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Regional governance solutions for sea-level rise adaptation: Perspectives from Humboldt Bay, California

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ABSTRACT

Sea-level rise (SLR) is a complex challenge which could require the development of new special-purpose governance arrangements that allow for better coordination across jurisdictions and levels. This paper explores perspectives related to regional coordination for SLR adaptation in Humboldt Bay, California. Humboldt Bay is experiencing one of the fastest rates of SLR on the West Coast and exists in a complex regulatory environment with over 20 government entities, three Tribes, and numerous community members and groups connected to the issue. Through a mixed-methods approach that included 46 semi-structured interviews with and a survey of 107 coastal professionals connected to the Bay, we sought to capture local perspectives related to the barriers and opportunities for SLR adaptation, potential regional governance solutions for SLR, and the incorporation of community and equity considerations into SLR planning. Respondents identified several barriers including competing priorities and timelines, ineffective communication, lack of funding and capacity, and the strictness and inflexibility of environmental regulations and permitting processes. There was near universal agreement among respondents that some form of regional coordination on SLR was necessary, but views on the best governance framework were murkier. There was most support for establishing a formal collaborative partnership among local government entities and least support for creating a new authority with concerns that it could siphon time and funding and create an additional layer of bureaucracy. Most respondents preferred the planning authority to be under shared local and state control and preferred coordination to occur on a bay-wide scale, perhaps nested with planning at other scales. Respondents consistently brought up a need for a neutral facilitator to support coordination and they indicated a need to better incorporate community engagement and equity considerations. Findings reveal that development of novel arrangements related to climate governance needs careful consideration as there are potential advantages and drawbacks to new approaches. Development of these frameworks should not be a top-down process foisted upon local areas, but rather be a more bottom-up process designed and led by local actors with a stake or jurisdiction in the specific climate planning process.

1. Introduction

Climate change adaptation is a complicated challenge crossing institutional, geographic, scalar, and even temporal boundaries. A range of scholarship has explored governance arrangements best suited for the development of timely, effective, and equitable climate change adaptation in the face of such uncertainty and complexity (e.g. Lubell et al., 2021; Margerum and Robinson, 2015; Mukheibir et al., 2013; Termeer and Dewulf, 2014). Numerous scholars espouse the importance of multi-level governance systems to address environmental challenges.

According to Termeer et al. (2010, p.29), multi-level governance systems are those that emphasize, “the threefold displacement of state power and control: (1) upwards to international actors and organizations, (2) downwards to regions, cities, and communities, and (3) outwards to civil society and non-state actors (Pierre and Peters, 2000). Governing is then interpreted as a process of continuous interactions among governments and private entities, operating at, and between, several administrative levels and ultimately aiming at the realization of collective goals.”

While multi-level governance systems may best fit to address

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problems that span scalar and jurisdictional boundaries, a key cost or challenge inherent in these systems relates to inefficiencies in coordinating across the different levels or jurisdictions (Termeer et al., 2010). One issue in coordination is that of policy incoherence where the policy frameworks or goals among levels or jurisdictions do not align (Jordan and Lenschow, 2010; Scobie, 2016; Smith et al., 2022). Overall, the need to coordinate among so many different actors, levels, and policy frameworks can produce inefficiencies, conflict, and compromises which can result in less ideal or watered-down decisions and the slowing or even lack of action (Scharpf, 1997; Hooghe and Marks, 2003; Termeer et al., 2010). This is a crucial challenge, particularly in cases where timely action is needed as in climate adaptation.

Many scholars have explored avenues to improve coordination, reduce inefficiencies, and match problem scale in multilevel governance. One such solution posited is the development of multilevel arrangements or “special-purpose governance units that cut across jurisdictions” (Carlisle and Gruby 2017, p 928; Termeer et al., 2010; McGinnis and Ostrom, 2011; Ostrom, 2005; Ostrom, 1990; Dietz et al., 2003). These arrangements can span a range of alternatives from formal to informal or permanent to temporary. The literature emphasizes the importance of designing coordination frameworks that best fit the context of the places and issues they are meant to address (Termeer and Dewulf, 2014; Ostrom, 2009; Ostrom, 1990).

Several scholars have noted the unique governance challenges of sea-level rise (SLR) adaptation (e.g. Abel et al., 2011; Pinto et al., 2018; Lubell and Robbins 2021; Measham et al., 2011; Moser, 2005). Smith et al. (2022) observe that the policy environment related to coastal hazards is especially complex because it crosses the land-sea interface and is governed by disparate policy frameworks related to both contexts. SLR crosses scalar and governmental levels with international, federal, state, and local nexuses all driving the problem and potential solutions (Kettle and Dow, 2014; Lubell et al., 2021; DeLorme et al., 2016). Additionally, SLR and coastal flooding are slippery; easily crossing political and jurisdictional boundaries. For example, coastal flooding in one jurisdiction can contribute to flooding in another. SLR protection strategies such as sea walls or levees in one jurisdiction can transport wave energy, erosion, or other impacts to another (Dugan et al., 2011). Given these complexities, scholars question whether current governance arrangements are appropriate for addressing the unique nature of SLR (Lubell and Robbins, 2022; Pierson, 2000).

Scholars and practitioners alike have begun to consider whether SLR in itself might require the development of new special-purpose governance arrangements that allow for better coordination across jurisdictions and levels (Kettle and Dow, 2014; Lubell et al., 2021; Lubell and Robbins 2021). The state of California has shown interest in developing regional governance arrangements related to climate change and SLR (e.g. AB 11: Climate Change: Regional climate change authorities; SB 852: Climate resilience districts). As various jurisdictions explore the development of special-purpose governance units or multilevel arrangements related to regional SLR adaptation they must consider many factors. At best, a special-purpose unit could bring disparate governance frameworks together to make adaptation planning and implementation more efficient and effective. At worst, a new governance arrangement could contribute an additional layer of bureaucracy that further slows climate action while siphoning away additional resources and staff time. Important considerations could include: the appropriate scale of the unit, the structure and formality of the arrangement, membership and leadership within the arrangement, and the role of Tribes, stakeholders, scientists, and the public (Termeer et al., 2011; Termeer and Dewulf, 2014). To match the local context and be effective and equitable, the development of any new SLR governance structures should be informed by the perspectives of planners, practitioners, Tribes, scientists, and community members within the region of interest (Termeer et al., 2011; Hügel and Davies, 2020).

This paper focuses on considerations related to SLR governance on Humboldt Bay or Wigi - the Wiyot name for the bay which is part of the

ancestral territory of the Wiyot People. Humboldt Bay is the second largest enclosed bay in California, located on the rural north coast, and surrounded by the 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). Due to tectonic processes in the region, the land surrounding Humboldt Bay is subsiding as seas are rising, causing it to experience the fastest rate of relative SLR in all of California, if not the entire West Coast (Patton et al., 2023). The region should expect about 1 ft of SLR by 2040; 1.5 ft by 2060; and 2.5 ft by 2080 (Ocean Protection Council SLR Guidance, 2024; Intermediate Scenario; Fig. 1). Future SLR has the potential to affect important community resources including: residential housing; community businesses; transportation infrastructure; agricultural lands; Tribal cultural resources; natural communities and habitats; recreational facilities; contaminated sites; and utilities and wastewater infrastructure (Richmond et al., 2023; Brown et al., 2024). In addition to posing a future threat, coastal flooding is also a challenge in the present as much of the shoreline is protected by aging dikes and railroad beds at risk of breaching and several parts of the Bay, including multiple residential communities, already currently experiencing intermittent coastal flooding during some of the highest tides of the year (Richmond and Kunkel, 2024; Laird, 2018).

