiliations by stakeholder category. Stakeholder categories were developed by the project team, however a second question asked respondents to self-identify their agency or organization. By utilizing self-identified agency/organizations we could update responses
by re-categorizing them into consistent stakeholder categories. This also allowed for additional analysis to be conducted based on specific agencies if the sample size was large enough (n>3). It is important to note that analysis done at the specific agency level may not represent an official view of the agency/organization respondents work for and therefore is not treated as such. We ran basic descriptive statistics for each survey question using Microsoft Excel (version 2110) and created figures Microsoft Excel (version 2110) and R Core Team (version 2019). Results for survey questions not included in this report are presented in Appendix E.

3.4.5 Respondent Demographics and Characteristics

The average respondent was a white college-educated male, 45 years of age or older. The vast majority of respondents (78%) were Caucasian/European American/White; while 4% of respondents were American Indian/Alaskan Native/Native American, which was the next most represented race/ethnicity. Two percent (2%) of respondents were Asian/Asian American and 2% were Hispanic/Latino/Spanish. No respondents identified as African American/Black, Middle Eastern/North African, or Native Hawaiian/Other Pacific islander. Fifty-one percent (51%) of respondents were 45 years old or older (Figure 9) and 80% had either a Bachelor’s or Post-graduate (Master/PhD) degree (Figure 10). Fifty percent (50%) of respondents identified as male, 37% were female, and no respondents identified as genderqueer or non-binary. For all four demographic questions, approximately 12-14% of participants chose “prefer not to answer” or did not answer the questions.
Respondents represented 11 stakeholder categories and 47 agencies/organizations (Table 2). State government was the most represented (25 respondents), followed by city, non-government organizations (NGO), and private sector consultants (12 respondents each). The only stakeholder category not chosen by a respondent was “Agricultural Industry,” however some respondents that were affiliated with government entities who represent agricultural stakeholders and interests did participate in this survey and were
categorized by their state or local affiliation. Some respondents had multiple roles within the community and self-identified two affiliated agencies/organizations (i.e., a specific state government and a specific local government). Their responses were reported with the stakeholder group they chose when responding to the survey, even if it did not match both self-identified entities.

Table 2: Number of respondents per stakeholder category and self-identified respondent agency/organization affiliation.

<table>
<thead>
<tr>
<th>Stakeholder Group with Specific Agency/Organization</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academia/Research</strong></td>
<td><strong>7</strong></td>
</tr>
<tr>
<td>• California Sea Grant Extension</td>
<td></td>
</tr>
<tr>
<td>• Humboldt State University (now Cal Poly Humboldt)</td>
<td></td>
</tr>
<tr>
<td>• San Francisco State University</td>
<td></td>
</tr>
<tr>
<td><strong>City Government</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td>• City of Arcata</td>
<td></td>
</tr>
<tr>
<td>• City of Eureka</td>
<td></td>
</tr>
<tr>
<td><strong>County Government</strong></td>
<td><strong>5</strong></td>
</tr>
<tr>
<td>• Humboldt County</td>
<td></td>
</tr>
<tr>
<td><strong>Federal Government</strong></td>
<td><strong>4</strong></td>
</tr>
<tr>
<td>• Bureau of Land Management</td>
<td></td>
</tr>
<tr>
<td>• US Fish and Wildlife Service</td>
<td></td>
</tr>
<tr>
<td>• US Department of Agriculture-Natural Resources</td>
<td></td>
</tr>
<tr>
<td>Conservation Service</td>
<td></td>
</tr>
<tr>
<td><strong>Infrastructure/Service Provider/Community Services District</strong></td>
<td><strong>9</strong></td>
</tr>
<tr>
<td>(e.g., roads, water, sewer, gas, electric)</td>
<td></td>
</tr>
<tr>
<td>• Humboldt Bay Municipal Water District</td>
<td></td>
</tr>
<tr>
<td>• Humboldt CSD</td>
<td></td>
</tr>
<tr>
<td>• Manila CSD</td>
<td></td>
</tr>
<tr>
<td>• Peninsula CSD</td>
<td></td>
</tr>
<tr>
<td>• Vero Networks</td>
<td></td>
</tr>
<tr>
<td><strong>Non-Government Organization</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td>• Coalition for Responsible Transportation Priorities</td>
<td></td>
</tr>
<tr>
<td>• Friends of the Arcata Marsh</td>
<td></td>
</tr>
<tr>
<td>• Friends of the Dunes</td>
<td></td>
</tr>
<tr>
<td>• Friends of Elk River</td>
<td></td>
</tr>
<tr>
<td>Stakeholder Group with Specific Agency/Organization</td>
<td>Number of Respondents</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Humboldt Baykeeper</td>
<td></td>
</tr>
<tr>
<td>Redwood Community Action Agency</td>
<td></td>
</tr>
<tr>
<td>Redwood Region Audubon</td>
<td></td>
</tr>
<tr>
<td>Surfrider Foundation</td>
<td></td>
</tr>
<tr>
<td>Timber Heritage Association</td>
<td></td>
</tr>
<tr>
<td><strong>Private Sector Consultants</strong></td>
<td>12</td>
</tr>
<tr>
<td>GHD</td>
<td></td>
</tr>
<tr>
<td>Greenway Partners</td>
<td></td>
</tr>
<tr>
<td>H. T. Harvey &amp; Associates</td>
<td></td>
</tr>
<tr>
<td>ICF</td>
<td></td>
</tr>
<tr>
<td>Northern Hydrology &amp; Engineering</td>
<td></td>
</tr>
<tr>
<td>Stillwater Sciences</td>
<td></td>
</tr>
<tr>
<td><strong>Regional District or Association or Special District (e.g., Harbor District, etc.)</strong></td>
<td>9</td>
</tr>
<tr>
<td>Humboldt Bay Harbor, Recreation and Conservation District</td>
<td></td>
</tr>
<tr>
<td>Humboldt County Association of Governments</td>
<td></td>
</tr>
<tr>
<td>Redwood Coast Energy Authority</td>
<td></td>
</tr>
<tr>
<td><strong>State Government</strong></td>
<td>25</td>
</tr>
<tr>
<td>California Coastal Commission</td>
<td></td>
</tr>
<tr>
<td>California Department of Fish and Wildlife</td>
<td></td>
</tr>
<tr>
<td>California Geological Survey</td>
<td></td>
</tr>
<tr>
<td>California State Coastal Conservancy</td>
<td></td>
</tr>
<tr>
<td>California Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>Humboldt County Resource Conservation District</td>
<td></td>
</tr>
<tr>
<td>North Coast Regional Water Quality Control Board</td>
<td></td>
</tr>
<tr>
<td>Office of Planning and Research</td>
<td></td>
</tr>
<tr>
<td>State Lands Commission</td>
<td></td>
</tr>
<tr>
<td><strong>Trade/Business/Industry Group</strong></td>
<td>4</td>
</tr>
<tr>
<td>Coldwell Banker Sellers Realty</td>
<td></td>
</tr>
<tr>
<td>Hog Island Oyster Co.</td>
<td></td>
</tr>
<tr>
<td>Humboldt Association of Realtors</td>
<td></td>
</tr>
<tr>
<td><strong>Tribal Government</strong></td>
<td>7</td>
</tr>
<tr>
<td>Blue Lake Rancheria</td>
<td></td>
</tr>
<tr>
<td>Wiyot Tribe</td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>1</td>
</tr>
</tbody>
</table>
Elected officials made up a small number of respondents (16%); however, they represented most local stakeholder groups that have elected officials, including City Government, County Government, Tribal Government, Regional/Special Districts, and Infrastructure Service Provider/CSDs. Respondents had varying degrees of professional experience and involvement with SLR-related work (Figure 11, Figure 12). Approximately 8% of respondents had never done SLR-related work and had no SLR-related professional experience. Alternatively, almost 50% were involved with SLR-related work moderately (monthly) to a great deal (weekly, daily) and 60% had more than 5 years of experience. Overall, survey respondents seemed fairly knowledgeable on this topic, as suggested by these levels of involvement and experience.

![Frequency of involvement with SLR-related work](image)

**Figure 11:** Respondents’ frequency of involvement with SLR-related work (n=107). Frequencies were quantified as: never (no involvement), rarely (1 time or less per year), occasionally (2-11 times per year), moderately (monthly), a great deal (daily, weekly).
Figure 12: Respondents’ years of SLR-related professional experience (n=97).
4.0 RESULTS

Research results are divided into two sections. The first, 4.1 Governance Barriers and Opportunities, focuses on structural challenges related to interjurisdictional coordination and regional SLR adaptation. Major themes include cross-jurisdictional governance preferences, coordination challenges, balancing the permitting status quo and innovation, and the need for more resources. The second section, 4.2 Behavioral Barriers and Opportunities focuses on how actors within the governance system contribute to coordination and adaptation barriers and opportunities. Major themes include attitudes around climate change and SLR, job subjectivities of coastal professionals, leadership, trust, public engagement, and issues related to uncertainty and novel science. While I am unable to report every topic discussed by my study participants, results focus on the topics most frequently noted overall or most frequently noted by specific stakeholder groups during semi-structured interviews conducted in 2020 and an online survey conducted in 2021.

4.1 Governance Barriers and Opportunities

The structure of governance system can influence how collaboration occurs across geographic areas and governmental or institutional scales for the implementation of regional SLR adaptation solutions (Lubell et al., 2021). Because it can shape how actors within a system interact, the governance system and the actors’ perceptions of the governance system are important to understand in the context of regional collaboration.
In this section, I report results from the survey and interviews related to the preferences of Humboldt Bay coastal professionals for various governance structures to support regional SLR planning, general challenges with stakeholder SLR coordination, experiences with SLR issues and existing environmental regulations, and resource limitations and opportunities.

4.1.1 Regional Coordination and Governance Structures

The survey instrument and interview guide both contained questions related to regional coordination, including questions linked to belief in the importance of coordination, strengths and challenges for coordination, and preferences for a future structure to support coordination. This section highlights some of the key findings on this topic, including the finding that study participants recognized that increased coordination of SLR planning among the various stakeholders will be an important element of adaptation efforts in Humboldt Bay. Study participants also acknowledged general challenges with coordination that any local regional governance structure could experience, including asynchronous paces of planning and project implementation by different jurisdictions, different perceptions of SLR risks and actions, limited resources, competing interests within and across agencies/organizations, and the difficulty balancing collective interests. I summarize these themes below.

Perceived need for coordination and governance changes

Results indicate a perception among Humboldt Bay coastal professionals that some increased amount of regional coordination is necessary in local SLR adaptation planning. Ninety-five percent (95%) of survey respondents agreed that SLR planning and
adaptation success requires coordination between local governments, Tribes, management agencies, and the public (Figure 13). Interviewees corroborated this sentiment with statements such as, “any solution that isn’t a group solution is unlikely to be successful” (P24) or “…it doesn’t make sense going alone and seeing what would happen without working [together], it wouldn’t work... it’s got to be a collaborative effort” (P21). Study participants perceived coordination as essential for many reasons, some of which include Humboldt’s unique geography, existing development on diked former tidelands, as well as cascading and compounding effects that could occur due to impacts to transportation and utility infrastructure. Interviewees also noted that a coordinated effort could help the area attract funding, make permitting easier, and improve the capacity of local entities to share resources and expertise.

Figure 13: Survey respondents' level of agreement with the need to regionally coordinate SLR adaptation planning (n=103). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

We asked survey respondents how they would prioritize the creation of an overarching regional SLR adaptation plan for Humboldt Bay. The vast majority of respondents thought it was a high or essential priority (80%), 10% thought it was a medium priority, 4% designated it a low priority, 6% were not sure and choose “I don’t know,” and no respondents said it was not a priority at all (Figure 14).
Many interviewees commented on the challenges involved in developing an effective coordination framework – one described as “three-dimensional chess” (P21). Coastal professionals indicated that one reason SLR planning is so complex is due to the many stakeholders that need to be involved. One engineer described,

“There's just a lot more that goes in to SLR projects... if you're away from the water [including aquatic habitats and the Coastal Zone], projects can be a little bit more simple, you just have less regulatory agencies and less agencies involved in general.” (P11)

Interviewees noted that it takes a lot of time to meet with other stakeholders and experts and then to absorb and digest information presented or shared. And when it comes to making decisions on how to proceed, one interviewee said, “it's really hard to pick losers” (P15) and another said, “a lot of people don't really want to consider [SLR] because it's hard” (P2). Coordination challenges are exacerbated because, as this interviewee shared, “Unfortunately, there's not a single voice or a single entity, and only a portion of the people that matter are at the table” (P27).

While there was overwhelming recognition that coordination of planning and adaptation strategies is crucial (Figure 13), 50% of survey respondents thought the
current governance structure was not sufficient for addressing SLR impacts and concerns on Humboldt Bay (Figure 15) and 57% thought it should be a high or essential priority to develop a formal governing structure for working regionally across jurisdictions and organizations (Figure 16). Interview responses and document review indicated that there is no single entity responsible for shoreline maintenance or SLR adaptation planning on Humboldt Bay. Currently in SLR planning efforts, most of Humboldt Bay stakeholders are using “informal coordination” through various self-organized meetings; few formal agreements have been established.

Figure 15: Survey respondents’ level of agreement that the current governmental structure is sufficient to address SLR adaptation planning (n=103). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Figure 16: Survey respondents’ prioritization of the development of a governance structure for cross-jurisdictional and cross-agency coordination (n=95). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line.
**Governance structures**

We asked survey respondents to note their level of support or opposition for five different levels of coordination, ranging from no coordination to the creation of an entirely new regulatory entity (Figure 17). The options provided were based on ideas collected during the interviews. The creation of a formal collaborative partnership (e.g., Memorandum of Understanding, Memorandum of Agreement, Joint Powers Authority) was the most supported, with 79% of respondents favoring this option. A majority of respondents also favored empowering an existing regional authority (65%) and engaging in informal coordination (55%). Respondents had the most neutral responses (35%) for establishing a new regional authority, which may be due to the uncertainty around what such a large change would entail. According to this survey, over 60% of respondents strongly opposed, and another 25% somewhat opposed, the idea that no regional SLR planning should occur. Additional ideas expressed in an open-ended survey question included the development of a multi-agency task force to identify action items for areas across jurisdictions, and development of MOUs to outline budgets and timelines for those areas, as well as consideration of the political aspects of selecting an entity to lead, including fitness for the task and the potential that such a designation would cause resentment from other agencies.
Figure 17: Survey respondent initial support for or opposition to various strategies for regional coordination of SLR planning (n=93-94). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Ideas from interview participants on how to coordinate generally followed similar trends as the survey responses. Although participants suggested a variety of ideas, there was no consensus regarding how to move forward with regional planning, only that some level of coordination is crucial. There were very few interview participants who seemed confident in describing how they thought Humboldt Bay stakeholders should coordinate. Many participants added caveats to their responses such as, “I don't think there's a simple answer” (P20) or “There's probably a number of ways you could look at it” (P11). And some participants responded simply, “I mean, I just don't know at this point... I don't think any of us know” (P5) or “I don't know, we just need to start sketching some stuff”
out” (P27). Although many stakeholders were not sure about the right path forward, they usually provided some potential options or ideas. Table 3 shows example interview quotations that are generally in support or opposition of each of the five strategies identified in the survey. Some quotations discuss multiple types of strategies, demonstrating the lack of clear direction or illustrating potential hybrid approaches. No interviewee expressed support for having no coordination.

Table 3: Five potential strategies for regional coordination of SLR planning from the survey and statements of support of oppositions from the interviews.

| Strategies                                                                 | Support                                                                 | Opposition |}
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No regional planning should occur, local jurisdictions should individually respond to SLR as they see fit.</td>
<td>none</td>
<td>So, any one of us that starts planning in a vacuum is doomed to failure in my world, because there's just so many interconnections between what we are and what we do, and everyone else. (P24)</td>
</tr>
<tr>
<td>Engage in the sharing of information and coordinated planning with other organizations through working groups with no formal agreement or commitment (e.g., an initiative).</td>
<td>I think there needs to be something similar to this Humboldt Bay SLR Adaptation Group, you know, some organization like that needs to be formed... to both enable people to find out more about what science is saying about SLR, but also to take input into these planning processes. (P1)</td>
<td>And so, if you were to adopt a regional adaptation strategy...that would commit their agencies to implementing that strategy. That would have to be vetted by those agencies, and the decision would have to be made by the decision-making body of those entities, not the staff who are attending the meeting. (P4)</td>
</tr>
<tr>
<td>Strategies</td>
<td>Support</td>
<td>Opposition</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Create a formal collaborative partnership between existing agencies and</td>
<td>I think we probably look toward the Climate Action planning effort as a</td>
<td>I think that a JPA is messy every time. It always gets complicated... I</td>
</tr>
<tr>
<td>stakeholders to address sea level rise (e.g., Memorandum of Understanding</td>
<td>desired outcome of this regional planning effort, where all the</td>
<td>think in the shorter term, it would be more likely that it's a MOU</td>
</tr>
<tr>
<td>[MOU], Memorandum of Agreement, Joint Powers Authority [JPA]).</td>
<td>jurisdictions are coming together voluntarily with a shared vision of</td>
<td>between agencies that facilitates this cooperation. In the future when</td>
</tr>
<tr>
<td></td>
<td>complying with these new state requirements in a meaningful way. And</td>
<td>it comes to ultimately, financing and executing implementation projects,</td>
</tr>
<tr>
<td></td>
<td>committing staff and resources to that effort. Being wholehearted</td>
<td>then that could change. Then maybe there would be a need for something</td>
</tr>
<tr>
<td></td>
<td>partners in that effort. And so, to me that's kind of the desired body.</td>
<td>like the JPA. I don't know what that would look like at this point. (P33)</td>
</tr>
<tr>
<td></td>
<td>Where whoever the key players are, the ones that need to be at the table,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>are there, fully engaged, committed and willing to allocate staff and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>financial resources to support the effort. (P36)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>... like a JPA between everybody to come up with a regional sea level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rise plan. Maybe it's going to take something like that. (P31)</td>
<td></td>
</tr>
<tr>
<td>Empower or retool an existing regional agency (e.g., Harbor District,</td>
<td>The jurisdictional boundaries aren't going to stop the rising tides. I</td>
<td>I don't think anybody's really set up for it. (P13)</td>
</tr>
<tr>
<td>Humboldt County Association of Governments, Humboldt County Flood</td>
<td>think there needs to be either broad support and buy in to some</td>
<td></td>
</tr>
<tr>
<td>Control District, etc.) to serve as a lead agency to coordinate and</td>
<td>underlying principles and goals amongst the various jurisdictions along</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with some strong leadership in coastal planning. Or there needs to be</td>
<td></td>
</tr>
<tr>
<td></td>
<td>an agency that either is formed or is appointed to take that leadership</td>
<td></td>
</tr>
<tr>
<td></td>
<td>role. (P7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>So, it seems to me like what we need is a single entity that brings</td>
<td></td>
</tr>
<tr>
<td>Strategies</td>
<td>Support</td>
<td>Opposition</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>address regional sea level rise.</strong></td>
<td><em>everybody together, creates this plan, and creates milestones based on, 50 years out, 100 years out, 150 years out, and with a monitoring component, just so it becomes very clear what the plan is, because right now we have pieces to the plan. We don't have anywhere close to implementation.</em> (P27)</td>
<td></td>
</tr>
</tbody>
</table>

| **Establish a new regional authority to address sea level rise (e.g., Joint Powers Association, Special District).** | *So, if we were to all agree that sea level rise is a priority, which we have already pretty much, and we needed to create a regional entity in order to manage the response to planning, creating JPA to be tasked with doing that might be a way forward. Or we could just use the communication and the collaboration that we've already work with... But if you've got to implement the plan, that's going to require quite a bit of decision making and agreement on a legal basis, because now you're talking about property, etc.* (P17) | *The last thing that we need is another regulatory authority to address these things. I think that that is just asking for more... we have enough oversight of it.* (P29) |

When discussing informal coordination, many interviewees noted the Adaptation Planning Working Group (APWG) or Humboldt Bay Initiative as an example. Concerns about informal coordination centered around lack of decision-making authority, lack of the ability to commit or enforce strategies, and stakeholder meeting fatigue. Participants noted that a formal group could better ensure stakeholder commitment. Many interviewees discussed potential formation of a “new entity” without determining if it
would be through the empowerment of an existing entity or creation of an entirely new regional authority. While participants shared some ideas of local and state agencies with existing jurisdiction over area vulnerable to SLR, participants cited concerns about empowering existing agencies due to current lack of funding, staff capacity, or expertise. The main concern around creating an entirely new entity was the complexity of creating and maintaining it. Some participants thought a newly created or empowered entity might be necessary for financing and implementing projects and would also provide a central entity or liaison to contact and engage with.

