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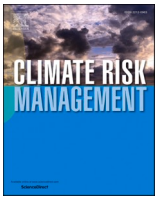

Living in the 'Blue Zone' of a sea-level rise inundation map: Community perceptions of coastal flooding in King Salmon, California

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ABSTRACT

As sea-level rise (SLR) inundation maps proliferate, it is important to study their politics – both how they are created and how they act upon and shape various lives and places. This paper uses the example of King Salmon, CA – a rural, low-income residential area projected to be one of the most at risk to SLR on the US West Coast – to examine how a community responds to external projections showing SLR risk to their homes and businesses. Through interviews with 17 King Salmon community members and observation of a county-hosted 'communities at risk' workshop, we examined the community's social context, their past experiences with flooding, and their reaction to SLR projection maps including what next steps they would like to see taken. Residents expressed a strong connection to the place, noting that it is one of the few affordable places to live on the coast in California. We found that residents already live with regular flooding during larger tides of the year and have taken steps to adapt. We observed a strong generational component in responses to projection maps with many older respondents believing or hoping that the worst effects from SLR would not come until after they passed away. Residents expressed a lack of faith in government to address flooding concerns both at present and into the future, noting that general maintenance issues have gone unaddressed for decades. Many residents interviewed and observed seemed open or at least resigned to the possibility of relocation at a future undetermined time. This work reveals the power dynamics inherent in climate projections like SLR maps, which, due to their technical nature and mobility, can leave communities out of conversations related to potential futures. Findings also have implications related to climate and SLR work – highlighting the importance of understanding community context; contributing to equity considerations about how wealth and other demographic factors shape how communities interact with SLR planning; and spotlighting the need for sustained learning, engagement, and co-production with communities in the 'blue zones' of SLR inundation maps.

1. Introduction

The sea-level rise (SLR) inundation map has become a commonly-circulated object during this time in the Anthropocene (see e.g. NYT, 2016; Lu and Flavelle, 2019). Although the location, size, and medium of these maps may differ, they all take on a similar form

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and aesthetic. They show sections of coastal land - often in white - being overtaken by a translucent blue area that represents projected water elevations at different time periods. Some SLR inundation maps like the New York Times "What Could Disappear" map (NYT, 2016) are digital and dynamic, incorporating a lever or animation that allows the viewer to watch as cities, towns, and even entire countries are engulfed by rising waters over time – like a mini disaster movie playing on a loop on the screen.

Once these inundation maps are created, they represent a kind of break; they start to produce new types of places. Cities, towns, communities, which were just sitting there, existing, emerge as sites of contestation and consternation. The places in the blue zones of the maps gain new labels such as 'vulnerable', 'disappearing', 'drowning', or 'facing erasure' (e.g. Holder et al., 2017; Lu and Flavelle, 2019; Bendix, 2020; Davis, 2022). The planners, professionals, and New York Times readers who consume the maps might begin to speculate about the future of these places - should residents 'strategically retreat' or do the sites warrant the construction of seawalls or levees to protect them? Importantly, all of this labeling and debate can occur without residents of these zones participating in the discussion or even being aware at all.

As these SLR maps proliferate, it is important to study their politics – both how they are created and how they act upon and shape various lives and places. Scholars within the field of science and technology studies have drawn attention to the inherent power imbalance in scientific practices which allow scientists to "act at a distance on unfamiliar events, places, and people" - in part by rendering these places "mobile" such as through the construction of maps, graphs, or datasets (Latour, 1987, p 223). These scholars also show how scientific images can "construct the 'truth' […], position us as witnesses to a looming crisis, and call us into action" (Braun, 2002, p 217). SLR maps are similar to scientific phenomena described by scholars such as Braun and Latour, yet they may also add a new layer to this power dynamic. The SLR maps do not just purport to represent present or past conditions; they foretell a new, predicted future state. What, perhaps, could involve a greater power imbalance than a situation where external entities have access to detailed information about the potential future risk to places while residents remain unaware and unable to shape the narrative about their communities?

Whereas a science studies approach might involve examining the scientists and practices behind the construction of SLR inundation maps, this analysis trains its lens on a different set of actors in this system – the residents of places that are depicted as 'now vulnerable' in the SLR projection maps. We ask: what is life like in a community within a 'blue zone' on a SLR projection map? How do residents respond when presented with SLR projections for their region? Do they accept the projections as a new reality to grapple with? Do they resonate with external framings of their community as vulnerable or facing a crisis? What do they hope to have happen next?