Humboldt Bay is governed by a patchwork of local, state, and federal entities with sometimes conflicting missions and priorities. Coastal planning entities from the region have begun to consider the development of regional governance frameworks related to SLR coordination and planning across the Bay. The Humboldt County government received a grant from the California Coastal Commission (CCC) to explore the feasibility of sea-level rise regional planning and in these efforts they have explored the viability of various governance options (Humboldt County, 2023). We conducted social science research to help inform these discussions. Using a mixed methods approach that included a survey (n = 107) and semi-structured interviews (n = 46) with coastal professionals in the region, we explored the following research questions:

- (1) What are local perceptions of SLR planning to date and views of potential barriers and opportunities related to SLR planning and coordination on Humboldt Bay?
- (2) What are local preferences related to potential SLR governance arrangements for Humboldt Bay?
- (3) What are local views related to the incorporation of community, stakeholder, and equity considerations into SLR planning efforts?

Results from this work can inform Humboldt Bay efforts related to SLR coordination and can also provide insights related to effective governance frameworks for SLR, climate adaptation, and other complex environmental challenges that cross jurisdictions and levels.

2. Humboldt Bay and multi-level governance

The state of California is known to have some of the strictest environmental laws and governance processes in the United States (Vogel, 2019). While these policy frameworks have delivered numerous benefits in terms of environmental and coastal protection; some have questioned whether the complex regulatory environment has also become a barrier impeding the timely implementation of environmental and socially beneficial projects such as those related to ecological restoration, climate mitigation, affordable housing, and climate adaptation (California Landscape Stewardship Network, 2020; Carlin and Farabee, 2011). Projects within the California coastal zone – a stretch of land generally about 1000 yards inland from the mean high tide – are even more strictly regulated due to the California Coastal Act. Passed in 1976, the Coastal Act formed a state agency related to coastal management - the CCC - and required that all development within the zone receive a Coastal Development Permit (CDP) by complying with additional

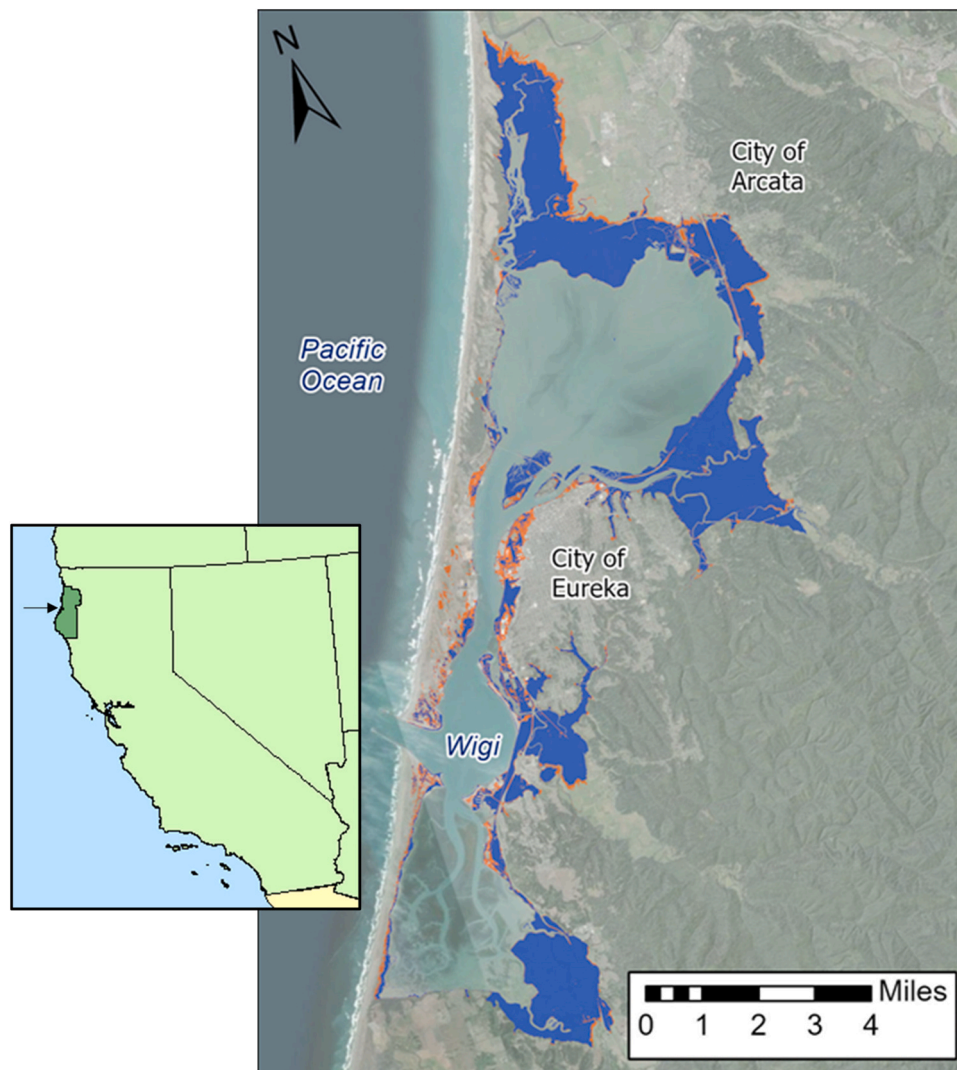


Fig. 1. Maps of Humboldt Bay or Wigi showing (a) its location within the state of California and (b) sea-level rise inundation areas with 0.5 m (1.6 feet - approximately 2060, intermediate scenario) (in blue) and 1.0 m (3.2 feet - approximately 2090, intermediate scenario) (in orange) of relative sea-level rise. One mile is approximately 1.6 kilometers.

guidelines specific to the coast.

Given this context, SLR adaptation and planning in California and Humboldt Bay specifically occur within one of the more complex regulatory environments in the United States. [Table 1](#) provides an overview of some of the different levels and entities connected to SLR adaptation and planning processes in Humboldt Bay. There are multiple entities with local jurisdiction over development and planning on certain lands and tidelands around the Bay: a county, two cities, a regional Harbor District, and four federal or state agencies with land holdings around the Bay. Within the framework of the Coastal Act, city and county governments can develop Local Coastal Programs (LCPs) related to development and planning in their coastal zones. Once the CCC approves those LCPs, the local governments have the authority to issue CDPs on their lands within the coastal zone. All three local governments have LCPs, but the CCC retains primary CDP permitting authority over former tidelands which include many coastal lands in Humboldt Bay, creating areas of overlapping jurisdiction between the state (CCC) and local governments ([CCC, 2022a](#)). This means that the CCC is acting on multiple levels: both setting policy on a state scale and controlling local development processes in areas of retained jurisdiction (gray areas in [Fig. 2](#)). Most SLR adaptation strategies would occur in these areas, so the CCC would play a large oversight role in SLR adaptation processes in the

region.