One strategy not captured in the survey that was mentioned frequently in the interviews was nesting scales of coordination. For example, there could be multiple subgroups or working groups organized based on similar assets, common interests, or specific areas where infrastructure/assets overlap jurisdictions and the subgroups could operate within a hierarchical system contributing to a larger effort, like “spokes on a wheel” (P37). One interviewee described a potential structure like this,

“You know, you probably need to create different types of groups for people to work through different types of questions. You've got the highly technical questions that need to be worked through, you've got social, political, public access questions that need to be worked through, you've got regulatory questions. But even within each of those, I think you need a facilitation body that can cultivate some relationships and get an initial understanding, and broker a little bit of, if not trust, at least relationships. So that you know how to start those early conversations with these big groups.” (P26)

The concept of a neutral facilitator, like the one described above, was mentioned by at least eight interview participants. They noted that a facilitator could help to guide and manage an efficient and effective process (P20), keep people engaged and energized (P7,
P28), facilitate constructive dialogue (P15), and encourage consensus or compromise between stakeholders (P20). Additionally, a neutral facilitator could help people feel they are being heard and balance differing needs with less bias (P28, P26).

**Government leadership**

We asked survey participants about their thoughts on what level of government should hold the majority of planning control and authority. Only 4% of respondents thought planning authority should be shared at the state and federal level or federal-only level. Interviewees rarely brought up federal involvement in a regional planning effort, except when discussing funding or permitting. The vast majority of survey respondents (64%) preferred the planning authority to be under local and state control, while 19% preferred local-only control and 14% preferred state-only control (Figure 18). One participant thought there was need for both local and state involvement by sharing the following,

“In certain contexts, the local government, by definition, is taking the lead on planning, but there's certainly a role for state agencies. You know, whether it's reviewing these local coastal programs, providing grant funds, working on the science... And so, there's really a need in all levels for people to be involved. ...you know, the way planning is done in California, and across the nation, there's more of a local emphasis and so I don't think [the state] would be the lead per se, but [the state] would need to be heavily involved.” (P1)

Although many interviewees acknowledged the need for state involvement, some participants shared concerns about potential “one size fits all” approaches by the state. A couple interviewees also shared a similar sentiment as this interviewee,

“I don't think it would work very well for a state agency to come in and say, ‘Okay, we're gonna do this and you guys should come and then
coordinate. ‘Because I think that would look more like somebody imposing it on people as opposed to people being involved in the process.’” (P40)

Generally, interview and survey results indicated that local planners have a preference for a structure with some combination of local and state control.

Figure 18: Survey respondents’ preference for what level of government should hold the majority of the planning control and authority (n=80).

Stakeholder level of involvement

In addition to asking about the planning authority, we asked survey participants about how involved their agency should be in a regional SLR planning effort. As shown in Figure 19, only 7% of respondents indicated a preference to lead a regional SLR planning effort. When discussing the structure of regional coordination with interviewees, a few agencies were continuously mentioned as potential leaders: the most commonly cited included Humboldt County, the Harbor District, the Cities of Arcata and Eureka, and the California Coastal Commission. According to the survey, however, on average,
no stakeholder group indicated a desire to lead. The most common reasons stated in the interviews for not wanting to lead a regional planning effort included low staff capacity, limited funding, not enough time available, and/or lack of relevant jurisdictional authority. Additionally, some interviewees thought there shouldn’t be one leader, rather leadership should be shared equally among several entities.

Most respondents indicated that their agency/organization should participate (55%) or should be involved in a mix of participation and leadership (26%) (Figure 19).

![Preferred level of involvement](image)

Figure 19: Preferred level of involvement of survey respondent’s agency/organization in regional SLR planning effort (n=89).

Many interview participants thought their agency should be involved but should not be the primary leader, such as this interviewee, “I think clearly we are one of the agencies that needs to be at the table. Who’s at the head of the table? Like, I’m not sure” (P13).

The average survey responses of the stakeholder groups of County Government and the Harbor District (when separated from other Regional/Special Districts) indicated a
preference between participating and leading. Average stakeholder group answers for Federal Government, City Government, State Government, Tribal Government, and Academia all indicated a solid preference in participating.

Only 12% of survey respondents indicated they should either be rarely involved or not involved (Figure 19). On average, stakeholder groups comprised of Infrastructure/Service Providers, Business/Industry Groups, NGOs, and Consultants indicated their involvement should lie between participation and no involvement. However, in interviews, participants identified infrastructure and asset managers as stakeholders that should be highly involved.

*Missing stakeholders*

We asked coastal professional survey respondents about their level of agreement regarding whether all the right stakeholders are in the room during regional conversations about SLR. Only 5% agreed that all the right stakeholders were included, 57% were neutral, and 38% disagreed (Figure 20). A follow up fill in the blank question requested that respondents write in any groups, organizations, sectors, or types of people that they think have been missing or not sufficiently included in SLR-related planning and activities on Humboldt Bay. The most indicated group included private property owners, residents, taxpayers, and business owners. Slightly less frequently, respondents noted that disadvantaged and environmental justice communities, Tribes, and communities highly vulnerable to SLR should have a seat at the table. A few respondents mentioned specific land and asset managers, community services districts, and public interest/user groups such as environmental groups. The most frequent industry noted was the agricultural
community, with fishing, cannabis, construction and development, banking, and insurance industries also mentioned. Section 4.2.4 (4.2.4 Public Engagement) includes additional information on public engagement and inclusion of some these groups in SLR planning.

Figure 20: Survey respondents’ level of agreement regarding the current stakeholders included in regional conversations about SLR (n=102). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

**Spatial scale**

We asked survey respondents to identify what spatial scale should organize regional coordination. Thirty-seven percent (37%) of survey respondents thought that planning should be either focused on a watershed unit or other unit that is smaller than the entire bay. Sixty-two percent (62%) of respondents thought regional coordination should occur on a bay-wide scale (Figure 21). One interviewee said,

“Well, it needs to happen on a bay wide scale... I could see where maybe the best way to do it would be to have it almost broken up into pieces, but like four pieces or something quarters, thirds, something like that. With the goal of them all, also interacting with each other for an overall goal, but maybe almost like subgroups part of a bigger group, potentially.” (P27)

And another described that “people need to take a lead role within each discrete spatial area” (P8). This interviewee discusses the importance of building leadership at multiple
scales, a concept shared by many interviewees in the context of how a regional planning structure as described above might be composed.

Figure 21: Survey respondents’ preferred spatial scale to focus regional SLR coordination efforts (n=87).

Although no survey respondents thought that regional planning should occur on a project-by-project basis, some interviewees provided reasons why a project-level scale would be important to consider. One interviewee said,

“I think it would be more beneficial if it was more project based somewhat, kind of like the [Eureka] Slough Project. Everybody's on a different planning timeline and when their general plan or the coastal plan gets updated is on a different date. That collaboration would be good on a project base for certain things that could benefit multiple jurisdictions.” (P29)

The “Eureka Slough Project” referenced by this interviewee occurred within the Eureka Slough hydrographic unit with a project focus of developing adaptation planning options for specific infrastructure and resources within that area (GHD, 2021). In addition to
timeline considerations, this interviewee shared that a project-level scale was important due to other social and technical considerations,

“A bay-wide approach is important...But it's not sufficient in terms of thinking and moving towards actual adaptation actions. It's too big. There are just too many stakeholders, too many decision makers, the natural processes that are critical to understand are too complicated.” (P20)

Both interviewees quoted here demonstrate the need for SLR planning at multiple scales.

**Perceived differences in problem definition and adaptation approach**

Multiple interviewees noted that there was not currently consensus on how to move forward with regional planning or SLR adaptation planning in general. A coastal professional commented, “I think there's competing visions. And I think it's too early to assume that there can be consensus on a vision. So, we're in the early stages of negotiating a vision for Humboldt Bay” (P20). Interviewees discussed challenges with how stakeholders perceive SLR issues differently and have different ideas for how to approach solutions. These challenges can lead to difficulties in regional coordination, as described by this interviewee,

“The challenges I would say are, first of all getting everybody to agree to a shared purpose. We're not on the same page and that's a barrier and a challenge to developing a cohesive regional model. And maybe it's not. Maybe the model can accommodate differences in approaches. But there are ways that these differences in approaches may end up making the overall mission fail. Like for instance those uses that occur on either side of a city boundary, if each jurisdiction is going in their own direction on either side of the boundary, you're going to have different approaches that are being implemented. And to the extent that one approach is less protective of the asset, then that's going to result in the asset in the area that's more protected being compromised.” (P36)

To collect information on these differences, we asked survey participants about perceptions of risks and adaptation actions. Survey respondents were fairly evenly
distributed between agreeing (32%), feeling neutral (32%), and disagreeing (34%) that stakeholders agree on risks posed by SLR (Figure 22). Some of the interview discussions about understanding SLR risks revolved around differences in interpreting uncertainty and the timelines for SLR impacts. One interviewee summarized how this uncertainty, coupled with other challenges such as politics and access to resources, can exacerbate issues with coordination,

“I think there’s a level of uncertainty that you’re never going to get around. But it just makes it harder for people to bite the bullet in working together and it just leaves more room for people to take different approaches. And that’s I guess where politics is coming into play as well. But we know the sea level rise is coming, and it’s going to happen, but we don’t really know when. And planning departments I think generally had like a 20-year timeframe and we’re looking at asking people to plan for 30 years or for 80 years. So, it’s really different and it’s hard to make tough decisions that far out with imperfect information, and politics and budgets that are not leaving you a lot of room to maneuver. So, I think those are all things that make sea level rise planning challenging and coordination challenging, because I feel like those issues play out really differently in different communities with different resources and politics and histories.” (P19)

A few people thought that updated and ground-truthed data could help stakeholders understand the problem and develop solutions. However, another interviewee cautioned,

“we don’t want to wait forever for perfect information, but it also can’t be so conservative that we’re prematurely foreclosing options” (P20).
Figure 22: Survey respondent level of agreement that Humboldt Bay stakeholders generally agree on SLR risks and adaptation actions, as well as if stakeholders’ conflicting values/preferences are a barrier in selecting adaptation strategies (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Very few survey respondents (11%) believed that stakeholders agree on the actions needed to address SLR. Most respondents (53%) felt that stakeholders did not agree on the necessary actions (Figure 22). Approaches differed in considerations of timeline, scope, scale of adaptation, and interpretation of the problem of SLR. For example, these two interviewees discussed different approaches based on their differing interpretation of SLR scenarios:

“Okay, let's take worst case scenario, these guys over on this slide are saying it's three meters, and you guys over here saying it's only one, but let's be cautious. If we're gonna put all the expense of having the equipment out there and doing the environmental work, let's build for the worst and hope for the best.” (P32)

“...the worst-case scenario, it's not a very likely case scenario, in the way that we plan for things... And I don't think that you can make a reasonable argument that the risk at those scenarios is so extreme that we shouldn't take advantage of the economic investments already in these areas.” (P7)
Although they offered different approaches, both interviewees above, which were from different stakeholder groups, were concerned about economic aspects of SLR. As noted in Figure 22, most survey respondents either felt neutral (43%) or agreed (48%) that conflicting values could hinder stakeholder agreement in selecting SLR adaptation strategies (Figure 22). Interviewees indicated that some of these values could be influenced by political or geographical differences. Data indicated that stakeholders who may be impacted by SLR have a variety of political priorities and focus on different assets which can influence their desired approach. Additionally, interviewees mentioned that SLR will physically impact jurisdictions differently based on their geographies, which could also influence their approach. These perceived differences could provide challenges to developing a “shared vision” or “cohesive regional model.”

*Inconsistent interpretations of data*

Seventeen coastal professionals discussed the need for consistent data use and interpretation between stakeholders, such as data on timelines and projections. They noted that if stakeholders would agree on an acceptable model for Humboldt Bay, it would reduce ambiguity for stakeholders working on project engineering and implementation. For example, “*We need to get to a true working standard, so we all know what the game is! Everybody is having to guess and hire their own engineers and do all their own stuff. We just need a standard and that comes back to the data*” (P23) said one engineer. Coastal professionals recognized that it will be a challenge to find an acceptable model that the majority of stakeholders agree on due to differences in people’s tolerance for risk and different visions for Humboldt Bay’s future.
Respondents were asked if their agency/organization is using a specific timeline and/or projection for their SLR planning or advocacy work. Approximately 40% of respondents noted that their agency/organization was using specific timelines/projections (Figure 23). Answers ranged from 1.6 feet by 2040, 1.9-3.5 feet by 2050, 3.3 feet by 2057, 3-3.3 feet by 2016, 4-12 feet by 2070, or 2.7-10.9 feet by 2120. Respondents who provided additional details via fill in the blank and short answers shared that their guidance came from local planning documents and vulnerability assessments (n=16), OPC SLR guidance (n=16), other state-level documents (n=3), and some were not sure of the specific source of their timelines/projections (n=3).

Figure 23: Percentage of respondents whose agency/organization is or is not using specific timelines and/or projections for SLR planning or advocacy (n=105).
Almost 60% of respondents were not using specific timelines/projections (Figure 23). Survey participants who addressed a short answer question about why they were not using specific guidelines (n=60) responded that: guidance wasn’t relevant to their organization (either due to a different mission/role or they rely on other partners for that information such as from state government or permit agencies); their organization was complacent and therefore not planning for SLR; it was something they would “deal with in the future;” or there was limited data availability to make those decisions. Some respondents reported that a change in leadership or organizational structure hindered their SLR planning processes or that they were dealing with a lack of resources, including being unable to dedicate resources to SLR planning because it was “beyond our collective bandwidth” as volunteers. Some respondents noted that they chose “no” because they were unsure if they had specific guidance or because they were currently in the process of planning or just started those discussions. In addition, some respondents noted that their agency/organization was using a strategy different from planning with timelines and/or projections. Some strategies included focusing on risk tolerances, using elevation/inundation levels rather than timelines, considering different scenarios or ranges of projections/timelines, or using the best available science depending on the project/location/goals.

Within each stakeholder category, and even within each agency/organization, there was variation in answers to this yes/no question. While this could illustrate inconsistencies within a group, it’s possible this reflects normal differences between departments (i.e., Long-range Planning and Engineering) or that stakeholder groups
consist of agencies that require different focuses (i.e., State Government: CDFW or Caltrans). Although sample sizes were small, there seemed to be some differences within stakeholder groups and even specific agencies. For example, in County Government three respondents choose no and two choose yes, in City Government (with minimal difference between the two cities) three respondents choose no and eight choose yes, and of respondents who were affiliated with Caltrans, four responded no and seven responded yes. The stakeholder groups of Federal Government (n=4), Infrastructure/Service Provider/CSDs (n=5), and Business/Industry Groups (n=4) were the only respondents to all indicate that their entity is not using a specific timeline or projection.

**Competing modes and frameworks of planning**

**Disjointed timelines**

Interviewees acknowledged that differences in local jurisdictions’ procedures created challenges with coordination for SLR. Interviewees noted that “the different jurisdictions were working at different rates, and on different premises, and also the scale and scope of the challenges around sea level rise were just really different” (P7). According to multiple interviewees, local jurisdictions were on different timelines for creating adaptation plans or updating their LCPs. This made a couple interviewees nervous to coordinate, such as this interviewee, “Yes, it's nice to do that [coordination], but I don't want to be caught and bogged down with other agencies. If we come to a disagreement on how we want to address something, I think that's just going to prolong the process” (P29). In addition to the time it takes to coordinate, some interviewees
thought that other stakeholders generally took longer to plan and implement projects, which could slow their progress.

*Muddled Communication*

Another procedural challenge was communication within a department or agency. Some interviewees mentioned they do not communicate often with other departments within their agency/organization, or they indicated that challenges could arise from differences in technical languages used by different departments. “In some ways we talk different languages. You know, they talk more planning concepts and policies and I talk more technical analysis and project development” (P20), said one interviewee.