There are also numerous federal and state agencies who have a stake in SLR adaptation processes on the Bay. These agencies connect in two broad ways: first providing regulatory oversight related to the implementation of SLR adaptation strategies where they control the issuance of permits related to wetlands, endangered species, water quality, and more. In these processes they can decline to issue permits and halt a project or can require modifications or mitigation components which can increase the cost and timeline related to implementation but can also improve the environmental and social outcomes from the projects. Second they set priorities related to SLR and provide funding opportunities. Indeed much of the initial planning and implementation related to SLR on the Bay has been funded by state and federal sources. Additional entities control aspects of infrastructure around the Bay – notably Caltrans which has jurisdiction over planning and implementation related to major roadways and transportation corridors that surround the bay.

Three area Tribes have crucial connection to SLR adaptation processes in the region as the Bay is a part of their ancestral territory. Tribal consultation occurs on SLR projects regionally, as required by state and federal law. Additionally, the Tribes are interested in playing a leading role in planning for the future of the Bay. Indeed local Tribes are already

Table 1

Descriptions of the different entities connected to SLR planning in Humboldt Bay and various levels of governance. Not to be considered a complete list.

Level of governance	Entities	Description
International	United Nations Framework Convention on Climate Change Intergovernmental Panel on Climate Change	International entities form agreements to reduce GHG and future SLR and also provide science to inform local projections for SLR.
Tribal	Wiyot Tribe Blue Lake Rancheria Bear River Band of the Rohnerville Rancheria	Humboldt Bay is part of the ancestral territory of the Wiyot People descendants of whom are part of three area Tribes. Tribes have consultation rights on development and planning. Currently coastal lands owned by Tribes are fee simple so still overseen by local planning frameworks. Tribes assert the right to a leadership role in planning for the future of coastal resources within their ancestral territories.
Federal	Bureau of Land Management Federal Emergency Management Agency National Oceanic and Atmospheric Administration US Army Corps of Engineers US Department of Agriculture-Natural Resources Conservation Service US Fish & Wildlife Service	Federal entities set policies and funding related to flooding impacts and mitigation and provide regulatory oversight of wetlands and endangered species impacts from SLR adaptation strategies. Several federal agencies own and manage land surrounding the Bay.
State	California Coastal Commission California Department of Fish and Wildlife California Geological Survey California State Coastal Conservancy California Department of Transportation Humboldt County Resource Conservation District North Coast Regional Water Quality Control Board Ocean Protection Council Office of Planning and Research State Lands Commission	State entities oversee local government planning programs in the coastal zone; have authority over development in submerged and tidelands; set funding and strategy related to SLR; have regulatory authority related coastal development and potential impacts from SLR adaptation strategies. The CCC has retained jurisdiction on some coastal lands in the Bay so is the primary coastal permitting authority on those lands over the county/cities.
Regional	California Department of Transportation District 1 Community Service Districts Humboldt Bay Municipal Water District Humboldt Bay Recreation, Conservation & Harbor District Humboldt County Association of Governments PG&E Redwood Coast Energy Authority	Several entities oversee development and maintenance of community infrastructure, some of which may be impacted by SLR. Additionally, the Humboldt Bay Recreation, Conservation & Harbor District has permit authority for some development within the tidally influenced areas of Humboldt Bay.
Local	Humboldt County City of Arcata City of Eureka	Three local governments have jurisdiction related to planning and permitting activities on certain lands and resources within and surrounding Humboldt Bay.
Community	Non-governmental Organizations Residents Business Owners Land Owners Agricultural Operators Recreationalists & Cultural Practitioners	Numerous local non-governmental entities in the region have a stake in SLR planning and potential outcomes from SLR. Several local organizations have played a key role in SLR and climate planning for the area and

Table 1 (continued)

Level of governance	Entities	Description
	Private Consultants Scientists/Academics/ University	advocate for various resources and livelihoods. Scientists and academics play a role in understanding SLR processes and implications to inform best practices.

leading efforts related to SLR planning and restoration - developing climate adaptation plans, acquiring and restoring coastal lands, and leading SLR planning efforts (Richmond et al., 2023; Helvarg, 2020; Savage, 2022). Local tribal staff members have said that Tribes “should have a front seat at the table” when tackling complex issues like climate change and SLR (Canter, 2024). However, Tribes only own a small portion of coastal lands around Humboldt Bay; cities and counties maintain jurisdiction and they have not often included Tribes as partners or drivers in their SLR adaptation planning efforts. There are also many members of the wider community who have a stake in local SLR planning processes including residents, land and business owners, the general public, academic institutions, and environmental organizations who have played a large role in bringing attention to SLR and supporting initiatives related to adaptation and planning. International frameworks and science inform understanding of global climate change processes and SLR impacts and local scientists can provide important information about the potential implications of SLR and effectiveness of various adaptation strategies (Richmond et al., 2023)

Efforts at regional coordination related to SLR on Humboldt Bay have progressed in fits and starts. In 2013 there was an effort funded by the California State Coastal Conservancy for local planners and scientists to coordinate on assessment and planning related to SLR that resulted in the formation of a “Humboldt Bay SLR Adaptation Planning Working Group,” but that group disbanded in 2016 when state funding ran out. At the time of this research, most SLR planning around the Bay was occurring in siloed fashion with each jurisdiction developing their own SLR plans for their lands and coordinating in a more informal and ad hoc fashion as specific projects and efforts warranted it. However there has been a recognition about the need for better coordination and push to consider various coordination strategies. Better coordination could: (1) ensure that jurisdictions are coordinating to address SLR on Humboldt Bay holistically and to make sure that planned strategies work together and do not deliver negative impacts to other areas; (2) help to streamline regulatory processes related to implementation by including regulatory agencies early in planning phases and ensuring the proposed adaptation measures are likely to be approved or supported by regulatory bodies; (3) provide a venue for Tribes, members of the public, and other stakeholders to meaningfully participate in SLR planning. The CCC has been supportive of bay-wide coordination, funding Humboldt County to explore feasibility options and stating that they would prefer to see bay-wide planning for SLR prior to approving individual one-off SLR adaptation projects in individual jurisdictions (California Coastal Commission, 2022a; California Coastal Commission, 2022b).

3. Methods

This research drew from a mixed-methods approach that included document review, semi-structured interviews, and a survey. The goal of the study was to capture the perspectives of individuals who had some connection to SLR or coastal planning processes within Humboldt Bay and could comment on past planning and potential future governance scenarios. To identify interview and survey participants we used the concept of “coastal professionals” defined by Moser et al. (2018) as “individuals involved in [...] coastal resource management, conservation, and protection from coastal hazards”. We used document review, local knowledge, and the expertise of local SLR planners to develop a

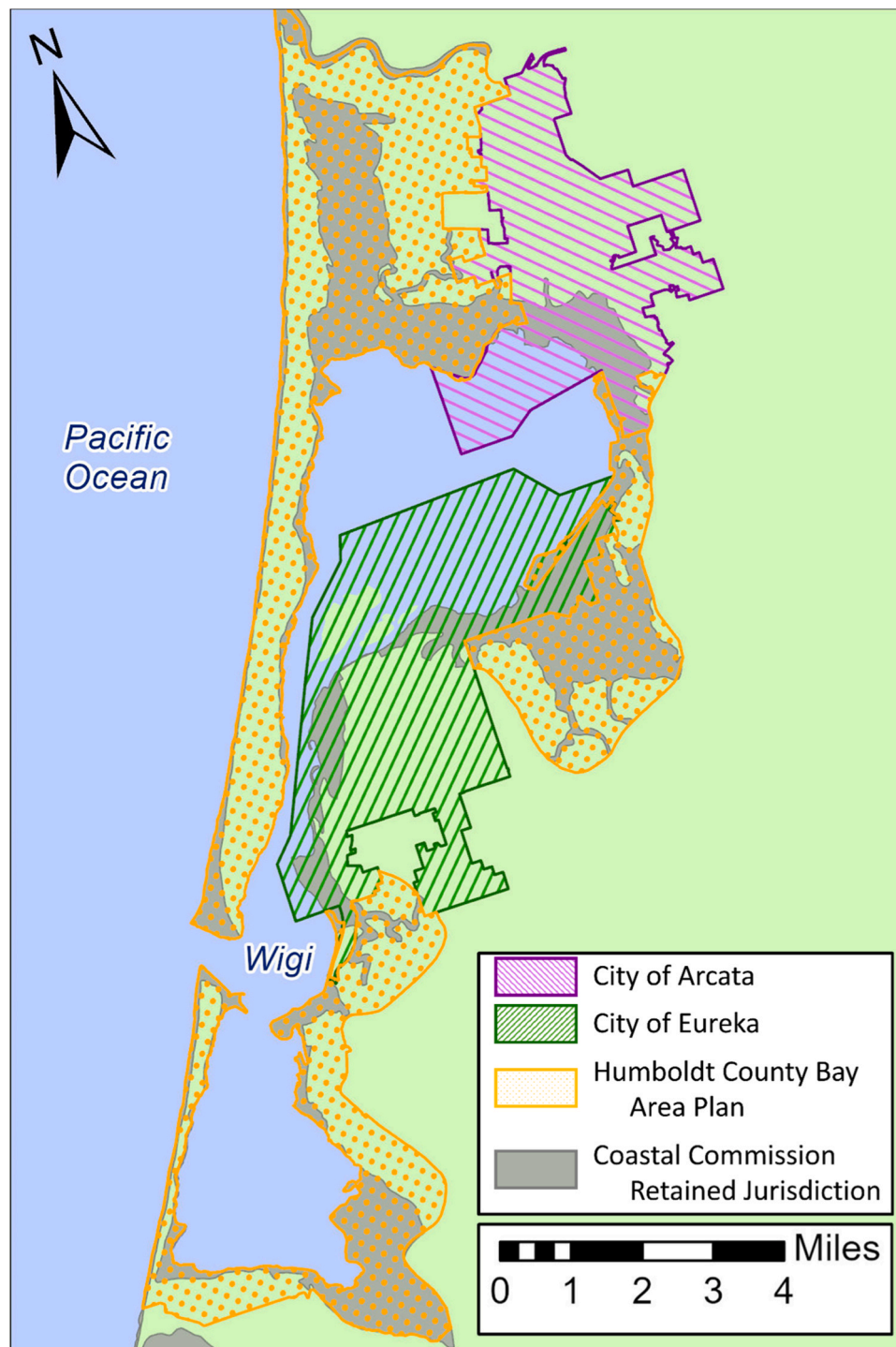


Fig. 2. Map of Humboldt Bay or Wigi showing some of the key jurisdictional boundaries: Humboldt County's Humboldt Bay Area Plan Local Coastal Program Area; City of Arcata and City of Eureka city limits; and Coastal Commission Retained Jurisdiction areas. One mile is approximately 1.6 kilometers.

master list of entities and individuals involved in SLR activities and reached out to all possible individuals for participation in the survey and to a subset of those individuals for participation in interviews. Efforts to map these entities were later incorporated into a stakeholder catalog published by Humboldt County (Richardson et al., 2022). Participants in the survey and interviews included representatives from most of the levels and entities listed in Table 1, with the exception of those operating at international scales. Human subjects research proceeded under Humboldt State University IRB 19–163. Additional information about methods can be found in Orth-Gordinier (2022) and Orth-Gordinier

et al. (2022) as well as the Supplemental Materials (SM).

3.1. Document review

To begin the research, we collected, reviewed, and collated documents and data related to SLR in Humboldt Bay. This included a total of 81 documents from local ($n = 41$), state ($n = 25$), and federal ($n = 15$) sources across the years 2005–2021 (SM:A). All documents were added to the Cal Poly Humboldt Sea Level Rise Institute's document repository making them better organized and accessible to the community.

Information about the documents can be found in the SM and [Laird and Orth-Gordinier \(2021\)](#). Documents were reviewed for information related to SLR science, policy, jurisdiction, and coordination and informed the development of interview and survey instruments.

3.2. Semi-structured interviews

Study author Orth-Gordinier conducted all 46 semi-structured interviews with coastal professionals connected to SLR issues on the Bay between March and October of 2020. [Table 2](#) provides a list of the stakeholder categories of interview participants. Interviews followed a general question guide (SM:B) that could vary depending on the position of the participant and the flow of the conversation. Interview topics included: 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. Due to the context of the COVID-19 pandemic most interviews were conducted via video conferencing or over the phone. If the interviewee granted permission, interviews were recorded and a transcript was generated; if not, the interviewer took detailed notes for later analysis.

3.3. Survey

We conducted an online survey of coastal professionals in 2021. We coordinated with Humboldt County on the design of the survey so responses could directly inform their Regional Coordination Feasibility Study. The survey consisted of 35 questions related to topics including the demographics of participants; their experience with SLR planning; their involvement in collaborative activities in the past; their views of SLR planning efforts to date; and their interest and preferences related to future governance or collaborative activities (SM:E). In developing survey questions we drew from relevant literature, other climate-change related surveys in California, and findings from semi-structured interviews and document review.

We used SurveyMonkey to distribute the survey to collect responses because an online format was suitable for the target population. We

Table 2

Number of interview participants and survey respondents from various stakeholder categories and levels of governance. Note: some interview participants represented multiple stakeholder groups so the total number of people interviewed is lower than the sum of the numbers from the various categories.

Level of governance	Stakeholder category	Number of interviewees	Number of survey respondents
Federal	Federal Government	4	4
Tribal	Tribal Government	1	7
State	State Government	11	25
Regional	Regional District or Association or Special District	3	9
	Infrastructure, Service Provider, and/or Community Services District	5	9
Local	City Government	8	12
	County Government	5	5
Community	Non-Governmental Organization	2	12
	Landowner	4	0
	Trade/Business/Industry Group	6	4
	Private Sector Consultant	4	12
	Academia/Research	0	7
Other		0	1
Total Number of Respondents		46	107

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. We sent the survey to 297 individuals and received 107 complete responses for a response rate of 36 %.

Respondents represented 11 stakeholder categories and 47 agencies/organizations ([Table 2](#)). There were seven respondents connected to Tribal governments. A complete list of reported affiliations can be found in [Orth-Gordinier et al., \(2022\)](#). Overall, survey respondents demonstrated knowledge and experience related to SLR. Only 8 % of respondents reported that they had never done related work. 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. Of the respondents who answered a question about their race or ethnicity (14 % declined to answer); 91 % selected white; 5 % selected American Indian, Native American, or Alaska Native; 2.5 % selected Asian or Asian American; and 2.5 % selected Hispanic or Latino.

3.4. Analysis

Information from the document review was used primarily to inform the development of interview and survey questions and to provide an understanding of the science and policy context related to SLR locally. We used standard social science qualitative analysis techniques to analyze the semi-structured interview data ([Newing et al., 2011](#)). We exported all interview transcripts to the qualitative analysis software Atlas.ti. We iteratively 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. We developed 191 codes based on 2234 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 SM:C for full code list). To protect confidentiality, we assigned a number to each participant (e.g., P1, P2, P3), which are used throughout this paper. For analysis of survey data, we ran basic descriptive statistics for each survey question using Microsoft Excel (version 2110) and created figures using Microsoft Excel (version 2110) and R Core Team (version 2019). When citing descriptive statistics from Likert scale questions we generally lump them into groups of agreement (strongly agree and agree) and disagreement (strongly disagree and disagree) while providing the statistics from each level or agreement in parenthesis after it is mentioned. Complete results for survey questions can be found in [Orth-Gordinier et al., \(2022\)](#).