Communication with other organizations and agencies also seemed like a challenge. This was stated by some interviewees and inferred based on the lack of information or misinformation some interviewees shared regarding another agency or organization’s SLR planning process or progress. In the survey, 40% of respondents thought there was not clear communication between agencies/organizations about their SLR planning efforts, 18% of survey respondents felt there was clear communication, and 42% of survey respondents felt neutral (Figure 24). Interviewees did think better communication, including sharing information as well as listening, would be important in regional efforts. One coastal professional described the importance of communication across sectors for technical information as well as to understand the needs of various stakeholders to support better and more equitable outcomes for those impacted by SLR:

> “Probably the key thing is communication. If the group works in isolation, they don’t get the full understanding of everyone’s viewpoints of land practice. You know, so inclusion is an important part in these efforts.”
Multi-disciplinary understanding of the issues is important. You just can't have a model or develop a model, without understanding how people plan to use their land, how they plan to maintain their levees or not maintain their levees, what the challenges they have in making adjustments to sea level rise. So, just to reiterate, I think inclusion and communication is important to have a good outcome.” (P25)

Figure 24: Survey respondent level of agreement that there is clear communication between agencies/organizations about their SLR planning efforts (n=102). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Managing competing institutional values and priorities

A diverse set of stakeholders are involved in SLR planning, each bringing their different institutional values and priorities. One interviewee described that “each jurisdiction has their unique perspective based on their assets and their political leanings of their boards” (P5). This sentiment was shared by many interviewees as a challenge to creating a shared regional vision for Humboldt Bay in light of SLR. Some interviewees pointed out that the diversity of stakeholders means that each may have something different at stake.

Competing interests within an agency

Within an agency/organization there are other priorities that may limit their ability to focus on SLR. Thirty-three percent (33%) of respondents agreed that their agency/organization currently had more pressing issues that take priority over SLR
planning; 32% were neutral to that statement, and 28% disagreed (Figure 25). One of the most common themes from interview participants, regarding competing priorities, seemed to be related to other immediate issues and the perception that SLR is a future issue. One coastal professional said,

“The thing with sea level rise is that it’s a much longer-term future... the average person is not having to deal yet with sea level rise impacts. And so, for them, it is not as present as when they walk through the community and see many, many homeless people on our streets and needles in our parks. That's a very present everyday issue. So, I think that's the challenge that most communities and our politicians face, is having to balance that current day to day on urgent issues with the longer-term sea-level rise issues.” (P5)

Other current issues mentioned included the COVID-pandemic, fires, health services, and access to education. When discussing various SLR-related planning efforts, some interviewees were not sure about when they would have time to work on them. Another theme regarding prioritization of SLR-related work was that long range planning can be difficult for some service providers to justify to their ratepayers or taxpayers or they encounter limitations that require them to only start a project or commit funding to a physical need or problem. Other interviewees cautioned that although other issues may deserve attention now, if stakeholders keep pushing off SLR adaptation, it could become an even bigger issue in the near future.
Competing interests between stakeholders

Interviewees noted that there were also competing interests between stakeholders involved in SLR planning. An example pointed out by multiple interviewees was competing economic interests. One interviewee noted,

“Short-term economic interests versus long-term community resiliency are sometimes at odds with each other. So, the landowners wanna use their land, the highest and best economic value right now, but doing so may preclude solutions to sea level rise 20 or 30 years from now.” (P16)

And another interviewee shared,

“I think there's also a barrier in terms of concern about the economy of the county. ... different perceptions of what a healthy economy looks like, can be a barrier to communicating. Because there are different ways of looking at the bay, and at the harbor, for instance, what is its greatest and best use.” (P17)

Interviewees also commented on challenges related to economic interests due to short-versus long-term benefits as well as individual versus community benefits.

Other examples of competing interests were related to some SLR adaptation measures, specific land uses, and sensitive habitats. One coastal scientist commented,
“I think the biggest challenge is that a lot of times, there are a lot of competing priorities. You know, interest in habitat restoration or maintaining infrastructure. So, it’s trying to thread the needle of accommodating everyone’s objectives. It can be difficult. Those solutions can be found most times, but it does sometimes require compromise.” (P25)

Even when a solution, like a living shoreline with protection and habitat benefits, seems to meet multiple stakeholder interests, there are still physical resource tradeoffs that stakeholder will have to discuss. One interviewee described how a living shoreline can have habitat and infrastructure protection benefits; however, the shallow slope of the living shoreline could require the filling of more wetlands which could impact more habitat. Another example requiring compromise is related to restoration and vulnerable agricultural land. An interviewee described that Humboldt Bay has many opportunities to retreat and restore tidal connectivity to some undeveloped areas, however,

“It comes at the cost of our agricultural land, which is extremely important to our regional economy. As much as we can, in the near term, there are ways to find balances to be able to do that sort of work, so that we don’t immediately lose our agricultural land.” (P28)

Many interviewees talked about SLR adaptation and retreat in the context of “winners and losers.” Another inherent competition within SLR planning was the overall theme of coastal development. Interviewees talked about balancing the need to protect “public health, safety, and welfare” from coastal hazards with individual and the regional economic health from coastal industries, development, and tourism. The solutions to these tradeoffs and competing interests seemed unresolved according to most interview participants who discussed these challenges.
Balancing collective interests

Interviewees indicated that while stakeholders have different concerns and specific interests, they will need to work together. “I think, there's always going to be some competition, for this way or the other, but bottom line is everybody's got their own turf that they have to defend and work with, but we all see the benefit of working together” (P17) said one interviewee. They highlighted the need for balance and compromise. Another interviewee said, “So I think that people are going to have to come together and do what's best for the whole county and not what's best for them” (P32).

Although people may not get what they want, many interviewees recognized that every stakeholder voice should be heard, it is healthy to have different opinions, and that solutions based on cross-sectoral large group input and compromise can provide better, more effective, creative, and equitable outcomes.

4.1.2 Case Study: Humboldt Bay SLR Adaptation Planning Working Group

In 2013, the California State Coastal Conservancy (SCC) funded Humboldt Bay’s first large scale regional sea level rise adaptation planning project, which supported the development of a hydrodynamic model and SLR inundation maps, vulnerability and risk assessments, as well as the creation of a regional adaptation planning working group (APWG) to discuss SLR research, Bay-wide impacts, identification of vulnerable areas and assets at risk, and to explore adaptation strategies (Laird 2015). The APWG team consisted of two local government co-chairs, a consultant team to manage the process and provide technical information, and a stakeholder group representing more than two dozen entities including local, state, federal and tribal governments, land and asset managers,
local organizations representing land resource and agricultural businesses, and grant funders. I asked interview participants about their involvement and perceptions of the APWG, and coded quotes related to general thoughts, level of involvement in the process, and positive and negative attributes of the effort. Of the participants asked about this effort during the interviews, 19 were involved with the APWG in some capacity, ranging from either leading aspects of the overall project or attending a couple of the meetings over the course of the two-year project. A couple participants (n=7) were not involved or did not remember if they participated.

The majority of the participants that were involved had positive comments about the regional planning project and the APWG. I captured 50 quotes about positive attributes of the APWG and related efforts. Common reflections focused on the important role the APWG had as an early effort to create a locally relevant foundation for future planning efforts and in getting people in the same room. I captured 25 quotes related to negative aspects of the APWG. All but two participants who shared negative reflections, had also shared positive reflections. Negative comments centered primarily around: who was missing from the room, the focus on information sharing instead of action, the conflicting interests of stakeholders, and meeting fatigue. These themes are further described below.

**Developing foundational knowledge**

The most commonly shared positive attribute of the APWG was that it facilitated the development of Humboldt Bay’s foundational SLR research and planning tools. Interviewees shared additional important aspects of this foundational knowledge,
including that it was “really helpful to get on the same page about baseline conditions” (P37) and it was “cutting edge research...to create tools that were specific to Humboldt Bay, rather than just using a generic sea level rise viewer that was built for the whole West Coast that really didn’t have specificity for Humboldt Bay or didn't take into account our unique conditions and stuff” (P4). Interviewees shared that consistent, locally relevant data contributed to a “local understanding” in order to “develop a good strategic plan, and a good understanding of what the potential risks are coming to the area” (P25). Stakeholders on Humboldt Bay continue to use the data developed during the APWG. The SLR inundation vulnerability mapping by Northern Hydrology & Engineering is the foundation for many local vulnerability assessments. Local vulnerability assessments were one of the most cited strengths of the region’s SLR planning efforts.

Building relationships

The second most frequent positive theme shared by interviewees was based on social aspects of the APWG. It was noted that the APWG was the “first time that we had multi-jurisdictional people in the room talking about this stuff” (P31) and the group helped “keep everyone a little focused on the topic” (P7). Interviewees shared that in addition to it enabling stakeholders to “sit down at the same table and hear that information and be able to ask questions and debate” (P7) it was also “a really good forum for different entities working on sea level rise planning and adaptation projects around the bay, for them to come together and update each other about what they're doing” (P8). Results from our survey indicated that APWG participants were able to co-
learn about new SLR information from the meeting facilitators and learn about various projects or efforts being led by their colleagues. Two interviewees also noted that it was a comfortable atmosphere where people were able to “speak their mind” and that it promoted relationship building and networking (P4, P37). Four interviewees specifically recommended rekindling an effort like that again to help coordinate people and get on the same page.

**Missing landowner input and education**

The most common negative reflection was that there was a lack of inclusion of landowners, especially those with agricultural lands and dikes. One coastal scientist lamented,

> “There is a clear disconnect between the [agencies] and the people that are actually on the ground that are responsible for those levees... Unfortunately, there's not a single voice or a single entity, and only a portion of the people that matter are at the table, and then the people that are actually on the ground are concerned about the people that are at the table, that's kind of what I witnessed.” (P27)

Other interviewees thought the group should have also expanded the stakeholders involved to special interest groups or members of the general public.

**Lacking actionable outcomes**

Interviewees expressed another negative sentiment about feeling that a lack of progress has been made to address big questions or planning constraints. Interviewee participants felt that the APWG was focused on information sharing rather than action. One participant described it like,

> “Is more just like everyone kind of goes around the table and gives your updates and stuff like that. Which is useful, not to trivialize it, but I see
there's kind of things like that that we try to make it seem like we're doing more than we are.” (P8)

And another interviewee commented, “It ended up being more meetings to make more meetings” (P29). While sharing information was helpful, the lack of action and perceived conflicts between stakeholders caught some interviewees attention. An interviewee keyed in on both issues and said, “It was good that we had everybody in the room. We worked through some case studies, but I felt like nothing ever really got resolved. Everybody didn't take their jurisdictional hats off at the table” (P31). That interviewee described what others also felt; the APWG was a large group with many diverse stakeholders with specific interests and conflicts between interests were not explored or resolved through the APWG effort. While the APWG was the first local example of large-scale SLR regional coordination, it ultimately ended in 2015. Although most interviewees noted that it ended due to lack of consistent funding, a few noted that interest in the effort waned.

4.1.3 Environmental Law and Regulation

Thirty-nine (39) interviewees, representing every stakeholder group, discussed environmental policy and permitting challenges and opportunities for regional SLR adaptation. We asked survey respondents if they thought that existing environmental laws and regulations present an insurmountable barrier/obstacle to SLR adaptation; 39% agreed, 31% were neutral, and 29% disagreed (Figure 26). Interviewees most frequently mentioned environmental regulation challenges related to the California Coastal Commission in regard to wetlands and retained permit jurisdiction; the Regional Water Quality Control Board (RWQCB) and U.S. Army Corps of Engineers (USACE) in regard
to dredge sediment reuse; and occasionally Environmentally Sensitive Habitat Area (ESHA) challenges or challenges related to Federal Emergency Management Agency (FEMA) flood zones and analysis.

Figure 26: Survey respondents’ level of agreement that existing environmental laws and regulations present an insurmountable barrier/obstacle to SLR adaptation (n=102). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

In this section, I summarize results related to complications of permitting adaptation strategies, issues with trust between permitters and permittees, concerns about changes that SLR brings to existing conditions that are not accounted for in environmental laws, challenges arising from state retained jurisdiction on Humboldt Bay, and the request for more creative thinking and innovation.

Challenges to regional adaptation strategies

Two commonly discussed potential SLR adaptation strategies on Humboldt Bay include raising existing dikes and levees and/or creating living shorelines, as well as using dredge sediment to raise the elevation of land for development and/or restoration/enhancement. Seventy-five percent (75%) of Humboldt Bay’s current shoreline consists of man-made structures that need periodic maintenance in order to function properly (Laird, 2013). Many interviewees suggested raising existing levees and
dikes to protect the property, critical infrastructure, and development that is behind them. Living shorelines could be constructed along existing levees and dikes to provide SLR protection as well as enhanced habitat. Although some interviewees see this as one of the simpler solutions to protection against SLR, they did not believe this would be allowable under the Coastal Act and other environmental policies that would limit the filling of coastal wetlands, except under specific circumstances. Some interviewees felt that although many environmental regulatory agencies support living shorelines as an adaptation strategy, no one has a realistic solution for permitting them on Humboldt Bay due to potential habitat impact and mitigation requirements. This planner described this challenge,

“I think, as a society, what we're going to have within environmental regulation is the no net loss wetland gets restrictive sometimes. And if we're going to build levees and protect anything with those levees, they're gonna have to get wider so they can get higher. That means you're filling wetlands on one or both sides of it. And if you want to incorporate the living shoreline that means the levee gets even wider because the slopes a lot shallower which means you're filling even more wetland.” (P13)

Forty-nine percent (49%) of survey respondents seemed to recognize the regulatory barriers to adaptation and thought it was a high or essential priority to develop regulatory solutions to allow for wetland fill for the purpose of SLR adaptation (Figure 27).
Figure 27: Survey respondents’ level of priority for developing regulatory solutions related to wetland fill and dredge sediment reuse (n=94-95). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line.

Another adaptation strategy includes beneficial use of dredged sediments from Humboldt Bay that are currently required to be discarded at designated sites. According to interviewees, there was interest around the state in how to beneficially reuse dredging spoils to raise the elevation of land for development above projected SLR elevations, to supplement wetlands with sediment to assist in natural sediment accretion, or to provide material for the construction of living shorelines. Participants reported that reuse of dredge spoils can encounter many challenges due to the impacts that dredging causes on sensitive species, lack of mitigation opportunities, as well as the additional need for testing and processing sediments for suitability. Some of these challenges can be cost prohibitive. And some are still unresolved; coastal professionals are currently working through permit complexities to allow for the beneficial reuse of dredge sediment for various projects around Humboldt Bay. Sixty-five percent (65%) of survey respondents thought it was a high or essential priority to develop regulatory solutions to allow for reuse of dredge spoils for SLR adaption projects such as living shorelines (Figure 27).
Level of effort to adequately protect coastal resources

When interview participants discussed why they thought some environmental laws and regulations were a challenge to SLR adaptation, the most frequent reasons were related to the effort it took to secure permit approval or the feeling that necessary adaptation strategies would not be permitted or authorized. Some interviewees attributed the amount of effort to concerns over time and money and other times related to uncertainty. Because environmental policies are set up to protect environmental resources, they often require stringent justification for proposed impacts and clearly obtainable mitigation. Environmental policies can also require project proponents to evaluate alternatives that sometimes lead to better, less damaging outcomes. One interviewee noted,

"The Coastal Act is one of the [regulations] that everyone can use to also take into account the need to protect these vital coastal resources and not have them get lost in the shuffle... it needs to be difficult to some extent, so that the resources are adequately taken into consideration." (P1)

However, justifying coastal resource impact through impact analysis and alternatives evaluations can require a lot of time and money, as described by this coastal scientist,

"It can be so extremely costly to be within the regulatory framework. It's like you pay double for the effort you put into designing a project. You pay double to then get it through the compliance pathway. And then when you're implementing it, you have to pay double, because you might have to truck that sediment tens of miles away." (P38)

Other challenges that exacerbated the effort it takes to permit coastal projects include inconsistencies and distrust. "I've consistently said that the biggest problem with implementation of sea level rise is the local and state regulatory agencies are just totally wishy washy on the subject" (P3) said one interviewee. Another wished for "some sort of
permitting process that doesn't burn people out and make them feel like they wasted, three, four, five, or six years. Some assurance that whatever effort is permittable” (P21).

Inconsistencies or lack of clear direction can lead to more time spent on project permitting and therefore additional project costs. Interviewees shared various institutional biases and described instances where they didn’t trust someone they were working with. Interviewees from some state and federal regulatory agencies described feeling that they couldn’t trust some project applicants seeking a permit such as some local governmental entities or a private landowner. And interviewees who were project applicants (such as Local Government or Landowners) described times where they felt they did not trust the people issuing the permits (such as State or Federal Government). Study participants who represented regulatory agencies, as well as participants who represented project applicants, both described experiencing dishonest communication and feelings of “playing a game,” or being in a “battle” or “fight.” Individuals expressed historic or institutionalized distrust, partially molded by negative past experiences. This distrust seemed to further hinder working relationships leading to difficulties experienced by all stakeholder groups.

Changing environment and static policies

Another challenge expressed by interview participants was conflict between short- and long-term costs and benefits and the uncertainty of SLR impacts on existing conditions. Many interviewees acknowledged the important role environmental law and regulations have had in shaping a more natural and accessible coastal California. I’m very grateful for [the Coastal Act] as a coastal resident of California” (P16) said one
interviewee. Some interviewees cautioned that changing policies related to filling wetlands would be short-sighted due to the long-term protection that strong environmental policy provides to coastal resources. However, some interviewees questioned if those policies were maintaining a status quo that wasn’t achievable anymore due to the habitat changes that SLR will bring. One coastal scientist commented,“So, I think that really under the sea level rise, climate change scenario, all of our laws need to be sort of ramped to accommodate this change that’s got to happen, that’s going to have winners and losers, but in order to keep all the pieces, we have to back up.” (P27)Interviewees wondered how, and if, policies might change as the habitats that they protect also change due to SLR. One interviewee explained an approach to improving vulnerable agricultural lands while simultaneously enhancing wetland functions, however also described it as not currently permissible. They said, “So those opportunities are going to be gone in 10 to 20 years. And if we don’t get our crap together in that time then those opportunities are gone” (P31) for the low-lying agricultural land that is vulnerable to SLR. Others also shared concerns over mitigation and monitoring requirements as habitats change due to climate change and SLR, reducing mitigation opportunities or requiring continuous adaptation management of dynamic naturally changing habitat conditions.