4. Results

4.1. Challenges and opportunities related to SLR governance in Humboldt Bay

In the interviews and survey, we asked respondents to reflect on the history and future of SLR planning on Humboldt Bay and to consider some of the potential challenges and opportunities related to SLR governance and coordination in the broader Humboldt Bay region. [Table 3](#) provides a summary of some of the key challenges and opportunities discussed along with examples from interviews and survey responses. Overall respondents presented numerous challenges related to effective governance and coordination including those related to competing priorities and timelines, ineffective communication, lack of funding and capacity, and the strictness and inflexibility of environmental regulations and permitting processes. Respondents also highlighted opportunities or strengths in the region, many stemming from the fact that Humboldt Bay is in a relatively rural and small community

Table 3

Perceived challenges and opportunities related to SLR governance and coordination in the Humboldt Bay region expressed in interviews and survey responses.

Issue	Example Interview Quotes	Survey Results
CHALLENGES		
Perceived differences in problem definition and adaptation approaches	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. (P36)	Very few 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.
Long planning horizon and uncertainty/lack of agreement related to SLR science	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. [...] 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. (P19)	Respondents were fairly evenly distributed between agreeing (32 %), feeling neutral (32 %), and disagreeing (34 %) that stakeholders agree on risks posed by SLR.
Disjointed planning timelines among jurisdictions/ entities	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) 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)	N/A
Ineffective communication between and within entities	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)	40 % of respondents thought there was not clear communication between agencies/ organizations about their SLR planning efforts, 18 % of respondents felt there was clear

Table 3 (continued)

Issue	Example Interview Quotes	Survey Results
Competing priorities within and between entities	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. (P25)	communication, and 42 % of survey respondents felt neutral
	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. 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) 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)	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
Environmental laws, regulations, and permitting processes	[I wish 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 permissible. (P21) 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 slope's a lot shallower which means you're filling even more wetland. (P13)	39 % of respondents agreed, 31 % were neutral, and 29 % disagreed when asked if they thought that existing environmental laws and regulations present an insurmountable barrier/ obstacle to SLR adaptation. 49 % of respondents thought it was a high or essential priority to develop regulatory solutions to allow for wetland fill for the purpose of SLR adaptation. 64 % of 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.

(continued on next page)

Table 3 (continued)

Issue	Example Interview Quotes	Survey Results
Funding, resources, & staff capacity	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. (P38) 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) 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 get extra time to take this stuff on and they had plenty to do before [SLR] was a duty. (P19) 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)	71 % of respondents did not feel that their agency or 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.
High implementation costs	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)	
OPPORTUNITIES		
Broad regional agreement that SLR is an important issue	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	71 % of respondents thought that SLR was already affecting the Humboldt Bay region and 0 % of respondents thought SLR impacts would never occur. 58 % of respondents agreed, 28 % were neutral, and 14 %

Table 3 (continued)

Issue	Example Interview Quotes	Survey Results
Staff find work on SLR fulfilling & engaging	bay. It's already here. Nobody here is like debating there's an issue, there's always been an issue, we developed on a floodplain. (P15) 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)	disagreed that leadership within a respondent's agency/ organization was making SLR adaptation planning a priority. Over 65 % of respondents felt SLR work was engaging and fulfilling and almost 75 % of interview participants who discussed their specific feelings about performing SLR-related work used positive terms to describe the work.
Strong personal relationships and history of collaboration in this rural region	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) 23 interviewees, representing all except for one stakeholder group, commented on existing relationships as opportunities.	43 % of respondents agreed that they trust other stakeholders, 47 % were neutral, and 10 % disagreed.
Strong public interest in SLR planning	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)	44 % of respondents either agreed or strongly agreed that members of the public were clearly interested in policies and planning to address SLR.

where people know each other and have an investment in environmental issues and SLR planning. Many interviewees pointed to the fact that groups have coordinated effectively on SLR planning in the past through the Humboldt Bay SLR Adaptation Planning Working Group and many described that effort in a positive light. As regional partners look to develop regional SLR governance solutions, they will want to consider structures that help to address and overcome those challenges while drawing from the strengths.

4.2. Perceptions of potential regional governance and coordination strategies

4.2.1. 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 of survey respondents agreed (22 %) or strongly agreed (73 %) with the statement that SLR planning and adaptation success requires coordination between local governments, Tribes, management agencies, and the public; 5 % were neutral on the statement and 0 % of respondents disagreed. Interviewees corroborated these sentiments 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.

Survey and interview responses indicated that many coastal professionals do not feel the current governance system on Humboldt Bay is sufficient for addressing SLR. When asked to rank their level of agreement with the statement the current governmental institutional structure is sufficient for addressing SLR impacts and concerns 50 % of respondents disagreed (8 %) or strongly disagreed (43 %) while only 12 % agreed (9 %) or strongly agreed (3 %). Interviewees described how the regulatory complexity in the coastal zone has made SLR planning a challenge with one person stating “there’s just a lot more that goes into SLR projects. If you’re away from the water, projects can be a little bit more simple” (P11). Another stated that progress on SLR adaptation has been a challenge because, “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).

Results showed that coastal professionals believed that the development of regional governance and planning in the Humboldt Bay region was a high priority. When we asked survey respondents how they would prioritize the creation of an overarching regional SLR adaptation plan for Humboldt Bay, the 80 % respondents thought it was an essential (40 %) or high (39 %) priority, 10 % thought it was a medium priority, and just 4 % designated it a low priority. No respondents said it was not a priority at all. When asked about developing a formal regional management or governing structure for SLR the results were slightly more dispersed but still showed a high prioritization with 56 % indicating it as an essential (27 %) or high (29 %) priority; 23 % designating it as medium; 6 % as low; and just 3 % as not a priority at all.

Combined these results indicated that as a whole coastal professionals agreed that coordination is necessary and seemed to support the development of more formal regional planning or governance related to SLR adaptation on the Bay. However, when we asked them specifics about what regional governance should look like the results

became a bit murkier.

4.2.2. Perceptions of potential governance structures or models

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 (Fig. 3). 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. 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.

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. One participant responded simply, “I mean, I just don’t know at this point... I don’t think any of us know” (P5).

Interviewees made statements of support and opposition to the four

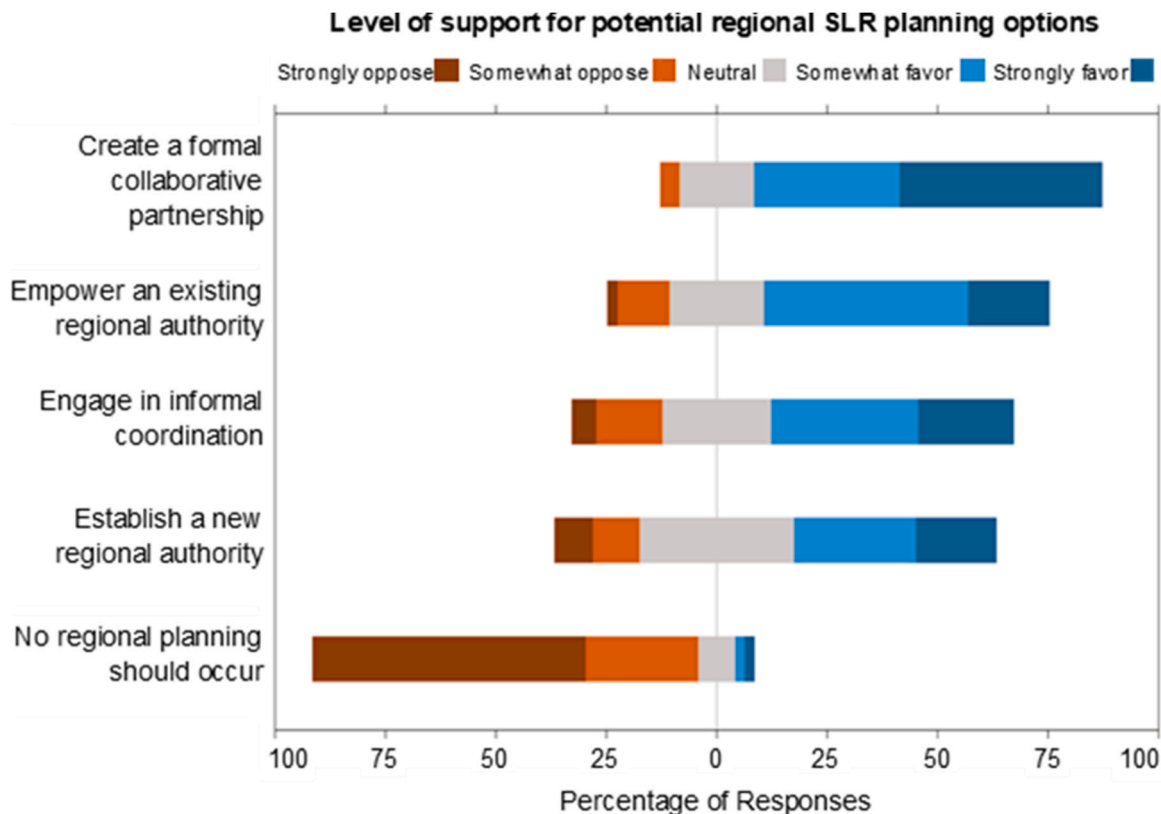


Fig. 3. Survey respondent initial support for or opposition to various strategies for regional coordination of SLR planning (n = 93–94). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

proposed regional governance options (see: SM:D). 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 areas vulnerable to SLR, participants cited concerns about empowering existing agencies due to current lack of funding, staff capacity, or expertise. The main concerns around creating an entirely new entity were the complexity of creating and maintaining it and the potential for added bureaucracy. One respondent said, “The last thing that we need is another regulatory authority to address these things. I think that that is just asking for more [oversight] we have enough oversight of it” (P29). 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 with whom to contact and engage.

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).

4.2.3. Views on leadership in regional governance

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 shared local and state control, while 19 % preferred local-only control and 14 % preferred state-only control (Fig. 4). 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).

In addition to asking about the planning authority, we asked survey participants about how involved they believed their agency should be in a regional SLR planning effort. As shown in Fig. 5, most respondents indicated that their agency/organization should participate (55 %) or should be involved in a mix of participation and leadership (26 %). 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

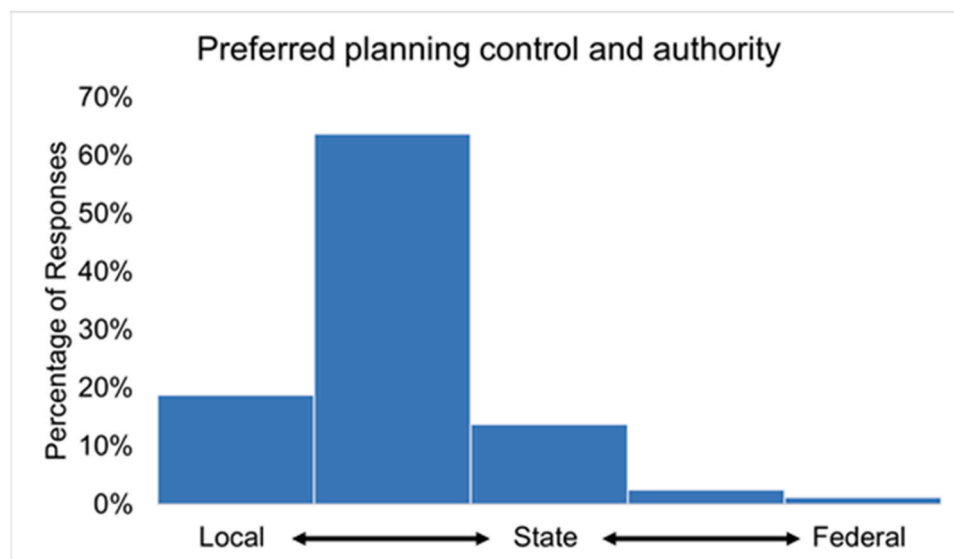


Fig. 4. Survey respondents’ preference for what level of government should hold the majority of the planning control and authority (n = 80). Local government includes Humboldt County City of Arcata, City of Eureka.

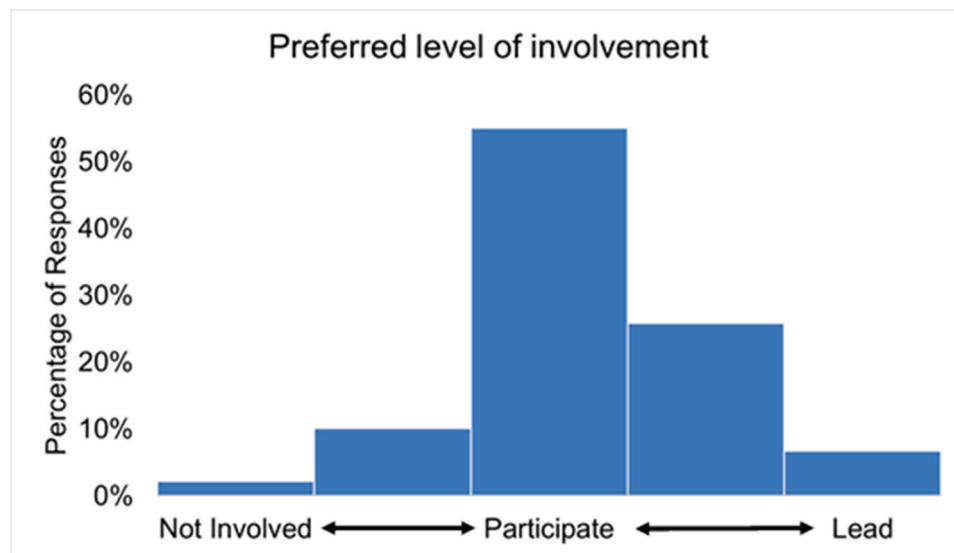


Fig. 5. Preferred level of involvement of survey respondent's agency/organization in regional SLR planning effort (n = 89).

leaders: the most commonly cited included Humboldt County, the Harbor District, the cities of Arcata and Eureka, and the CCC. The average survey responses of the stakeholder groups of County Government and the Harbor District 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 preference in participating. According to the survey, however, on average, no stakeholder group indicated a clear desire to lead. 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 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 among several entities.