**Unique jurisdictional complications**

According to interview participants, another challenge to regional SLR planning is the California Coastal Commission’s retained coastal development permitting authority
in Local Coastal Program (LCP) areas. “I don't think that other parts of the state are dealing with this as much as we are up here in the north coast. Because in a lot of other parts of the state, the line between the Commission's jurisdiction and the local governments is just a lot more divided” (P9) said one interviewee, describing how this challenge is fairly unique to Humboldt Bay. Coastal Commission and Local Government staff that participated in interviews described that due to this overlapping jurisdiction boundary, Humboldt Bay LCP jurisdictions prepare land use and development plans within the Coastal Commission’s jurisdiction. LCP policies, if consistent with the Coastal Act, can be used as guidance by the Coastal Commission in evaluating Coastal Development Permit (CDP) applications. However, the Coastal Commission is not legally required to comply with the LCP.

Some interviewees from local jurisdictions seemed discouraged to move forward with planning efforts in areas of state retained jurisdiction because there was no guarantee that the Commission will follow local policies. Sixty-four percent (64%) of survey respondents thought it was a high or essential priority to address planning conflicts resulting from the California Coastal Commission’s retained coastal development permitting authority in Local Coastal Program areas (Figure 28). Interviewees noted that if state decisions did not align with LCP policies, there could be wider implications on local non-coastal development, long-range economic plans, and environmental justice goals. For example, one interviewee shared,

“There are a lot of impoverished neighborhoods, neighborhoods that are principally of color, that are in these zones that are potentially at risk from sea level rise. And if we say that you can't rebuild a structure, modify
Generally, the retained jurisdiction seemed to create an additional layer of uncertainty for local planning processes that were already dealing with the inherent uncertainty of SLR. Comments from some Local Government interviewees suggested that although they would prefer more control and certainty over their planning processes, they also looked to the Coastal Commission for leadership and guidance. While the Coastal Commission is responsible for protecting for public trust resources within the Coastal Zone, interviews with Coastal Commission staff suggest the Commission was also looking to local government for leadership through LCP guidance.

**Innovation, creativity, and flexibility**

Interview participants described experiencing challenges related to the relative newness of SLR as an issue. One participant summarized sea level change as “a basic change in our fundamental thinking about things” (P1). Interviewees expressed concern that this not only affected the way they think about planning but also left them dealing
with regulations devised decades before SLR was identified as a hazard and with a lack of historic precedent or examples to guide decision making.

Some interviewees stated that many policies reinforced low risk tolerances due to their minimal allowances for failure of project outcomes, which could stifle innovative approaches. They described how most regulatory agencies were “institutionally oriented towards the status quo” due to “sensitivity about precedent and consistency” (P20) One interviewee said, “The regulatory framework is just not adaptive. And so progressive ideas, and even testing concepts, can be virtually impossible” (P28). Another interviewee said, “We do run into problems that some of the regulations, the way they're written, don't allow us a lot of flexibility. And we're coming to a point that... it's going to be a choice between enforcing regulations, or just override them” (P25). Various interviewees representing both State and Local Government stakeholder groups called for more creativity in how to approve projects with environmental and public benefit as well as innovation for SLR adaptation projects that focus on alternatives to fortifying the shoreline. Part of this creativity is likely to be developing some balance and compromise between various stakeholders. Although there seemed to be a divide on whether interview participants thought some habitat conservation policies need amending or were important to preserve as is, people on both sides of the argument agreed that more creative thinking was necessary. One interview pondered the regulatory future,

“How do you balance uncertainty? Like, do the benefits outweigh the risks? ...there's kind of different perspectives on the status quo versus innovation in a regulatory context... And the only way we're going to solve that is through dialogue and trying to understand each other's needs and interest and negotiating a balance.” (P20)
Multiple interviewees thought a good place to start having these tough conversations would be through pilot projects and small-scale examples. One interviewee suggested,

“If we’re going to adapt, everyone is going to have to adapt, including the regulatory agencies, to see outside of the box and at least start to experiment with small scale studies. I think, that’s how we can start to maybe be effective, looking at some of these strategies.” (P30)

4.1.4 Funding and Resources

Funding for all stages of adaptation planning was one of the most frequent challenges mentioned by interview participants and survey respondents. Interviewees stated that funding was lacking for data collection, data analysis, planning, engineering, project implementation, monitoring, and maintenance; the two most frequent funding gaps stated were insufficient funding for implementation projects and staff to dedicate to SLR-related activities. The survey showed similar results. In a series of 22 survey questions asking about various challenges to SLR planning and coordination, two statements the most respondents disagreed with were related to having sufficient funding and resources (Figure 29). Seventy-one percent (71%) of respondents did not feel that their agency/organization had sufficient staff resources to dedicate to planning and 68% felt that their organization did not have enough funding to engage in SLR planning as much as they would like.
Figure 29: Survey respondent level of agreement with statements regarding funding of SLR planning (n=100). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

**Staff capacity**

Many coastal professionals commented that staff were limited in the amount of time and effort they can dedicate to SLR-related work. They described that many of the agencies around Humboldt Bay had few employees and staff bridge multiple roles and responsibilities. Some noted that due to small staffing sizes, agencies sometimes relied on partnerships with external agencies/organizations to get more done, which can be an opportunity to build trust and relationships. Twenty-six percent (26%) of survey respondents noted their agency/organization has shared personnel with other agencies/organizations for SLR-related work within the past four years (Figure 30). Of the respondents who said their agency has not shared staff with other agencies/organizations, 81% said they would be interested in engaging in that collaborative activity (Figure 31). Interviewees also noted that fewer staff can also cause meeting fatigue and turnover.
Figure 30: Survey respondents' perception of their agency/organization’s engagement over the past four years in collaborative SLR activities on Humboldt Bay (n=105-106). Non-engagement is located left of the 0 line, and engagement is located right of the 0 line.

Figure 31: Survey respondents' perception of their agency/organization’s interest in collaborative activities, if not currently engaged (n=105-106). Level of interest in engagement is located left of the 0 line, and level of interest in engagement is located right of the 0 line.

While many of the SLR adaptation efforts on Humboldt Bay to date have been paid by state and federal grants, some interviewees noted that grants are often "opportunistic," and do not "promote efficiency or strategic planning and implementation" (P26). And grants often do not assist with staff capacity issues, as this interviewee noted,

"The jurisdictions don't typically hire more staff because the grants limited time and hiring is expensive, and you don’t want to hire someone to just lay them off. So, you hire a consulting firm. So, in the end, the staff at the jurisdictions who are holding the longer-term picture don't really
Although grants may not assist directly in developing capacity and institutional knowledge internally, this did not deter agencies/organization from spending time pursuing grants. According to the survey, 42% of respondents stated that their agencies have been or were currently engaged in collaborating with other agencies/organizations to apply for and/or secure SLR-related project funding through grants or other sources (Figure 30). Of those not engaged, 96% were interested (Figure 31); this was the activity with the highest interest out of the series of 10 different types of collaborative activities presented in the survey.

Another capacity challenge was the need for designated staff to focus on SLR efforts and provide consistent, sustainable momentum. A government employee stated,

“Government doesn’t really want anybody to have any free time because that would be a waste. So, if everybody’s fully allocated to stuff, when something new comes up, you have to find a way to break people loose and create new allocations and say this is important.” (P24)

This becomes a “multiplier on the capacity issue...when you try to create new or grow interdepartmental coordination” (P26), which would be critical for regional coordination. The same interviewee noted that “in the absence of a funding opportunity, I think that's incredibly hard to sustain coordination and commitment at a scale that goes so far beyond any particular agency's mandate, or capacity, really” (P26). Which once again, noted the lack of current capacity of staff to deal with the fairly recent emphasis on SLR issues. Overall, interview participants noted a local need for funding for staff to enable the time and focus necessary to plan for SLR adaptation.
Implementation costs

Many interviewees expressed concern over the “hugely expensive (P38)” costs associated with the implementation of SLR adaptation projects. For example, the 2013 Shoreline Inventory noted costs of $900,000 to $2,000,000 per mile for the fortification and rehabilitation of existing dikes and the City of Arcata has noted the relocation of their Wastewater Treatment Plant could cost well over $150 million (Laird, 2013; personal communication). These large numbers can be cost prohibitive for a landowner or rural city. Interviewees wondered where the funds for SLR adaptation would come from and some postulated that state and federal funding resources would be necessary. A concern shared by many interviewees was future competition for funding resources between locations as well as other hazard types. Some interviewees, such as this coastal professional, worried that the Humboldt Bay region would be a low priority compared to urban centers,

“You think about how much of California's people and infrastructure is really low, we're going to be competing for the same pots of federal money with the San Francisco Bay Area, okay, we're nothing compared to them in populous or Gross Domestic Product.” (P27)

However, some interviewees thought that the sooner relative time scale of impacts to Humboldt Bay could elevate the priority of the region for funding. Another competition for funding could be due to the prioritization of other hazards, as stated by this interviewee,

“The next thing is going to be fires, especially in California. If you were a year ago wanting to get funding for sea level rise, you may have gotten some grant money here or there and been able to build up some type of program. Today, I think 90% of the available money is going to go to
In addition to competition for future funding resources, interviewees noted how current emergency priorities, such as the COVID-19 pandemic, can hinder the prioritization of resources to an issue that is perceived as not having immediate impacts, such as SLR. An interviewee mentioned this when talking about SLR planning and adaptation efforts,

“If you're talking about a government entity doing that, then they need the funds to do it. Which now is going to be increasingly difficult with dealing with a pandemic, and even more costly ... and the lack of tax dollars coming in through sales, and all the all the impacts from COVID.” (P28)

In addition to re-prioritization of funds, as this interviewee noted, the region may be dealing with long-term effects of reduced funding. In the survey question about engagement and interest in collaborative activities, only 29% of respondents have or are currently contributing funding towards SLR-related projects that benefit multiple agencies/organizations (Figure 30) and 65% were interested (Figure 31), which was the lowest interest shown for any of the activities presented in the survey.

Funding opportunities

Although insufficient funding was a notable challenge, many interviewees also shared ideas or strategies for funding SLR planning and implementation. Many saw an opportunity for regional coordination to set the region up for receiving more significant amounts of funding, pooling resources, and creating stakeholder buy-in. A coastal professional commented,

“In these regional discussions, we need to start thinking about what we can afford locally as a community to do this stuff. That's another thing
that's going to drive this and be too late. If we wait for 30 or 40 years, and then want to jump on it, we're not going to be able to compete with San Diego, LA, and San Francisco. Whereas, if we get creative now, there's probably funding opportunities for us to do things in the next 10-20 years, that could help us 50-60 years out.” (P31)

Essentially this interviewee suggests that working together can give the region a louder voice in state and federal funding conversations. Many commented that the region has and can continue to strategically place representatives in state conversations,

“Lobbying groups can end up being mutually helpful in securing resources... [for example,] the county has a supervisor on the Coastal Commission, a supervisor that's on the Rural Counties Association, a supervisor that's on the California Association of Counties.” (P36)

Generally, interviewees thought the biggest funding opportunities could come from state and federal sources and a few noted that the state could use funding to incentivize SLR planning, retreat, or other state priorities.

Another funding opportunity discussed by interviewees focused on strategic regional project planning through short-term investments and focusing on SLR projects with multiple benefits for multiple stakeholders and jurisdictions. Short-term investments or projects that were urgent currently due to other reasons, such as a failed culvert or unsafe road, could consider SLR in a way that was appropriate for phased adaptation. An interviewee noted that,

“If we make targeted investments in certain locations, especially the most vulnerable locations, we might be able to buy ourselves some time...” and “...even if something's too expensive to address now, there might be some smaller things that we can consider. If we just look at future scenarios and not more short-term scenarios, then we're kind of losing an opportunity to make strategic investments.” (P22)

Several interviewees suggested that regional-wide planning could help identify projects and priorities to implement before they are urgent,
“Then it'll be much more cost effective, we'll already be looking at the next thing as opposed to trying to react just to sea level rise. It won't be sucking up all our resources to be moving roads and moving infrastructure when it becomes urgent. And so, we can plan for and gather the funding before it becomes an emergency.” (P40)

This interviewee indicated that strategic, timely investments in short-term projects with future phases were a potential funding opportunity for the Humboldt Bay region that could be supported by a regional coordination effort.

Local data availability

We asked survey respondents if they agreed/disagreed that their agency/organization could begin implementing SLR adaptation activities based on their currently available data/information. Forty percent (40%) of respondents agreed or strongly agreed, while 23% disagreed or strongly disagreed that they had enough data and information (Figure 32). One of the most frequently stated opportunities for planning in Humboldt Bay was locally specific data developed by local experts. About a quarter of interviewees mentioned the importance of inventory of Humboldt Bay shoreline assets, SLR inundation vulnerability mapping, and region-wide vulnerability assessments conducted by Aldaron Laird and Northern Hydrology and Engineers. Interviewees noted that information was a strength of this region, and it could be built on for future efforts.

“I think the opportunity is to take the momentum that's achieved so far and to translate it into solid policies and projects that have an environmental benefit, economic benefit, social benefit” (P21). Other studies cited by coastal professionals included research on sand dynamics in coastal dunes and sediment dynamics in marshes by USFWS and USGS; environmental analysis on dredge sediment reuse by the Harbor District; and
Humboldt County’s Adaptation Planning efforts for the Eureka Slough Area and Regional SLR Planning Feasibility Study. Another opportunity interviewees raised involved sharing SLR information through groups such as the Humboldt Bay Initiative or the Cal Poly Humboldt SLR Initiative.

![Survey respondent’s level of agreement regarding their agency/organization ability to begin implementing SLR adaptation plans and activities](image)

Figure 32: Survey respondent’s level of agreement regarding their agency/organization ability to begin implementing SLR adaptation plans and activities based on their current data/information (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Coastal professional study participants also identified current data gaps. The most requested information was ground-truthed and validated SLR projections and models. Validated data could decrease planning uncertainty and help prioritize SLR planning.

“We’re gonna need to pay attention to see if that projection is coming to fruition, because I think that there needs to be that for the people that don’t believe in this yet or are speculative or skeptical” (P27) said one coastal scientist. Additionally, interviewees called for updated and refined maps and models; more information on geomorphology, sediment dynamics, hydrology, restoration, groundwater, and vertical land motion; as well as information about SLR impact interactions with shoreline/waterfront and with other hazards such as earthquakes and tsunamis. Some interviewees saw opportunities to
collect regional data at regular intervals, such as High-Definition imagery, LIDAR mapping, and tidal data. This interviewee commented their data needs,

“I think our need is that ongoing need for updated data. You know, it'd be great if it was every year, but at least every couple of years having some updated data I think would be really important for our planning process. And the data could be Bay-wide. So, you know, the County, Arcata, Eureka, Caltrans, railroads, they all benefit from it.” (P10)

A couple of interviewees discussed the importance of learning from SLR adaptation and planning examples in other areas throughout the world, bringing in state and federal input related to hazard zones, and building on monitoring information collected at specific project sites related to flooding experiences for example. Two interviewees noted that incorporating indigenous knowledge could benefit regional SLR planning efforts. One interviewee described the benefits of incorporating Tribal knowledge, “They bring generations of experience with the coastal environment here around Humboldt Bay. And stories about 100-year storms and flooding...no one really has that long-term perspective like indigenous people do” (P30).

To guide local SLR adaptation practitioners, the State has released various guidance documents (interviewees most frequently cited the 2018 OPC SLR Guidance and the 2018 California Coastal Commission SLR Policy Guidance) and is developing more assistance programs (such as the Office of Planning and Research Integrated Climate Adaptation and Resiliency Program [ICARP] Adaptation Planning Guide). Elements of these State-led efforts seemed generally helpful to most, but they also sparked comments about the need for more guidance in developing locally specific interpretations of the data.
4.2 Behavioral Barriers and Opportunities

Extensive research and scholarship highlights the important role that individual actors can play in climate adaptation and how the interactions of actors can contribute to or inhibit collective action (Ford & King, 2015; John & Yusuf, 2019; Lubell et al., 2021; Moser & Ekstrom, 2010). The survey instrument and interview guide both contained questions related to various social challenges to SLR planning such as leadership, public engagement, stakeholder attitudes around climate change and SLR, and how coastal professionals feel about performing SLR-related work. In this section I report results on opportunities and challenges related to the actors on Humboldt Bay and how these behavioral elements both positively and negatively contributed to stakeholders’ interest in working collaboratively together and prioritizing SLR-related work.

4.2.1 Attitudes and Job Subjectivities

In the following sections I describe results related to stakeholder and public opinions around SLR and the emotional elements of performing SLR-related work. The attitudes of people involved and affected by SLR contribute to coordination challenges and opportunities.

**Attitudes regarding climate change and SLR**

Interview participants noted that local stakeholders, decision makers, and the public’s attitudes with respect to SLR provide both opportunities and challenges for SLR adaptation efforts. Thirteen participants noted that a regional challenge is that SLR can be a “*politician*” issue that “*some folks think is made up*” or “*it won’t happen in their
lifetime” (P37, P30). However, a few participants noted that climate change and SLR skepticism was not a large factor in this region and “was a bigger concern back in 2010, when people were just saying, ‘who invented this?’” (P4). Fourteen interview participants thought the Humboldt Bay community’s understanding and belief that SLR is occurring is an opportunity and a strength for the region. This was also indicated in the survey results; 71% of coastal professional respondents thought that SLR was already affecting the Humboldt Bay region and 0% of coastal professional respondents thought SLR impacts would never occur (Figure 33). Figure 33 also compares results from the same question asked in a public survey conducted by Humboldt County Planning and Building Department in the summer of 2021. Almost 50% of public survey respondents believe Humboldt Bay is already being impacted by SLR, while less than 10% thought SLR impacts would never occur (Figure 33).
In describing the Humboldt County community’s belief that SLR is impacting the region, some participants thought that there is more openness locally to the fact that SLR is occurring than in other places. One participant noted,

“Yeah, I guess another opportunity with Humboldt is that we can already see it. It’s obvious, like it’s coming, it already is here, with king tides. On that highway and you see that those buildings where the levee is, and Jacobs Avenue is lower than the bay. It’s already here. Nobody here is like debating there’s an issue, there’s always been an issue, we developed on flood plain.” (P15)

There are many places around Humboldt Bay where community members can observe flooding, especially during king tides (Figure 34, Figure 35, Figure 36, Figure 37).
Figure 34: Swain Slough across Elk River Road during a king tide in January 2020 (Photo Credit: Adam Canter).