4.2.4. Preferences related to 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 (Fig. 6). 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. For example, one respondent highlighted the importance of project-by-project planning in addition to regional approaches:

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

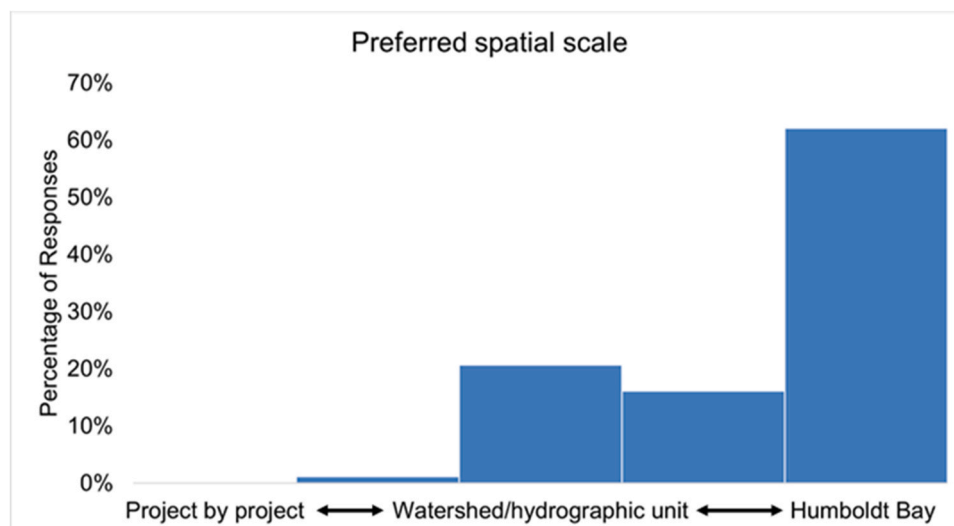


Fig. 6. Survey respondents' preferred spatial scale to focus regional SLR coordination efforts (n = 87).

natural processes that are critical to understand are too complicated (P20).

4.2.5. Perceptions related to public engagement and equity in SLR governance

We asked survey respondents about their level of agreement regarding whether all the right stakeholders have been in the room during regional conversations about SLR. Only 5 % agreed (5 %) or strongly agreed (0 %) that all the right stakeholders were included, 57 % were neutral, and 38 % disagreed (32 %) or strongly disagreed (6 %). 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.

Although community engagement is an important aspect of regional SLR planning, responses from the interviews and survey suggest room for improvement in the Humboldt Bay region. 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 just 19 % of respondents agreed (Fig. 7). 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). Interview responses generally supported these survey results by acknowledging

that the region needed to improve community engagement. One interviewee shared, “I do think that the public engagement is something that needs improvement” (P20). Equity and environmental justice was only discussed by six interviewees. One 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)

Survey respondents also indicated strong interest in implementing various SLR public outreach efforts – highly ranking the following efforts: “create a public engagement process to identify community goals and actions for addressing SLR” (81 % high or essential priority); “coordinating public outreach strategies to educate residents and business owners regarding SLR impacts and planning efforts” (76 % high or essential priority); and “create a single regional information platform concerning the status of projects and research related to SLR” (68 % high or essential priority).

5. Discussion

Findings from the research speak to conversations related to multi-level governance and climate change adaptation. They also can provide input to inform the development of governance and collaboration frameworks for Humboldt Bay specifically.

A key conversation in the environmental governance literature is

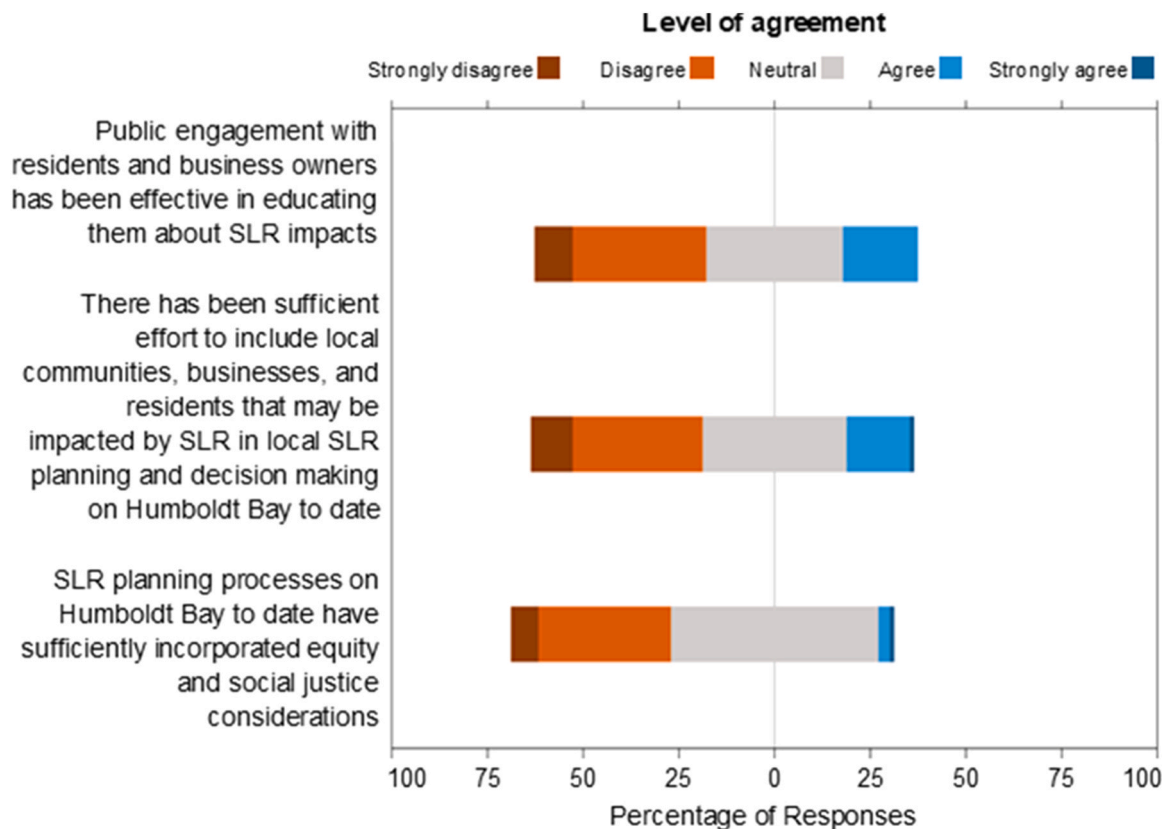


Fig. 7. Survey respondents' level of agreement with statements about SLR public engagement in the Humboldt Bay region (n = 101–103). Levels of disagreement are located left of the 0 line, and levels of agreement are located right of the 0 line.

related to whether climate change adaptation processes and SLR planning specifically require the creation of new special purpose governance units to help foster collaboration and increase policy coherence to move effective adaptation forward (Kettle et al., 2014; Lubell et al., 2021; Lubell and Robbins, 2021). Results from this research highlight that in California SLR adaptation operates within a complex and multi-level policy environment. Nearly all coastal professionals connected to SLR planning in the region agree that some kind of collaborative entity or planning process is needed to help move SLR adaptation forward in an effective, holistic, and equitable fashion. However, the results from this study did not show any consensus regarding the most appropriate structure of such an entity. Study participants seemed open to a variety of options but showed the most preference for creating a formal collaborative partnership and least preference for establishing a new regional authority. Many were concerned that forming a new authority would take a lot of time, effort, and funding and could create an additional layer of bureaucracy further slowing adaptation processes.

Groups around Humboldt Bay could draw inspiration from other efforts to develop regional governance units to address environmental challenges that cross spatial and jurisdictional boundaries. Interesting models have been developed related to watershed or river management (e.g. Hardy, 2022; Yoder et al., 2021) and wildfire/forest management (e.g. Bodin, & Nohrstedt, D, 2016; Brummel et al., 2012; Kelly et al., 2019). Scholars have evaluated the effectiveness of governance units related to climate adaptation in Europe and Canada (Termeer et al., 2011; Biesbroek et al., 2010; Bauer and Steurer, 2014; Stiller and Meijerink, 2016). Researchers have noted varying levels of effectiveness of different regional models, noting that those with a more voluntary or recommendation foundation experienced challenges towards implementation, but did result in other benefits such as the sharing of information and the better aligning of priorities. An interesting model is the German government-funded KLIMZUG project on climate adaptation in regions, where a regional governance entity appointed climate change adaptation officers tasked, “to raise awareness for climate change adaptation in the region, to engage with scientists and policymakers to identify promising adaptation options, and to initiate and implement pilot adaptation projects” (Stiller and Meijerink, 2016, p. 1545). The Humboldt County Associations of Governments, a joint powers agency that includes the county and seven cities to address regional transportation and planning issues, is a local model for possible inspiration; indeed many interviewees brought it up as an example when discussing governance solutions.

A consistent theme from the survey and interviews was the difficulty of developing and implementing adaptation strategies in such a complex permitting environment. Coastal professionals noted that the permitting process can be prohibitive to effective action because it adds both cost and time to a project. Survey respondents expressed concerns about no net loss wetland policies and how they may be restrictive to coastal adaptation strategies which typically occur in wetland areas. Challenges with restoration and resilience projects in the coastal zone of California have been documented across the state (Cleveland, 2024; Goodrich et al., 2023; Shumway et al., 2021; Ulibarri, 2020; Zedler, 1996). Better coordination frameworks could improve some of these challenges by bringing permitting agencies into planning processes earlier allowing project proponents to get more clarity and coherence related to permissible adaptation strategies. However, some of these challenges may also require larger policy-level solutions at the state and even federal scale, perhaps through legislation and activities that can streamline permitting processes related to climate adaptation – with efforts similar to those in the “cutting the green tape” initiative (California Landscape Stewardship Network, 2020). A model from which Humboldt Bay may draw inspiration is the San Francisco Bay Restoration Regulatory Integration Team (BRRIT), in which key regulators related to coastal restoration work together to try to streamline permitting processes for the Bay area region.

When thinking about regional approaches to climate adaptation,

scholars and policy-makers alike have given consideration related to the appropriate scale for climate planning activities (Termeer and Dewulf, 2014; Termeer et al., 2011). The literature related to multi-level or polycentric environmental governance highlights the importance of nesting scales in complex environmental concerns (Carlisle and Gruby 2017; Ostrom, 2009; Termeer et al., 2010). When asked about the appropriate scale for regional coordination, the majority of respondents expressed a preference for regional coordination to occur at the scale of Humboldt Bay. However in interviews, coastal professionals stressed that due to the complexity of the issue, planning will have to occur in nested scales, with decision-making processes at Bay scales, hydrographic scales, as well as on a project-by-project basis.

Participants were asked to describe their preference related to the structure and leadership of a coordinating group or entity. Results showed that while the majority of respondents would be interested in forming and participating in a coordinating unit, very few of them would like to lead it. Coastal professionals seemed wary about one unit leading the efforts and many thought that it should be co-led by several different groups. Survey responses show a preference for a combination of local and state authority, indicating a need to form a structure where state agencies like the CCC play some role. Interviewees mentioned the importance of having a neutral facilitator or organizing body to bring the different parties together to coordinate. This could be an important consideration for climate and SLR adaptation planning more broadly. Possible entities that could play this role include academic institutions, NGOs, and more neutral government units such as Sea Grant.

Definitions of multi-level governance also emphasize the displacement of power “outwards to civil society and non-state actors” (Termeer et al., 2010, p.29). Interview and survey accounts indicate that public knowledge and involvement in SLR planning and coordination activities is an important area for growth along with a need for better incorporating equity considerations. Results also showed strong prioritization to move forward with a range of public outreach and engagement strategies related to SLR. As such, any creation of a coordinating body or unit related to SLR on Humboldt Bay will need to consider developing structures to meaningfully incorporate public and community involvement. SLR planners will also need to consider avenues to better bring an equity lens to SLR planning. Herrera (2024) provides an overview of avenues for incorporating equity into SLR planning processes, including a suggestion to diversify coastal planning staffs, a possible area to consider in Humboldt Bay where 91 % of coastal professional respondents to the survey reported being white.

The development of a coordinating entity will also need to consider the role of local Tribes. In many planning processes, Tribes have been considered an afterthought only to be contacted during legally-mandated consultation processes after major decisions have been finalized (Bailey, 2018; Blumm and Pennock, 2022; Suagee, 2010). Humboldt County’s Regional Planning Feasibility Report does not explicitly address the role of Tribes within various potential coordination frameworks although it does identify the Wiyot Tribe as an “important voice to have at the table when discussing potential frameworks for regional adaptation planning” (Humboldt County 2023; p. 41). In the survey, respondents affiliated with Tribes did express an interest in being a part of regional governance for SLR in the region. Development of a coordinating body or group should include consultation with Tribes about their desired role within the efforts and consider incorporating Tribes within the leadership group from the beginning to support their more holistic involvement in planning for the future of coastal lands and resources within their ancestral territory.

There is a lot of discussion about the importance of regional and multi-level coordination for effective climate adaptation (e.g. Termeer et al., 2011; Driessen et al., 2018; John and Yusuf, 2019), but the particulars of how such a coordination process or entity should be structured is a complex question without easy answers. This study found individuals involved in SLR planning in a Bay region deeply weighing the potential benefits and drawbacks of various institutional

configurations. A limitation of this study is that while it provides insights into local perceptions of the barriers and opportunities for effective SLR planning and views of potential governance models, the results do not point to a clear path forward. Further research and planning are needed to support the development of effective SLR governance in Humboldt Bay. A network analysis of the regional coastal management system could contribute to better understanding by mapping the strengths of connections between individuals and entities. Professionally facilitated workshops with key stakeholders on Humboldt Bay might be a crucial next step to help drive local entities towards developing such governance solutions. Findings from this and future research as well as examples from other case studies could help to structure such discussions.

Through all their considerations, coastal professionals in the community stressed that regional coordination should not be a top-down process foisted upon local actors, but rather be a more bottom-up process designed and led by local actors with a stake or jurisdiction in the specific climate planning process. Social and political science like that included in this paper can play a large role in gathering information regarding local preferences related to climate governance and planning and contribute to the development of more bottom-up approaches to coordination that match the local context.

CRedit authorship contribution statement

Orth-Gordinier Kristen: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Richmond Laurie:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization.

Declaration of Competing Interest

The authors have no formal declaration of interests to declare. Information about the funding sources for the work can be found in the acknowledgements section which can be seen below. Our declaration of interests can be found in the below acknowledgements section for the paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.envsci.2025.104053](https://doi.org/10.1016/j.envsci.2025.104053).

Data availability

The data that has been used is confidential.

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