Figure 35: Blue Ox Millworks and Historic Village and the Eureka Waterfront Trail during a king tide (left) in December 2020 and low tide (right) in January 2021 (Photo Credit: Kristen Orth-Gordinier).
Figure 36: View from a northern section of the Eureka Waterfront Trail during a king tide in December 2020 (Photo Credit: Kristen Orth-Gordinier).

Figure 37: The Eureka Waterfront Trail during a king tide (left) in December 2020 and low tide (right) in January 2021 (Photo Credit: Kristen Orth-Gordinier).
Job subjectivities from coastal professionals

If there was time at the end of the interview, I asked participants, mostly planners or engineers (due to time or relevance), “How does it feel to be a planner/community leader dealing with SLR challenges?” Respondents provided many detailed and thoughtful answers to the question, and many appeared to have complex feelings about the nature of SLR planning work. Through coding, I uncovered 85 quotations related to ‘job subjectivities/feelings” across the interviews (n=26). Most respondents shared mixed positive and negative emotions about this work and their personal involvement, and the most common description of SLR-related work was “challenging.” The survey of coastal professionals also contained a series of questions related to respondent “feelings about performing SLR-related work.” Figure 38, shows the results from those questions and key themes from both data collection methods are described below.
Figure 38: Survey responses rating respondent level of agreement with statements about how they feel about performing SLR-related work (n=92-94). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

The challenging nature of SLR planning led some participants to discuss negative feelings such as frustration over current regulations, lack of capacity, climate change skepticism, and difficulty working collaboratively due to competing interests and stakeholder needs, as well as concern or worry about potential SLR impacts. One participant described their frustration, “I think if anything is frustrating about it, there’s all this mandate kind of to address it, but really not the funding to do it” (P8).

Interviewees commonly noted that a lack of resources made progressing SLR planning difficult, this interviewee further explained that a lack of resources also negatively impacted their feelings about their job. Over 50% of survey participants noted they were
frustrated by a lack of forward movement in SLR planning (Figure 38). When talking about lengthy regulatory discussions with no perceived solution in sight, one participant described that “It makes me feel like retiring, ha-ha” (P21). Additionally, some interview participants described feeling overwhelmed or challenged by understanding the technical complexity of the data and the inherent uncertainty of SLR science. Interviewees described how the novelty and continuing evolution of this field brings uncertainty in understanding the science and probability of future scenarios. This uncertainty was described by a coastal professional, “There's imperfect science so it's extremely challenging because we're making decisions on our best guesses, really” (P5). Survey results, however, ranked concerns around dealing with uncertainty and technical complexity the lowest among surveyed local professionals (Figure 38).

Many participants described the mental difficulty of doing work related to an imagined future and comprehending situations past their lifetime. The time scale of SLR was a challenge for some planners; one participant stated, “I have a challenging time thinking out, you know, to 2100. I’m not gonna be here by then, you know, maybe in 50 years I won't be here by then. So, planning now for things that are so far in the future, that’s a challenge for me” (P10). A common planning horizon for long range planning such as General Plans is 20 years, however SLR practitioners may have to consider 50–100-year time horizons, which increases the uncertainty of future conditions. When talking about perceived challenges with long-term planning, one participant exclaimed, “There’s gotta be opportunities out there that we’re not even considering. I think when we do these planning workshops, we should have high school kids come in, and they
should be part of this conversation” (P31). Interviewees identified the challenge of balancing current needs and constraints with projecting and imagining the needs and priorities of future taxpayers who may have completely different lifestyles than we have now.

Another theme brought up often by participants was their sense of personal responsibility to this topic and the impacts of their decisions on the future. Many participants expressed that they felt this work was incredibly important and were sometimes personally worried about the impacts of climate change on their communities and families. The statement most agreed with in the survey question about feelings was “I am worried about how our SLR planning decisions will impact future generations” and the second most agreed with statement was “I am personally quite worried about SLR” (Figure 38). One interviewee described their work, “I think it’s also a huge responsibility, both from a planner’s perspective and ultimately the decision maker’s perspective because the decisions that are going to be made have far reaching implications” (P5). Another said, “Yeah, it keeps me up at night. I feel like I have a lot of responsibility to make the right choices...And so yeah, I'm worried about it but it also makes my job feel important” (P15). And another exclaimed, “It's exhilarating, because it's one of the most important long range planning challenges that I think we face, both SLR and global climate change in general” (P7).

Although there were many negative sentiments, almost 75% of interview participants who discussed their specific feelings about performing SLR-related work used positive terms to describe the work. Some participants felt excited due to the novelty
of this field, which as discussed above, also made SLR planning challenging. Generally, participants seemed up to the challenge and found it enjoyable, interesting, and fun. Survey results also affirmed these sentiments: over 65% of survey participants felt SLR work was engaging and fulfilling (Figure 38). Multiple participants discussed their affinity for problem solving, one even describing SLR as an “interesting puzzle” (P8). Some shared hope that the small accomplishments made now would help future situations and that this challenge offered multiple opportunities for improvement of the Bay ecosystems and community life in general. A participant said, “You know, we have to take these challenges and make opportunities out of them” (P1). This outlook was shared by many interviewees.

4.2.2 Leadership

Within the Humboldt Bay SLR planning sphere, there are multiple governmental agencies each with their own levels and types of leadership, such as local, state, and federal leadership and directives, as well as elected political leaders, department heads, and individuals championing various topics. Interview participants discussed those levels and types of leadership in the context of SLR planning and adaptation. When asked in the survey if leadership within a respondent’s agency/organization was making SLR adaptation planning a priority, 58% of respondents agreed, 28% were neutral, and 14% disagreed (Figure 39). The paragraphs below discuss the challenges and opportunities of leadership, as described by the interview participants.
Figure 39: Survey respondent level of agreement about whether leadership within their agency/organization is making SLR adaptation planning a priority (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Missing or inconsistent leadership

Twelve interview participants talked about the lack of leadership as a challenge to regional coordination and SLR adaptation. As one interviewee put it, “The lack of true leadership from our political leaders contributes to the lack of action on sea level rise” (P37). Some interviewees at the staff level felt that without a directive or mandate from leadership within their entity, they were not able to prioritize SLR planning work.

“What would be nice is if there was a direction from [my agency's leadership] to say, we're going to work together to figure out how we might deal with sea level rise, and then we're going to work with the rest of everybody to come up with a future that makes sense.” (P27) said a coastal professional. This lack of leadership was noted at the local, state, and federal level, although there seemed to be less hope for consistent supportive leadership at the federal level.

Additionally, interviewees shared how changes in political attitudes and leadership can be a challenge. Many reported that inconsistencies due to turnover can redirect priorities and subvert momentum. For example, “...every time there's a new
board, they want to change directions. Really something like that has to be done within the span of four years, you have to have the same board. Otherwise, if you get a new board, they’re going to redirect it” (P20), said one coastal professional. Challenges related to changes in leadership positions can propel or impede long-term planning momentum. This planner described impacts due to changes in staff leadership roles, “People retire or move to other agencies.... I think that's maybe why we ran into some challenges, is that staff would change, and then things would be forgotten, or the focus is shifted on other priorities” (P22). Study participants indicated that when appointed leaders or staff-level leaders change, the pace of adaptation and planning processes slows down.

Leadership strengths and opportunities

Sixteen interview participants talked about current leadership as an opportunity in the context of SLR planning and adaptation. Some comments were focused on current leadership strengths, particularly that local leaders recognize that SLR was something that needs to be addressed and they were good at listening to and addressing community needs.

“I don't know if you've noticed, but I think it's pretty hard to get anything done in this country anymore. I think Humboldt County is good at getting stuff done. I mean, I think all of the city councils and the county supervisors are all pretty good at identifying things and if they have the money, they could find the will to do things.” (P44)

If local officials hear community concerns about SLR and are consistent in addressing those comments, they could address some of the leadership challenges discussed above.

Some participants also noted that shared leadership among local stakeholders can help
build buy-in with other agencies, organization, and the public which can foster better regional coordination.

Interviewees generally talked about state leadership in the context of funding and contributing interdisciplinary science and policy guidance, but they also saw an opportunity for state and federal land managers to lead by example. One planner suggested,

“If [state and federal land management agencies] really came out and said we’re really concerned about SLR, and we’ve come up with a SLR adaptation strategy to maintain these resources because they are land management agencies and they have the authority to do it and the money to do it. If they just did it and provided an example for it, then it would be really helpful to the County and City.” (P4)

So, in addition to providing leadership in the forms of directives or mandates, some coastal professionals also cited the need for leadership in the form of action as an opportunity. Considering that SLR adaptation is a relatively new field, pilot projects could help lead regional planning by providing important models and lessons.

4.2.3 Relationships and Trust

One of the more frequent opportunities for regional coordination regarded the health of the relationships between individuals and organizations. Some interviewees discussed the challenges of sustaining an effort can be based on the individuals involved and required cooperation between stakeholders with different interests. Survey respondents shared their level of trust with other stakeholders and interviewees shared thoughts on how trust is central to building effective working networks.
Importance of individual relationships for collective action

Twenty-three interviewees, representing all except for one stakeholder group, commented on existing relationships as opportunities. Interviewees brought up that the Humboldt Bay region benefited from its “small town” feel and many interviewees were friends with individuals who work at different agencies/organizations. People live and work in the region, providing a stronger sense of community responsibility; as one interviewee said, “We're all fighting for Humboldt Bay, we all feel ties to it... we live in the places [we are working] and we all know each other. That works in our favor” (P15). Interviewees also reflected on how friendly relationships and casual conversations are important for building stronger working relationships. One interviewee said, “You get more done when you're sitting around socially, building the network, drawing personal connections, sharing stories... Those networks are what lasts” (P28).

When interviewees were describing opportunities of relationships, they sometimes shared the names of individuals that they felt really contributed to coordination and productive projects. Some common descriptive traits of those people included helpfulness, honesty, empathy, accessibility, fairness, follow through, a good listener, integrity, realistic in providing answers or expectations, pragmatic, open-minded attitude, and a clear communicator with stakeholders who are from different backgrounds. People who have these traits were generally considered more credible and therefore more likely to be trusted and respected. One interviewee noted that in a small community, building that trust can take some time:
“It's funny when you get someone new in this community doing this stuff and everyone's like, 'Who's that?' Everybody's willing to work with them, but they don't necessarily trust [them]. After some point in time, you know people well enough, they're like 'Oh, if they said that, I trust them. I've worked with them, they know what they're doing, whatever they said is probably fine.'” (P18)

Similar to building trust with new individuals, interviewees also noted that consistency of staff in various projects or efforts can help build trust and those networking opportunities can foster future partnership in mutually beneficial projects, which continues to facilitate the formation of stronger relationships between agencies. When survey respondents were asked if they trust the other agencies/organizations that they need to work with in order to accomplish SLR planning, 43% agreed that they trust other stakeholders, 47% were neutral, and 10% disagreed (Figure 40).

![Figure 40: Survey respondents’ level of agreement regarding their trust in the agencies/organizations they work with in order to accomplish SLR planning (n=100). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.](image)

Interviewees discussed that the benefits of positive relationships with other individuals can help build good faith, excitement, and buy-in between stakeholder groups, which lead to more respectful, productive dialogue and more successful projects. The concept of reciprocity was brought up by one coastal professional,
“You got to be willing to give and take your needs. And it's been great because if you do that, then you build almost like a bank of back and forth between everybody, ... you have allies, right, like you don't have to fight that fight alone.” (P18)

Generally, interviewees agreed that individual relationships were an incredibly important aspect of coordination, especially in a small community, in part because trust and progress are “made on a person-to-person basis” (P24).

Distrust & personal agendas

Nineteen interviewees from nine different stakeholder groups noted that individual attitudes and a lack of trust can also provide barriers to successful planning and implementation. Some interviewees described a historic distrust between agencies/organizations that they wished could be “dealt with and put to rest... before we can move forward” (P15). Additionally, multiple interviewees called out a lack of trust by the public, and more specifically by the agricultural community, in government and the individuals that represent the government. Common themes among agency-agency and public-agency distrust were a lack of transparency, dishonesty, and the need for better communication that leads to more empathetic understanding between stakeholders. One interviewee commented, “I feel like we would come to better solutions if all the cards were on the table” (P15).

Some interviewees felt that the personal interests of an individual could get in the way of creative solutions that benefit multiple stakeholders. This could either be due to people being “ingrained” into the way they always do things, getting “very territorial about stuff and very threatened by people coming in,” or bringing “personal agendas”
that “they'll push it through hell or high water because they think it's great.” (P8, P18)

For example, one interviewee described trying to balance the pressures of regulatory agency staff to expand a restoration project with the needs of the private landowner for agricultural production. “Forcing” a process or project element through, interviewees noted, did not usually end in a positive outcome for the project.

In addition to individuals bringing personal agendas, interviewees described difficulties due to changes in individuals working on a project. One coastal professional shared an experience where “you work with some agency person for two years on a project, and then they go somewhere else, and you get a new person who has completely different views” (P31). Interviewees emphasized that the change of individuals can be a major challenge with maintaining momentum due to, not only the loss of project knowledge, but also the relationship and level of trust they may have built working together.

4.2.4 Public Engagement

We asked multiple survey questions related to public engagement and outreach and at least 37 interviewees talked about some aspect of public outreach and engagement. Topics ranged from the importance of outreach and public support, ways engagement could be improved, challenges with community involvement, and opportunities stemming from community strengths. Survey results related to public engagement are also shared below.

Community engagement and education was seen as essential by many coastal professionals that I talked with. Interviewees discussed the massive impacts SLR could
have on individuals and the Humboldt Bay’s community identity and how community engagement will be especially important in regional SLR planning due to separate land ownership along the shoreline. One interviewee shared this example, “Each little portion of the levee is owned by a different individual property owner, so trying to get everybody on the same page and figure out what they're all going to do, that would be a challenge” (P10). My study participants recognized that public support will be increasingly important as the community is faced with tough decisions and changes, such as conversations related to protection and retreat. One respondent said,

“...as the plans get further developed, it'll be real important to have a much wider group of folks coming together...you're not gonna get buy-in unless people are educated about the situation and have some ability to have input into the process.” (P1)

This interviewee described multiple sentiments shared by other coastal professionals, including the need to include diverse community members and to provide a strong educational outreach component. Interviewees also acknowledged public engagement should start sooner rather than later. “Oftentimes, when you fall out of planning mode, you're actually in action mode. There's probably less input from the community when the waves are lapping at your feet, or the fires is within a certain distance of your house” (P35) said one planner. Although SLR is sometimes seen as a future issue, this interviewee brought up the point that once SLR becomes an emergency, public engagement could be further stifled because public entities will focus their energy and time on quickly mitigating emergency situations to ensure the public safety.
Needs improvement

Although community engagement is an important aspect of regional SLR planning, responses from the interviews and survey suggest it needs improvement in the Humboldt Bay region. Current public outreach efforts described by interviewees included workshops hosted by local government in vulnerable communities, study sessions with government councils and commissions, and televised commission or council meetings with SLR updates. Forty-five percent (45%) of survey respondents disagreed or strongly disagreed that public engagement with residents and business owners has been effective in educating them about SLR impacts, 39% or respondents felt neutral, and 19% of respondents agreed public engagement has been effective (Figure 41). On average, survey respondents felt neutral or disagreed that there has been sufficient effort to include vulnerable communities and businesses in SLR planning and decision making or that there has been sufficient incorporation of equity and social justice considerations. Only 4% of survey respondents agreed or strongly agreed that equity and social justice considerations have been sufficiently incorporated into SLR planning (Figure 41). Equity considerations were rarely discussed during interviews.
Figure 41: Survey respondents’ level of agreement with statements about SLR public engagement in the Humboldt Bay region (n=101-103). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Additionally, in another survey question that asked coastal professionals about who might be missing from current SLR conversations, the most frequently indicated stakeholder group was the general public (see Section 4.1.2, Missing stakeholders). The coastal professionals I interviewed generally supported these survey results by acknowledging that the region needed to improve community engagement. “I do think that the public engagement is something that needs improvement” (P20) shared one interviewee.

We also asked survey respondents if they have coordinated with agencies/organizations regarding equity and environmental justice considerations into
SLR planning within the past four years. Approximately 18% of respondents were or have been engaged in such coordination efforts; half of the respondents engaged represented the State Government stakeholder category (Figure 42). Of the respondents who were not engaged, 62% were very interested in becoming engaged, 25% were somewhat interested, and 13% were not interested (Figure 43). Environmental justice was only discussed by six interviewees. This interviewee described the importance of incorporating environmental justice in local SLR planning efforts:

“I think for good regional coordination, get an understanding of who the different players and interest groups are, and how to conduct not just outreach but real engagement. Hand in hand with doing that right, you need an explicit recognition of inequities that exist, and access to engaging in processes, and who those processes are framed to help. So really an explicit acknowledgement upfront and consideration of equity issues, I think that's necessary to a successful regional collaboration.” (P26)

Figure 42: Survey respondents' perception of their agency/organization’s engagement over the past four years in collaboratively engaging in SLR equity and environmental justice activities on Humboldt Bay (n=106). Non-engagement is located left of the 0 line, and engagement is located right of the 0 line.
Figure 43: Survey respondents’ perception of their agency/organization’s interest in collaborative SLR equity and environmental justice activities, if not currently engaged (n=69). Level of interest in engagement is located left of the 0 line, and level of interest in engagement is located right of the 0 line.

Public interest

Interviewees discussed both opportunities and challenges related public interest in SLR. Interviewees who shared thoughts on a lack of public interest indicated that they thought disinterest generally stemmed from feelings that “we're getting ahead of ourselves” in terms of reacting to climate change and resistance to change. However, 44% of respondents either agreed or strongly agreed that members of the public were clearly interested in policies and planning to address SLR (Figure 44). “I think we do have an interested and engaged community. And I think that we have planners that want to hear from the community and are looking for ways to get input” (P5) said one interviewee.

Interviewees shared general comments about the opportunity to build on local efforts.

“You can just see how much people care about the strength and the resiliency of their communities and that manifests itself all over the place. And that’s just an impression thing. I mean, we’ve got so many individuals and so many communities that are trying their hardest to do the right thing. And to me, the opportunity is to harness that energy in a positive way. And I think, given our track record, there’s every expectation that we’ll be able to do it.” (P36)

“And I guess one of my goals is to see if there's some way we can find how people can get involved and contribute in some way. And I don’t know what that looks like. I just feel like we're dealing with, you know, people
feeling overwhelmed or feeling despair, like nothing to be done. Or, if we just find a way we can really harness people's interest and not pile them with just web maps that make everything blue.” (P20)

Another opportunity centered on how local environmental groups are good at keeping people engaged on topics. For example,

“The King Tide Photo Initiative [by Humboldt Baykeeper] really helped get the public a lot more engaged. Even if they don't go out and do it, they see it in the paper and hear about it on the radio and then you can't help but see the bay when you're driving around, you don't even have to get out of your car to notice how high it is. So, it's been really a good educational tool.” (P2)

Sharing information in a positive manner as well as continual interaction with the topic of SLR were approaches interviewees saw as opportunities for effective public engagement.

![Figure 44](image)

Figure 44: Survey respondents’ level of agreement with a statement about SLR public engagement in the Humboldt Bay region (n=101). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

Some of the coastal professionals that I interviewed and surveyed represented local industries and business such as fishing, aquaculture, real estate, or agriculture and some owned (or represented people that owned) coastal land vulnerable to SLR.

Interviewees representing Industry and Landowner stakeholder groups directly shared their interest in contributing to community engagement (Table 4). Although they voiced
interest, comments from these participants also indicated that they feel their stakeholder groups have not been consistently or meaningfully included in SLR conversations.

Table 4: Statements of interest in SLR efforts from Industry and Landowner stakeholder interviewees.

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Quotation (participant numbers removed for anonymity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry/Business</td>
<td>“I think the board of directors of Humboldt Association of Realtors would consider this extremely important, and they would make sure that there was somebody who was interested and eager to follow up on this topic.”</td>
</tr>
<tr>
<td>Industry/Agriculture</td>
<td>“My board could have this topic as a standing item on our agenda, that would be a good step forward. I think there’s things that you can do to create kind of like a culture of sea level rise planning if we put forth the effort to do.”</td>
</tr>
<tr>
<td>Industry/Business</td>
<td>“[As a board member overseeing a construction project,] I would be in the position to insist that they plan for the projected sea level rise on a facility like that.”</td>
</tr>
<tr>
<td>Landowner</td>
<td>“But there’s a whole lot of really good people living down here who really care deeply, and I think would pitch in however they could.”</td>
</tr>
</tbody>
</table>

Figure 45 shows results from survey respondents regarding how they would prioritize various SLR public outreach efforts the Humboldt Bay region. No respondent chose “not a priority” for the three public outreach strategies provided in the survey. On average, the highest priority strategy, with 81% of respondents saying it was a high or essential priority, was to create a public engagement process to identify community goals and actions for addressing SLR. Respondents also thought coordinating public outreach strategies to educate residents and business owners regarding SLR impacts and planning efforts was a high priority, with 76% saying it was a high or essential priority. The third strategy, to create a single regional information platform concerning the status of projects and research related to SLR was, on average, a medium-high priority, with 68% saying it
was a high or essential priority. A handful of respondents provided additional comments on public outreach efforts that specified that landowner, business, and agricultural community outreach should be a priority and that public engagement should also focus on schools. Other ideas to improve outreach included engaging people at the sub-watershed level due to diverse land use/management, conducting outreach with experienced organizers and going beyond traditional questionnaires, and partnering with realtors to assist with education through ethical disclosure standards.

Figure 45: Survey respondents’ prioritization for various SLR public outreach efforts in the Humboldt Bay region (n=94-95). Levels of no and low priority are located left of the 0 line, and levels of high and essential priority are located right of the 0 line.
Public trust

Interview comments from multiple stakeholder groups, including Local, State, and Federal Governments, Infrastructure, NGOs, Landowners, and Industry groups, illustrated a lack of trust between governments and the public. “I think between SLR and climate changes the whole region is affected. We kind of need to have representation from everybody. Although building that trust is going to be monumental” (P18) said one interviewee. Some interviewees representing NGOs and Industry stakeholder groups felt that agencies were not inclusive of the public in current planning efforts and were concerned about a lack of transparency, or what happens “behind closed doors.”

Representatives from Local and State Government acknowledged these perceptions as well. One Industry interviewee shared feelings that public engagement may occur just for show,

“I'm not sure that [public stakeholders] are going to have much voice because at the end of the day, [the public agencies] are going to decide whatever they decide. ... [Public stakeholders] should have a voice if they really have a voice, but don't invite them to the table just because you're trying to politically do the right thing.” (Participant number removed for anonymity)

One interviewee indicated that clear communication to the public about complex projects and processes is a challenge that can contribute to perceptions of secrecy and deception which further lead to distrust. They said,

“[SLR projects] will definitely be a public opinion challenge. We've gotten to the point in society where ideas are so complicated, and the problems are so complicated, and the solutions aren't easy to explain in sound bites all the time. And so, while it looks like we're not listening to the public like there's usually like really solid reasons that are fairly complicated as to
why we're not choosing that project alternative, you know. And so, we'll probably have to deal with that a bit.” (P13)

Another approach discussed by an interviewee that they felt further divided the public and agencies was when agencies brought solutions without consulting or involving the public or landowners. They described that assuming how landowner may be managing their land or what a landowner needs can lead to worse outcomes and continued distrust.

**Public perception**

Additional challenges shared by coastal professionals were related to public perception of the risk from SLR. One interviewee described it as a “slow moving emergency” (P27) which was a sentiment shared by many interviewees (see Table 5 for other descriptions). Interviewees described that because SLR was not an issue experienced daily and was perceived as future issue, “it's harder to convince people that they indeed need to spend money on something now that they're probably not going to see the benefits of for a minimum 10, more likely 20 more years” (P40). Another interviewee mentioned the difficulty in educating people who live and work inland about why they should also care about SLR. For example, if waterlines were compromised in Arcata, it could affect McKinleyville residents; or if the Highway 101 was inundated, access between northern and southern Humboldt Bay could become disrupted. The interviewees noted that public outreach should strive to communicate the benefits of SLR adaptation to people who do not live directly on the bay or that would not be immediately impacted by SLR.
Table 5: Descriptions of the pace of SLR from interview participants.

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Quotation (participant numbers removed for anonymity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Government</td>
<td>You know, luckily, it's not just going to sneak up on you tomorrow, like a tsunami. It's going to be there. It's like high blood pressure, you have to get it under control.</td>
</tr>
<tr>
<td>Consultant</td>
<td>SLR is like the steamroller moving at about a mile per hour.</td>
</tr>
<tr>
<td>Federal Government</td>
<td>It's kind of the frog in the pot, raising the waters slowly that you don't recognize the issue. We are seeing some impacts, but because they are growing at a rate that people are adjusting and accommodating over time.</td>
</tr>
<tr>
<td>Industry</td>
<td>I think the challenge of it is just sort of like a slow-moving process. In some ways, sometimes it's pretty fast.</td>
</tr>
<tr>
<td>Infrastructure/CSD</td>
<td>SLR is kind of a slow moving, regional wide disaster you know.</td>
</tr>
<tr>
<td>NGO</td>
<td>SLR is an emergency, but it's a slowly increasing emergency.</td>
</tr>
<tr>
<td>State Government</td>
<td>It's a long-range urgency, it's still an urgency.</td>
</tr>
<tr>
<td>State Government</td>
<td>SLR is like a slow-moving train wreck.</td>
</tr>
</tbody>
</table>

According to some interviewees, the long timeline of SLR and SLR projects makes maintaining public engagement difficult. Planners described having difficulty now with intermittent public engagement on projects, which will be difficult to balance with the anticipated longer timeframe for SLR adaptation projects.

“It's difficult because when we're in planning, we'll do some public interaction, we'll talk with folks and then our project will appear to disappear for a number of years. And then there'll be another public meeting, and people are like, ‘what's this project?’ right. And then it'll disappear for another four or five years and all of a sudden, it's ready to get built and people are like, ‘I never heard of this before, where'd this come from?’” (P24)

said one planner about their current experiences. Another interviewee who mentioned this inconsistency also shared that in their experience landowners are interested to know when project implementation will occur, because “it's hard to focus on [future and uncertain vulnerabilities] when [the landowners] have immediate challenges and immediate
concerns” (P20). A landowner shared a similar perspective from their experience at a public meeting,

“People wanted information and I felt like they really wanted to know what they could do and what was being done. I don’t recall anything terribly specific about ‘Here's what you can do. Here's when we're going to contact you next.’ I don't recall those things.” (Participant number removed for anonymity)

This landowner goes on to describe a similar experience as P24 above, feeling that there was a lack of follow up and consistent communication from the local government which left them and some of their neighbors feeling hopeless and isolated.

Information access

Access to information can be challenging for the public. One landowner said,

“I think I really truly don't feel connected to the alert system [for SLR-related studies and projects], like where do I find out those pieces of information? ... just because right now, going out and taking the time to find out about which public comment period is going on for what project...right now I just haven't had the bandwidth.” (Participant number removed for anonymity)

They then asked if there were any local community groups that focus on SLR issues that may be up to date on projects or planning efforts that they could learn from. Another stakeholder described their interest in attending a SLR meeting, “But I haven't heard of any meetings to go. ... there's certainly enough importance to the world, and enough importance to me that I would pay pretty close attention to them, if I knew about it!” (P44). Interviewees discussed how information was currently disseminated and acknowledged Zoom has allowed wider participation in public meetings, however some members of the public have difficulties accessing or using technology. One coastal professional pondered, “There needs to be a better way to inform people of what's going
on, and not just the bare minimum way, where we’re legally required to notify property
owners. There just should be a more robust program to inform people” (P35).
5.0 DISCUSSION AND RECOMMENDATIONS

5.1 Discussion

Qualitative and quantitative findings from this research can provide insights for the scientific literature on governance and social-ecological systems in the face of climate change as well as insights for SLR planning on Humboldt Bay and in other coastal communities. Although Humboldt Bay coastal professionals have been conducting SLR-related work for over a decade, based on comments from interviewees, as of 2021, there seemed to be little formal decision making and adaptation action by local agencies and organizations. This research may provide some insights as to why as well as recommendations for moving towards coordinated adaptation action.

5.1.1 Social-Ecological Systems (SES) Framework and SLR Coordination

When studying a system, such as Humboldt Bay SLR planning, the SES framework allows for consideration of the interactions and outcomes of that system’s resource units, resource system, governance system, and users/actors. Concentrated efforts have been expended on Humboldt Bay to understand the physical impacts and vulnerabilities of resources to SLR. By utilizing a social science mixed-methods approach, I was able to explore aspects of the governance systems and users/actors on Humboldt Bay to uncover variables related to social challenges and opportunities for effective coordination of SLR planning and adaptation. Such a comprehensive study of SLR adaptation social challenges has not been undertaken on Humboldt Bay before.
Governance and actors account for half of the SES model and my results support the significance of these aspects of a system. Social barriers have the potential to prevent effective adaptation and contribute to stalling or maladaptation. SLR brings many interdisciplinary challenges and social science research could contribute to uncovering patterns and diagnosing problems so that actions and next steps can be developed and implemented.

5.1.2 Humboldt Bay Coordination and Governance

One of the most fundamental findings from this research is that coastal professionals from the Humboldt Bay region overwhelmingly expressed a need for better coordination of SLR planning and adaptation efforts and a need for governance changes in order to sufficiently address SLR impacts and concerns. The Humboldt Bay SLR Adaptation Planning Working Group was the first regional planning effort that helped develop local foundational knowledge and build social capital through co-learning opportunities. However, study participants thought it was missing landowner and public input and lacked actionable outcomes. While its structure may have been sufficient for the time, in order to build on what was learned and move forward, stakeholders may need to evaluate other governance structures that allow for adaptation implementation, shared or simultaneous decision making, fund commitment, and consistent public outreach.

Although study participants supported a variety of governance structures, no clear consensus emerged on which structure would be the best option. Participants thought that leadership should be focused at the state and local level, not at the federal level. Most participants indicated an interest in their organization or agency participating in SLR
planning efforts, but few were interested in leading such an effort. Entities that were most frequently mentioned as potential leaders included Humboldt County, the Humboldt Bay Harbor Recreation and Conservation District, the Cities of Eureka and Arcata, the Coastal Commission, and Caltrans. As for the spatial extent of planning, survey respondents mostly favored a bay-wide planning effort, although interviewees also expressed a need for more specific planning at smaller spatial scales due to the technical complexity of projects. This research did not identify an entity that was willing to lead regional SLR adaptation efforts, had the political will to take responsibility for pushing forward tough adaptation conversations, was willing to build better relationships with other coastal management entities, and that had the resources to dedicate to an effort with no clear path forward and no clear end in sight. The lack of consensus regarding a single lead entity, perhaps also supports the need to build a regional collaborative or coalition of entities so that no single entity carries the responsibilities of encouraging regional dialogue and decision making around adaptation strategies. A regional collaborative or coalition could also better allow for the incorporation of Tribal leadership and co-management authority into SLR planning for Humboldt Bay.

Scholarship along with research findings suggest that in developing a governance structure, coastal planners should consider the importance of nesting scales and ideas to plan across jurisdictions and spatial scales that promote transparent communication and support relationship building. Entities and individual personnel that act as boundary spanners by connecting different stakeholders would promote ongoing adaptation planning and eventual implementation (Archie, Dilling, Milford, & Pampel, 2012; John
Boundary spanners and facilitated conversations between stakeholders are needed to move the governance framework conversation forward to support adaptation action. Boundary spanners could be individuals from outside the adaptation field to provide more diverse thoughts and perspectives, such as community-based organizations working with vulnerable communities or academic institutions.

**Resource challenges**

Consistent with other studies in California, a lack of funding and staff resources was one of the most frequently mentioned challenges to SLR planning and coordination (Lubell, 2017; Moser, Finzi Hart, Newton Mann, et al., 2018; Thorne et al., 2016). Few coastal professionals thought their agency or organization had sufficient funding or staff for SLR planning efforts and generally study participants mentioned that everyone was busy and had different priorities. Survey respondents were interested in coordinating on joint funding applications and sharing resources. Interviewees noted that SLR adaptation projects will be very expensive, so Humboldt Bay communities should start projects sooner rather than later to reduce funding competition with other areas. By coordinating early, local entities could identify priority projects, develop pilot projects, leverage existing funding, and strategize investments to benefit multiple projects and stakeholders.

**Institutional and philosophical differences**

Coastal professionals expressed perceptions of institutional procedural differences as a challenge to regional coordination of SLR planning. For more effective regional planning, the various organizations and entities may need to work together to determine whether and in what ways it might be feasible to develop more coordinated timelines and
decision-making processes. Perhaps imminent projects requiring near-term planning could serve as a useful test, since there are clearer pathways for shorter-term planning projects. Short-term projects could help actors focus on approaches to align procedures and timelines more broadly, or at the least, to help them determine strategies to resolve issues if it is not feasible to conform their processes and procedures. Findings suggest that communication and transparency within entities (e.g., between different departments at the same entity) and across entities may also need to be improved. Small pilot projects could be used to build relationships and communication protocol within and between entities.

Many coastal professionals also shared that they thought current environmental regulations make SLR adaptation difficult. There was a fairly even split of survey respondents who thought environmental regulations did or did not provide an insurmountable barrier to SLR adaptation, with slightly more respondents indicating environmental regulation was a barrier. Some interviewees perceived that SLR changes the status quo and current policies protect the status quo. Static, outdated laws provide challenges to permitting projects and study participants called for more creative approaches that built trust; increased transparency and consistency; and facilitated negotiation of diverse interests. Disagreement on the perceived severity of environmental regulation barriers seemed to contribute to the lack of adaptation action in part, and thus must be resolved in order to move forward. State and federal regulatory agencies have taken some initiative to reduce regulatory hurdles through programs such as CDFW’s Cutting the Green Tape Program or San Francisco Bay Restoration Regulatory
Integration Team (BRRIT); however, efforts such as these were rarely discussed by interviewees. More information is needed on the efficacy, replicability, and scalability of such programs.

An important step in regional coordination and collaboration is working to get stakeholders on the same page in understanding SLR risks and utilizing consistent language when discussing adaptation processes and strategies (Moser & Ekstrom, 2010; Ocean Protection Council, 2018). Local coastal professionals generally noted that locally specific data was a strength of the region. However, my data suggests coastal professionals in Humboldt Bay perceived that local stakeholders had inconsistent definitions of SLR risks, used different SLR projections and timelines or other strategies for planning, and disagreed on actions needed to address SLR impacts. Additionally, study participants were concerned that conflicting values and preferences would prevent agreement in selecting adaptation strategies. That concern was supported by other research that suggests conflicting values and preferences between stakeholders can hinder adaptation planning efforts (Kettle & Dow, 2014b) and can be a contributing factor to disagreement on adaptation actions (Archie et al., 2012; Moser & Ekstrom, 2010; Otto-Banaszak et al., 2011). The combination of disagreement on risks and actions, use of inconsistent information and strategies, and perceived conflicting values could be barriers to regional coordination of adaptation planning and could contribute to delays in agreeing on regional strategies and ultimately, implementing them.

Regionally coordinated adaptation inaction may also stem from how people understand, interpret, and communicate SLR data. SLR provides a challenge due its
uncertainty and its associated long planning horizon (Kettle & Dow, 2014b; Moser, 2005), what some interviewees described as long-term urgency. Although state policy guidance, state technical support, and locally specific data and modeling are helpful, SLR uncertainty allows for varied interpretations of the information. Uncertainty in the data used for planning or a lack of acceptance in data projections can be a barrier to adaptation planning and has been used by experts as a reason to delay planning (Kettle & Dow, 2014b; Moser, 2005). Similar to findings from a past local study of coastal manager needs (Thorne et al., 2016), study participants stated needs for more data, updated models, and consistency between local stakeholders to help advance regional planning.

5.1.3 Behavior of Actors

In California, SLR adaptation projects involve input and approval from multiple federal, state, and local authorities, making coordination and collaboration critical. Efficient coordination between levels of government and scientific disciplines, decision making authorities, and land and asset owners allows for resource and information sharing, encourages open and transparent communication, and builds consistent leadership and trust (Kettle & Dow, 2014b, 2014a; Measham et al., 2011). Study participants identified both opportunities and challenges with local leadership in regard to regional SLR planning. They stated that local political leaders were good at listening and acting on public concerns and thought SLR was a priority issue; however, leadership could contribute to inconsistent direction and slow critical momentum due to turnover and capacity issues. Scholars have found that due to the long-term and interdisciplinary nature of SLR planning, leaders or champions are needed at multiple levels of
government and staff positions as well as across sectors in order to sustain SLR adaptation momentum (Ford & King, 2015; Moser & Ekstrom, 2010).

Additionally, interviewees suggested that the individual actors in positions of leadership can derail SLR planning effort when they act on personal interests or are uninterested in collaborating, explaining the reason why friendly relationship building between stakeholders is so important for the success of regional planning. This may be especially relevant for smaller rural communities with fewer personnel working on a given effort. Interviewees generally felt that existing relationships between coastal professionals helped local SLR planning due to the accessibility of individual actors and personal connections they share. This finding also supports the importance of social-ecological actor-related variables within adaptation process (J. A. Ekstrom & Moser, 2014; Moser & Ekstrom, 2010).

Interviewees generally seemed to feel a sense of personal responsibility for SLR adaptation and had personal interest in the topic. It may be possible that the feeling of personal responsibility reinforced the importance of personal relationships in SLR planning and adaptation efforts. Authenticity and trust of individuals and entities were cross-cutting themes that emerged in conversations about public engagement, staff capacity/consistency, environmental regulations, leadership, and data uncertainties. Similar to other research (J. A. Ekstrom & Moser, 2014), this study on Humboldt Bay suggests the critically important role of actor-related barriers (i.e., leadership, communication, trust, understanding) in adaptation planning and therefore the importance of social science research in advancing adaptation.
5.1.4 Public Engagement

Involving the community in SLR planning can help decision-makers prioritize strategies based on stakeholder needs and values which in turn builds public support for adaptation strategies and builds resilient communities (Akerlof et al., 2016; Yusuf et al., 2018). Local coastal professionals recognized the importance of educating and gaining public support for these potentially contentious projects. Study participants thought the public was interested in engaging in this topic.

However, few coastal professional respondents thought public engagement to date had been sufficient or effective, nor had it incorporated equity and justice considerations. Future planning efforts need to improve engagement with the public, especially shoreline landowners, improve access to SLR-related information, and work on authentically engaging the community in order to build trust.

One interviewed landowner noted how overwhelming it was to wade through information and meeting invitations; and since they felt they could not keep up, they were deterred from further engaging on the subject. Coastal professionals will need to consider how to communicate information and what information is communicated in order to more effectively engage the public. Understanding the social values of various public stakeholders could aid in developing more efficient outreach and equitable outcomes (Graham et al., 2013).

A high level of perceived risk can motivate and help prioritize adaptation actions (J. Ekstrom et al., 2011; Kettle & Dow, 2014b). The majority of surveyed Humboldt Bay coastal professionals and the surveyed general public viewed SLR as an existing and
imminent impact to the region. One factor in local acceptance of SLR could be due to
direct flooding experiences by the community. There are many places around Humboldt
Bay where community members can observe flooding, especially during king tide events.
Direct experience of climate risks and extreme events has been shown to decrease
political polarization over climate issues and increase the relative importance of climate
adaptation for individuals and communities (Berrang-Ford et al., 2011; Cain et al., 2020;
Ford & King, 2015).

5.2 Recommendations

The following recommendations, based on my research, may help to inform
future SLR planning and coordination efforts led by state and local agencies and
organizations.

5.2.1 Recommendations for Humboldt Bay

Develop a funded coordination framework for the governance of multi-
jurisdictional SLR planning

This research identified a demonstrated need and interest in coordinating SLR
planning throughout Humboldt Bay. Coordinated SLR planning efforts should consider
the social-ecological health of the entire Humboldt Bay, while also incorporating
watershed-level or hydrologic unit-level planning efforts, which are needed to understand
the unique geophysical, ecological, and social attributes of an area and proposed project.
The coordination framework should consider how to develop consistency between
agencies, Tribes, and organizations including timeframes or triggers for implementation,
language standards, and a shared understanding of risks (and/or understanding of where definitions differ); however, it should also value differences in stakeholder needs as adaptation will need to balance competing interests. The framework should establish clear expectations for who is the lead; who is involved; what types of projects or locations need cross-collaboration; when and why their involvement is necessary; as well as outline a clear process for working together including understanding decision-making processes between agencies/organizations. These measures could help stakeholders’ understanding of whether key decisions need to be made before others can proceed with their planning or implementation.

In developing this coordination framework, discussions should be prioritized with local Tribes regarding their interest in taking a shared leadership role or preferred level of involvement in SLR adaptation planning, especially since Wigi (Humboldt Bay) is the Wiyot Tribe’s ancestral territory. Additionally, Tribal ecological knowledge spans much longer temporal scales than traditional western science and general planning; finding ways to incorporate long-term perspectives will be important when planning over such a long time horizon.

The use of neutral facilitators should aid in this process of developing a regional coordination framework to ensure the process stays on track and all stakeholder voices are heard and needs are considered. A professional, neutral facilitator could help develop protocol for and implement conflict resolution or dispute mediation, if needed. Furthermore, for the coordination effort to be sustained and not derailed by other political priorities, it needs personnel who can dedicate time to stay informed of SLR best
available science and facilitate more consistent communication and information sharing between Humboldt Bay entities. This is likely not a one-person job but would require coordinators at multiple agencies and organizations to help bridge between actors and reduce the burden on any single entity. Support at the state level for multiagency coastal adaptation task forces could enable this work and ingrain it into various job descriptions. The use of neutral facilitators and multiple coordinators, dedicated to tracking forward progress, could help Humboldt Bay stakeholders move past planning and into adaptation implementation.

The establishment of a regional coordination framework could also assist with lifting resource barriers. Strong coordination could facilitate the strategic planning of regional projects in order to make the best use of various funding streams. Local partnerships for funding could be mutually beneficial and help the region secure more funding. The region should also prioritize preventative planning in order to reduce potential future costs. According to the Natural Hazard Mitigation Saves 2017 Report, each $1 spent on mitigation saves an average of $6 in future disaster response costs (Multihazard Mitigation Council, 2017).

More research is needed to understand why stakeholders might not agree on risks or on the definition of the issue, which will ultimately be important for understanding how to build capacity for decision making and action (California Coastal Commission, 2018b; Moser & Ekstrom, 2010). Future efforts should also look into the perception of shared and conflicting values between stakeholders or jurisdictions on Humboldt Bay. Actors will have to balance individual institutional values and priorities with collective
interests and benefits of working together. Additional inquiry could help uncover what information is needed to assist in building agreement among stakeholders.

In order to promote negotiation and compromise, the risks and benefits of participating in joint decision making and negotiating areas of disagreement, must be understood by all stakeholders involved. It is unlikely an entity would reasonably participate in negotiation if the negotiated agreement does not leave them somehow better off than the status quo. SLR planning and the governance system that facilitates regional coordination would need to include incentives to support individual jurisdictions to consider collective action to address vulnerability and adaptation interdependencies. Participation is also unlikely if entities do not perceive that the effort would actually achieve adaptation action (i.e., attending many meetings that do not end in actionable next steps). Opportunities for joint gains and the benefits and costs of collaborating may need to be discussed first to determine whether, despite stated interest, collaboration is feasible.

**Improve public engagement and prioritize environmental justice**

My research results support the assertion that SLR-related public engagement needs improvement. Effective public engagement is needed because SLR issues are complex, difficult to address, and will occur over a lengthy time frame. Perhaps one way to accomplish more beneficial public engagement is by creating more of a “culture of SLR planning” by bringing SLR topics into public-facing conversations more regularly, celebrating community strengths and successes, and avoiding scare tactics. Improving access to and accessibility of information could help educate the public about SLR
adaptation planning processes, improve environmental literacy, and increase transparency which can help build public trust. Community engagement generally only accounts for 2-3% of a climate adaptation project’s budget (Chang, 2018), if it is even included in the project. More attention to and funding for community engagement is needed in order to build public support and acceptance of adaptation projects. Improved engagement could occur through implementing targeted environmental education campaigns, engaging the public early and often, providing clear follow through and follow up from public meetings, and hiring skilled facilitators to guide the public and agencies through community-based planning processes, decision making and consensus building exercises. These ideas could help to increase avenues for public understanding and transparency within the SLR adaptation planning process and ultimately help build trust.

Improving public engagement could assist in supporting goals for SLR adaptation planning to enhance environmental and social justice as well, which the majority of respondents thought were not currently adequately incorporated into planning efforts. Research demographics showed that 78% of the coastal professional study participants were white and a majority were males over 45 years of age. In order to promote more equity in planning, coastal professionals should carefully consider who is in the room and who is making decisions. A more diverse pool of coastal professionals (working for local, state, and federal entities with authority over coastal resources) may be better equipped to develop equitable and inclusive SLR adaptation strategies. Other local research has also found a lack of adequate community engagement in Humboldt Bay and noted the importance of assessing community perceptions of potential adaptation strategies.
(Kunkel, 2019). Additional research, like Kunkel’s, could help inform the implementation of more effective public engagement that focuses on the unique values and needs of specific communities around Humboldt Bay.

**Build trust, transparency, and empathy to improve stakeholder relationships**

Based on interview and survey responses from this study, good individual relationships between coastal professionals seemed to be a strength for the region; however, there also seemed to be a perceived lack of trust between some critical stakeholders, namely landowners, regulatory agencies, and LCP jurisdictions. To maintain or improve these relationships, actors should develop more empathy, honesty, and transparency. Relationship building with landowners may include reaching out to and actively listening to them often and early in a planning process. Work on SLR related topics can be daunting, challenging, and feel like a heavy responsibility, an orientation shared by landowners who face the prospect of losing their land. Interviewees generally shared many commonalities: their love for Humboldt Bay, the environment, and the community. Actors can build trust and relationships by identifying shared interests and values and common ground between stakeholders, rather than solely focusing on areas of disagreement.

**Conduct pilot projects**

Small-scale pilot projects should be used to jumpstart local action, develop productive relationships, and provide education on potential multi-jurisdictional and landowner engagement processes. Pilot projects may provide a low-risk opportunity to test the feasibility of coordination strategies as well as physical adaptation
implementation strategies. Most entities on Humboldt Bay have limited resources, both time and funds, therefore projects should carefully consider how to best respect project stakeholder limitations in participating in pilot projects, such as by providing stipends to participating organizations and landowners. Pilot projects may require less funding, and if organized strategically, could be leveraged for additional funding opportunities. Additionally, pilot projects should have a strong commitment to evaluating the process in order to learn and improve for future efforts and could provide opportunities to develop educational partnerships with Cal Poly Humboldt and other schools for long-term monitoring and research.

5.2.2 Recommendations for State and Federal Agencies

Provide resources to local agencies and organizations

Study results show that local agencies and organizations need to increase staffing and financial capacity in order to effectively address new challenges brought about by SLR and other climate hazards. Funding and staff resources were among the most frequent challenges noted by Humboldt Bay coastal professionals and interviewees requested assistance from state and federal resources, but additional resources are also necessary, such as assistance with meeting facilitation and trust building. While grants can fill funding gaps, they are often short-term and do not assist with increasing staff resources over the long-term on a timeline commensurate with the long horizon of SLR planning. State and federal governments should consider developing programs or financing mechanisms to increase staff capacity, such as helping regions or local governments to hire permanent staff to manage the extra work of climate mitigation,
including the extra effort it may take to coordinate planning between governments. The State of California has made significant strides recently in this effort with the approval of billions of dollars for climate action projects, including funding for local capacity building, regional coordination, and providing technical support for vulnerable communities (Office of Governor, 2021). Federal hazard mitigation assistance programs currently provide funding to reduce community vulnerabilities and local governments participate in hazard mitigation planning established by FEMA, which could be evaluated as a future incentive or template for SLR planning.

**Prioritize finding solutions to perceived regulatory hurdles**

Slightly more coastal professionals agreed than disagreed that existing environmental laws and regulations presented an insurmountable barrier or obstacle to SLR adaptation. Laws and regulations may need to be modified to accommodate adaptation to changing climate hazards or communication may need to be improved regarding how to approve realistic adaptation projects and remove barriers to action in a more timely and costly efficient manner. While interviewees discussed challenges related to the permitting processes of several state and federal agencies (CDFW, RWQCB, USACE, USFWS, etc.), challenges associated with the California Coastal Commission were discussed most frequently and with the most passion.

While part of the regulatory barrier results from legal requirements and precedents, the social context surrounding permitter-permittee adversarial relationships should also be addressed. Innovation and flexibility are stifled by power struggles and distrust; therefore, work should be conducted to build trust and empathy between federal
and state regulatory entities and local government. Identifying a shared mission and vision for Humboldt Bay could contribute to that effort since entities on both sides of regulatory challenges have shared missions in serving public interests, such as protecting the health of Humboldt Bay. Authentic efforts need to be concerted from all entities in order to productively move projects forward towards real action.

While local agencies and organizations identified additional funding and staffing needs, state entities also need additional resources to address perceived regulatory barriers more effectively and to work with local entities more efficiently. For example, due to the large amount of California Coastal Commission state retained jurisdiction on Humboldt Bay, more resources may be needed for the Commission’s State and North Coast offices in order to increase capacity to be more responsive to local needs. The Commission may need to take a larger role in Humboldt Bay SLR planning or relinquish or alter its responsibility so adaptation action can be accomplished in a manner consistent with the expected timing of SLR impacts and unique local needs. More research is urgently needed to understand the unique challenges related to state retained jurisdiction on Humboldt Bay and its intersection with the already complex process of adaptation planning.

Consider local context

State and federal regulatory agencies are tasked with balancing local needs with the potential to set larger precedents that could negatively impact other communities or resources. However, state and federal agencies need to consider local nuances, assets, and barriers when working with communities to adapt to SLR. For example, Humboldt Bay
has unique SLR challenges in that the shoreline contains many vulnerabilities to existing conditions and most of the vulnerable land is within state retained jurisdiction which reduces local control over future projects. As discussed above, the condition of state retained jurisdiction will require more coordination between the Coastal Commission and local governments than in other areas of the state.

Finally, Humboldt Bay’s current vulnerabilities may require swifter adaptation responses that consider current and future conditions. Permitting SLR projects on a project-by-project basis may be too slow for the scale of adaptation projects and efforts needed. State regulatory agencies should work with local stakeholders to develop faster processes for approval of priority adaptation projects once regional stakeholders develop trusted processes to determine local SLR adaptation priorities.
Overall, coastal professionals in the Humboldt Bay community indicated an interest in and need for engaging in regionally coordinated SLR planning. Elinor Ostrom (2007) noted that “We should stop striving for simple answers to solve complex problems.” The results from this work underscore Ostrom’s observation. SLR planning encounters many governance and actor-related challenges that do not have simple solutions. While professionals agree on many of the risks and immediacy of SLR impacts as well as the need to coordinate, few had clear ideas regarding what that process or governance structure should look like. Findings suggest the need for a SLR coordination governance structure that works across different scales, that builds accountability and trust, and that can be flexible and adaptive. Research suggests that the Humboldt Bay community has many of the right variables to further their adaptation planning such as leadership advocating for public interest, trust and friendly relationships between different sectors and entities, high perceived risk due to experiencing storm events, and locally specific data.

The Humboldt Bay community, as well as other coastal communities, will also need to work towards sustainable management of complex problems brought about by SLR. These problems cannot be solved by simple solutions and will require the development of iterative and long-term processes. Communities can build towards this process through the development of sustainable governance systems that balance the needs of various stakeholders by providing equitable outcomes as well as the
development of social systems that build trustworthy relationships between stakeholders to promote the considerations of collective impacts from SLR and SLR adaptation actions. Because human interactions and dynamics strongly contribute to challenges and opportunities for collaborative adaptation, social science research and considerations are needed to help inform the development of governance systems, social networks, and ultimately adaptation strategies.
REFERENCES


Office of Governor. (2021). "Governor Newsom Signs Climate Action Bills, Outlines Historic $15 Billion Package to Tackle the Climate Crisis and Protect Vulnerable


cultural-landscape-investigation-Rohde-2020


U.S. Census Bureau. (2019). American Community Survey 5-year estimates. Retrieved from Census Reporter Profile page for Census Tract 1, 2, 3, 4, 5, 6, 8, 9, 10, 11.01, 13, 107, and 108, Humboldt, CA.


Figure GIS References


October 27, 2020.


APPENDIX A

Appendix A: Compilation of SLR Documents and References for Humboldt Bay

Appendix A has been included as an attachment on the thesis webpage at Cal Poly Humboldt Digital Commons “Thesis/Projects from 2022” and on the Cal Poly Humboldt Sea Level Rise Initiative Digital Commons “Local Reports/Publications” page (https://digitalcommons.humboldt.edu/hsuslri_local/39).
APPENDIX B

Appendix B: Interview Guide

INTERVIEW GUIDE

Project Title: Social science research to advance regional coordination and collaboration of sea level rise (SLR) adaptation and planning on Humboldt Bay
PI: Kristen Orth-Gordinier; Master’s Advisor: Laurie Richmond

Interviews were semi-structured, meaning that the order of the questions could shift depending on the nature of the conversation. There were follow-up questions related to topics of interest. However, the interviews all followed this basic guide and structure.

Topics and Questions for Semi-structured Interviews

- Demographics focusing on personal and professional connection to HB
  - How long have you lived here?
  - What are the main projects in your purview?
- Past Experiences
  - What SLR work have you been involved in to-date?
    - How did that go? What worked/didn’t work? Why?
  - Were you involved in the 2013-2016 SCC regional SLR Adaptation planning Working Group?
    - If so, how did that go? What worked/didn’t work? Why?
- Current Experiences
  - What is your/your agency’s main role in SLR planning?
  - What data/information do you use to make SLR planning decisions?
  - If there are any, what are some current gaps in your SLR planning effort? What do you feel your organization needs in order to be successful?
- Values
  - How does it feel to be a planner/community leader dealing with SLR challenges?
  - What are your goals/priorities for SLR planning/implementation?
  - Do you feel supported in your goal/mission?
    - If not, what’s missing? What would you need to do this successfully?
- Barriers
  - What do you see as major barriers and challenges to successful regional SLR planning?
  - What are some barriers to your participating in regional SLR efforts?
- What would you need to become involved?

- Coordination
  - What does the term “regional coordination” mean to you?
  - In what ways does your agency/organization currently coordinate or collaborate with other agencies/organizations on SLR planning?
    - What are some of the challenges or benefits to that effort?
  - In your opinion, who do you think should lead a regional SLR coordination effort?
    - And who should lead permitting efforts? ...implementation? ...funding?

- Opportunities
  - What do you see as opportunities that could make Humboldt Bay successful in planning for and adapting to SLR?
Appendix C: Interview Code List

**INTERVIEW CODE LIST**

**Project Title:** Social science research to advance regional coordination and collaboration of sea level rise (SLR) adaptation and planning on Humboldt Bay  
**PI:** Kristen Orth-Gordinier; Master’s Advisor: Laurie Richmond  
This code list was developed from interview transcripts using Atlas.ti (version 9.1.7.0) and a grounded theory approach. “Number of quotations” refers to the number of times each code was attributed to an interviewee quote.

<table>
<thead>
<tr>
<th>Code</th>
<th>Number of Quotations</th>
</tr>
</thead>
<tbody>
<tr>
<td>APWG: After</td>
<td>3</td>
</tr>
<tr>
<td>APWG: General</td>
<td>28</td>
</tr>
<tr>
<td>APWG: Negatives</td>
<td>26</td>
</tr>
<tr>
<td>APWG: Not Involved</td>
<td>8</td>
</tr>
<tr>
<td>APWG: Positives</td>
<td>50</td>
</tr>
<tr>
<td>Challenge: &quot;Coordination&quot;</td>
<td>14</td>
</tr>
<tr>
<td>Challenge: agencies in different stages</td>
<td>23</td>
</tr>
<tr>
<td>Challenge: Climate Change Skeptic</td>
<td>23</td>
</tr>
<tr>
<td>Challenge: Coastal Commission/wetland fill/retained juris</td>
<td>148</td>
</tr>
<tr>
<td>Challenge: Communication</td>
<td>37</td>
</tr>
<tr>
<td>Challenge: competing interests</td>
<td>14</td>
</tr>
<tr>
<td>Challenge: Consistent Data/Model</td>
<td>13</td>
</tr>
<tr>
<td>Challenge: Control, turf</td>
<td>13</td>
</tr>
<tr>
<td>Challenge: Decision making authority</td>
<td>33</td>
</tr>
<tr>
<td>Challenge: different views/premise, opinions</td>
<td>37</td>
</tr>
<tr>
<td>Challenge: differing strategies</td>
<td>17</td>
</tr>
<tr>
<td>Challenge: Diverse/many stakeholders</td>
<td>26</td>
</tr>
<tr>
<td>Challenge: Funding</td>
<td>68</td>
</tr>
<tr>
<td>Challenge: Implementation Logistics</td>
<td>1</td>
</tr>
<tr>
<td>Challenge: imposing projects/solutions/top-down</td>
<td>2</td>
</tr>
<tr>
<td>Challenge: Individuals/relationships</td>
<td>31</td>
</tr>
<tr>
<td>Challenge: inter-department coordination</td>
<td>9</td>
</tr>
<tr>
<td>Challenge: It's hard/difficult</td>
<td>11</td>
</tr>
<tr>
<td>Code</td>
<td>Number of Quotations</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Challenge: Lack of Data</td>
<td>5</td>
</tr>
<tr>
<td>Challenge: Lack of resources</td>
<td>11</td>
</tr>
<tr>
<td>Challenge: Landowners/Community/Public Engagement</td>
<td>69</td>
</tr>
<tr>
<td>Challenge: Language/Standards</td>
<td>11</td>
</tr>
<tr>
<td>Challenge: Large Scale of the issue</td>
<td>5</td>
</tr>
<tr>
<td>Challenge: Leadership</td>
<td>17</td>
</tr>
<tr>
<td>Challenge: Liability/legality</td>
<td>10</td>
</tr>
<tr>
<td>Challenge: limited area</td>
<td>4</td>
</tr>
<tr>
<td>Challenge: Meeting fatigue</td>
<td>14</td>
</tr>
<tr>
<td>Challenge: narrow view</td>
<td>5</td>
</tr>
<tr>
<td>Challenge: Negative attitude</td>
<td>1</td>
</tr>
<tr>
<td>Challenge: New Science</td>
<td>11</td>
</tr>
<tr>
<td>Challenge: NR impacts</td>
<td>10</td>
</tr>
<tr>
<td>Challenge: order of operations</td>
<td>3</td>
</tr>
<tr>
<td>Challenge: out of the loop</td>
<td>4</td>
</tr>
<tr>
<td>Challenge: Personal interests, agenda, personalize</td>
<td>7</td>
</tr>
<tr>
<td>Challenge: Planning to Implementation</td>
<td>39</td>
</tr>
<tr>
<td>Challenge: Pointing Fingers</td>
<td>21</td>
</tr>
<tr>
<td>Challenge: Policies &amp; Laws</td>
<td>49</td>
</tr>
<tr>
<td>Challenge: Politics</td>
<td>41</td>
</tr>
<tr>
<td>Challenge: Priorities</td>
<td>43</td>
</tr>
<tr>
<td>Challenge: property rights</td>
<td>11</td>
</tr>
<tr>
<td>Challenge: Public Opinion</td>
<td>8</td>
</tr>
<tr>
<td>Challenge: RC skeptic, disagreements</td>
<td>4</td>
</tr>
<tr>
<td>Challenge: Risk tolerance</td>
<td>17</td>
</tr>
<tr>
<td>Challenge: rural, small community (low priority comparative to urban centers)</td>
<td>7</td>
</tr>
<tr>
<td>Challenge: RWQCB</td>
<td>8</td>
</tr>
<tr>
<td>Challenge: short term planning</td>
<td>4</td>
</tr>
<tr>
<td>Challenge: Staff Capacity</td>
<td>52</td>
</tr>
<tr>
<td>Challenge: stakeholder not at the table/missing</td>
<td>5</td>
</tr>
<tr>
<td>Challenge: Status quo</td>
<td>38</td>
</tr>
<tr>
<td>Challenge: Timeline/Long-term Issue</td>
<td>112</td>
</tr>
<tr>
<td>Challenge: Trust?</td>
<td>32</td>
</tr>
<tr>
<td>Challenge: Turnover</td>
<td>16</td>
</tr>
<tr>
<td>Challenge: Uncertainty of path forward</td>
<td>35</td>
</tr>
<tr>
<td>Challenge: Vulnerable Areas</td>
<td>19</td>
</tr>
<tr>
<td>COVID</td>
<td>37</td>
</tr>
<tr>
<td>How does it feel?</td>
<td>85</td>
</tr>
<tr>
<td>Code</td>
<td>Number of Quotations</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Need: Coordination</td>
<td>8</td>
</tr>
<tr>
<td>Needs: Champion</td>
<td>13</td>
</tr>
<tr>
<td>Needs: Commitment/Partnerships/Trust</td>
<td>11</td>
</tr>
<tr>
<td>Needs: Consistency</td>
<td>19</td>
</tr>
<tr>
<td>Needs: dedicated staff</td>
<td>4</td>
</tr>
<tr>
<td>Needs: Education</td>
<td>14</td>
</tr>
<tr>
<td>Needs: engineering efforts</td>
<td>5</td>
</tr>
<tr>
<td>Needs: Funding</td>
<td>16</td>
</tr>
<tr>
<td>Needs: interest, the will</td>
<td>8</td>
</tr>
<tr>
<td>Needs: listening</td>
<td>8</td>
</tr>
<tr>
<td>Needs: Patience, time</td>
<td>1</td>
</tr>
<tr>
<td>Needs: Personnel</td>
<td>8</td>
</tr>
<tr>
<td>Needs: Pilot Projects</td>
<td>3</td>
</tr>
<tr>
<td>Needs: Policy Changes</td>
<td>20</td>
</tr>
<tr>
<td>Needs: Practical/Implementation Guidance</td>
<td>14</td>
</tr>
<tr>
<td>Needs: Public Engagement, Input</td>
<td>10</td>
</tr>
<tr>
<td>Needs: retreat space</td>
<td>1</td>
</tr>
<tr>
<td>Needs: Science/Data</td>
<td>36</td>
</tr>
<tr>
<td>Next Steps: Adaptation Strategies</td>
<td>3</td>
</tr>
<tr>
<td>Opportunity: Affordable</td>
<td>2</td>
</tr>
<tr>
<td>Opportunity: Belief that SLR exists</td>
<td>18</td>
</tr>
<tr>
<td>Opportunity: Big Problems get attention</td>
<td>6</td>
</tr>
<tr>
<td>Opportunity: Communication</td>
<td>2</td>
</tr>
<tr>
<td>Opportunity: Community Interest/Engagement</td>
<td>29</td>
</tr>
<tr>
<td>Opportunity: Diverse Stakeholders/perspectives</td>
<td>15</td>
</tr>
<tr>
<td>Opportunity: Dredge/Sediment reuse</td>
<td>13</td>
</tr>
<tr>
<td>Opportunity: emergency permit</td>
<td>3</td>
</tr>
<tr>
<td>Opportunity: Excitement, buy-in</td>
<td>8</td>
</tr>
<tr>
<td>Opportunity: few development at risk</td>
<td>2</td>
</tr>
<tr>
<td>Opportunity: Few Stakeholders</td>
<td>9</td>
</tr>
<tr>
<td>Opportunity: fun/enjoyable to coordinate/work with others</td>
<td>1</td>
</tr>
<tr>
<td>Opportunity: Funding</td>
<td>41</td>
</tr>
<tr>
<td>Opportunity: Geographic Area</td>
<td>26</td>
</tr>
<tr>
<td>Opportunity: Habitat Enhancement</td>
<td>20</td>
</tr>
<tr>
<td>Opportunity: HSU</td>
<td>12</td>
</tr>
<tr>
<td>Opportunity: Improve safety</td>
<td>2</td>
</tr>
<tr>
<td>Opportunity: Incentives</td>
<td>12</td>
</tr>
<tr>
<td>Opportunity: Individuals/Relationships/trust</td>
<td>63</td>
</tr>
<tr>
<td>Opportunity: Job creation/Economy</td>
<td>8</td>
</tr>
<tr>
<td>Code</td>
<td>Number of Quotations</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Opportunity: Leadership</td>
<td>23</td>
</tr>
<tr>
<td>Opportunity: levees</td>
<td>10</td>
</tr>
<tr>
<td>Opportunity: Local Studies/Data/Modeling</td>
<td>39</td>
</tr>
<tr>
<td>Opportunity: make things better</td>
<td>12</td>
</tr>
<tr>
<td>Opportunity: Multi-benefit</td>
<td>9</td>
</tr>
<tr>
<td>Opportunity: Permit Streamlining</td>
<td>5</td>
</tr>
<tr>
<td>Opportunity: Pilot Projects/Examples</td>
<td>40</td>
</tr>
<tr>
<td>Opportunity: Projects with SLR/flooding adaptation needs now</td>
<td>21</td>
</tr>
<tr>
<td>Opportunity: rely on partners (due to limited resources)</td>
<td>2</td>
</tr>
<tr>
<td>Opportunity: share info</td>
<td>6</td>
</tr>
<tr>
<td>Opportunity: shared goals</td>
<td>16</td>
</tr>
<tr>
<td>Opportunity: staffing</td>
<td>1</td>
</tr>
<tr>
<td>Opportunity: State/Fed Involvement</td>
<td>31</td>
</tr>
<tr>
<td>Opportunity: steps/incremental change</td>
<td>1</td>
</tr>
<tr>
<td>Opportunity: Tribe</td>
<td>9</td>
</tr>
<tr>
<td>Opportunity: unified, got other local entities backs</td>
<td>4</td>
</tr>
<tr>
<td>Opportunity: unique NRs</td>
<td>2</td>
</tr>
<tr>
<td>Opportunity: Work well together</td>
<td>20</td>
</tr>
<tr>
<td>Quotes</td>
<td>112</td>
</tr>
<tr>
<td>RC Structure</td>
<td>63</td>
</tr>
<tr>
<td>RC Structure: Lead</td>
<td>33</td>
</tr>
<tr>
<td>RC: Funding</td>
<td>17</td>
</tr>
<tr>
<td>RC: General coordination thoughts</td>
<td>2</td>
</tr>
<tr>
<td>RC: General Thoughts</td>
<td>140</td>
</tr>
<tr>
<td>RC: IDK</td>
<td>15</td>
</tr>
<tr>
<td>SLR is happening</td>
<td>9</td>
</tr>
<tr>
<td>SLR Planning: Prioritizing Enough?</td>
<td>55</td>
</tr>
<tr>
<td>SLR Planning: Time</td>
<td>48</td>
</tr>
<tr>
<td>Topic: Aldaron</td>
<td>90</td>
</tr>
<tr>
<td>Topic: Age</td>
<td>18</td>
</tr>
<tr>
<td>Topic: Agriculture</td>
<td>63</td>
</tr>
<tr>
<td>Topic: Balance/compromise</td>
<td>80</td>
</tr>
<tr>
<td>Topic: benefit of this research/talking</td>
<td>2</td>
</tr>
<tr>
<td>Topic: Bridge</td>
<td>1</td>
</tr>
<tr>
<td>Topic: cascading impacts</td>
<td>6</td>
</tr>
<tr>
<td>Topic: Climate Change</td>
<td>11</td>
</tr>
<tr>
<td>Topic: Community Identity</td>
<td>20</td>
</tr>
<tr>
<td>Topic: Contamination</td>
<td>1</td>
</tr>
<tr>
<td>Topic: Creativity/innovation</td>
<td>31</td>
</tr>
<tr>
<td>Code</td>
<td>Number of Quotations</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Topic: Economy</td>
<td>27</td>
</tr>
<tr>
<td>Topic: Education</td>
<td>23</td>
</tr>
<tr>
<td>Topic: Environmental Justice</td>
<td>17</td>
</tr>
<tr>
<td>Topic: Existing/past Coordination Programs</td>
<td>82</td>
</tr>
<tr>
<td>Topic: Facilitation/Meetings</td>
<td>26</td>
</tr>
<tr>
<td>Topic: Groundwater</td>
<td>10</td>
</tr>
<tr>
<td>Topic: Humboldt Bay specifics</td>
<td>12</td>
</tr>
<tr>
<td>Topic: Information Sharing</td>
<td>14</td>
</tr>
<tr>
<td>Topic: Landowners</td>
<td>49</td>
</tr>
<tr>
<td>Topic: Levee</td>
<td>31</td>
</tr>
<tr>
<td>Topic: local control</td>
<td>4</td>
</tr>
<tr>
<td>Topic: Meeting types</td>
<td>10</td>
</tr>
<tr>
<td>Topic: one size fits all approach</td>
<td>9</td>
</tr>
<tr>
<td>Topic: Ongoing Learning</td>
<td>16</td>
</tr>
<tr>
<td>Topic: Ownership/Responsibility</td>
<td>9</td>
</tr>
<tr>
<td>Topic: Power</td>
<td>9</td>
</tr>
<tr>
<td>Topic: Protect</td>
<td>2</td>
</tr>
<tr>
<td>Topic: Public Engagement</td>
<td>16</td>
</tr>
<tr>
<td>Topic: Respect</td>
<td>10</td>
</tr>
<tr>
<td>Topic: Retreat</td>
<td>46</td>
</tr>
<tr>
<td>Topic: Safety</td>
<td>2</td>
</tr>
<tr>
<td>Topic: Shoreline Structures</td>
<td>8</td>
</tr>
<tr>
<td>Topic: SLR planning ideas</td>
<td>77</td>
</tr>
<tr>
<td>Topic: SLR Projects</td>
<td>35</td>
</tr>
<tr>
<td>Topic: SLR/Flood Experiences</td>
<td>27</td>
</tr>
<tr>
<td>Topic: State Involvement</td>
<td>19</td>
</tr>
<tr>
<td>Topic: stormwater, stream/river flooding</td>
<td>1</td>
</tr>
<tr>
<td>Topic: thresholds/triggers</td>
<td>5</td>
</tr>
<tr>
<td>Topic: Transportation</td>
<td>20</td>
</tr>
<tr>
<td>Topic: Unique</td>
<td>5</td>
</tr>
<tr>
<td>Topic: Urgent</td>
<td>11</td>
</tr>
<tr>
<td>Topics: other threats (earthquake, tsunami)</td>
<td>4</td>
</tr>
<tr>
<td>Your Role</td>
<td>76</td>
</tr>
<tr>
<td>Your Strength: Different Perspective</td>
<td>9</td>
</tr>
<tr>
<td>Your Strength: Example projects</td>
<td>2</td>
</tr>
<tr>
<td>Your Strength: Funding</td>
<td>5</td>
</tr>
<tr>
<td>Your Strength: Good Relationships</td>
<td>14</td>
</tr>
<tr>
<td>Your Strength: Guidance</td>
<td>3</td>
</tr>
<tr>
<td>Your Strength: Important</td>
<td>4</td>
</tr>
<tr>
<td>Code</td>
<td>Number of Quotations</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Your Strength: Interdisciplinary</td>
<td>1</td>
</tr>
<tr>
<td>Your Strength: Lobbying, political will</td>
<td>1</td>
</tr>
<tr>
<td>Your Strength: Multi-agency Cooperation</td>
<td>8</td>
</tr>
<tr>
<td>Your Strength: Personnel, interest</td>
<td>22</td>
</tr>
<tr>
<td>Your Strength: Provide input</td>
<td>3</td>
</tr>
<tr>
<td>Your Strength: Public education</td>
<td>3</td>
</tr>
<tr>
<td>Your Strength: Represent at State level</td>
<td>4</td>
</tr>
<tr>
<td>Your Strength: Science</td>
<td>8</td>
</tr>
<tr>
<td>Your Strength: Support, assistance</td>
<td>11</td>
</tr>
</tbody>
</table>
APPENDIX D

Appendix D: Survey Instrument

Appendix D has been included as an attachment on the thesis webpage at Cal Poly Humboldt Digital Commons “Thesis/Projects from 2022.”
Appendix E: Survey Results Report

Appendix E has been included as an attachment on the thesis webpage at Cal Poly Humboldt Digital Commons “Thesis/Projects from 2022” and on the Cal Poly Humboldt Sea Level Rise Initiative Digital Commons “Local Reports/Publications” page (https://digitalcommons.humboldt.edu/hsuslri_local/40).