This work addresses these questions by focusing on King Salmon, a small, low-income, rural, unincorporated community that has emerged as an important site of interest in relation to SLR in California. Policymakers in California have referred to Wigi[1] or Humboldt Bay as "ground zero" for SLR in California (Weinreb, 2019) because, due to geological and tectonic factors, the land around Wigi is subsiding while the sea levels are rising. This has led to Wigi having one of the highest recorded rates of relative SLR in California, if not the entire West Coast (NHE, 2014; Patton et al., 2017; Patton et al., 2023). The SLR projections show a handful of residential communities around Wigi facing possible inundation from SLR, and King Salmon has consistently emerged as the most at risk in the shortest time-frame (Laird, 2019). The community is so low lying that parts of it already flood during the highest tides of the year. While Wigi has SLR vulnerability assessments and projections dating at least as far back as 2015 that show the potential risk to King Salmon (Laird, 2015), until 2018 there had been no concerted effort to reach out to community members to inform them about these projections and to hear their thoughts and concerns.

Drawing from a multi-methodological approach that included semi-structured interviews with residents and observation of a 'communities at risk' workshop held by county planners, we sought to answer the following research questions:

(1) How are residents of King Salmon connected to the place and to one another?
(2) What are residents' experiences with coastal flooding in the past and present?
(3) What are residents' perceptions of projections of potential future sea-level rise for their community and what type of adaptation strategies would they prefer to see implemented, if any?

2. Literature review

This project is situated within a rich tapestry of social science research related to disasters and climate change impacts – particularly those on the coast (e.g. Hoffman and Oliver-Smith, 1999; Marino and Ribot, 2012; Eriksen et al., 2015; Adger et al., 2005). Scholarship shows that disasters, including those linked to climate change, produce inequitable outcomes especially without planning and responses that explicitly acknowledge and seek to overcome those inequities (Marino 2018a; Oliver-Smith, 1996; Paavola and Adger, 2006; Faas, 2016; Oliver-Smith, 2009).

Theory and findings from the fields of hazards social science have been applied to considerations around SLR impacts – revealing important racial, economic, and social equity concerns related to SLR planning processes (e.g. Siders and Ajibade, 2021; Marino 2018a, b; Hardy et al., 2017; Boyer and Penn, 2013; Herreros-Cantis et al., 2020). While definitions vary, the term 'managed retreat' has been used to describe SLR adaptation strategies that plan for the relocation or resettlement of homes, infrastructure, and/or communities out of SLR inundation zones. Scholars show that the concept of retreat has been divisive and not often well received by communities on the ground (Bragg et al., 2021). They point to a number of equity concerns about planning processes that might encourage some to

[1] We chose to use the term Wigi in place of Humboldt Bay throughout this paper as it is the Wiyot name and Wigi is a part of the ancestral territory of the Wiyot people.

move from the coast while other coastal sites are protected - considerations include place and community attachment, economic and racial disparities, structure of decision-making processes, and uneven access to resources and political capital (Marlow and Sancken, 2017; Marino 2018b; Dachary-Bernard and Rey-Valette, 2019; Siders, 2019; Bragg et al., 2021; Maldonado et al., 2021; Siders and Ajibade, 2021; Anderson, 2022; Ajibade et al., 2022; Jessee, 2022).

Scholars in this field also emphasize the importance of gaining rich, contextual information about the perceptions and values of communities facing coastal hazards, because external framings of the issue may not match the views, priorities, and realities in those real places (Farbotko and Lazrus, 2012; Bettini, 2013; Marino, 2015; McAdam, 2017; Marino, 2018b; Perumal, 2018; Stephens et al., 2020). Scholarship has also taken aim at the very notion of 'vulnerability' as it has been applied to communities facing coastal hazards, noting that this framing places focus on shortcomings within a community rather than upon the social processes that have produced those risks or vulnerabilities (Marino, 2012; Marino, 2015; Hardy et al., 2017; Whyte et al., 2019; Maldonado et al., 2021; Jessee, 2022). Research and journalism also show that communities facing SLR are not monolithic and contain internal power dynamics which shape their responses to SLR (Marino, 2015; Xia, 2019; Bragg et al., 2021; Jessee, 2022; Anderson, 2022).

As this study explores residents' reactions to SLR projection maps, this work also draws inspiration from scholarship in the field of risk communication; specifically related to SLR risk. Scholars examining user experiences with interactive sea-level rise viewers have highlighted the importance of "designer localization" which is defined "as the processes through which risk data is tailored, personalized, and structured to meet the needs of myriad localized audiences facing a shared vulnerability" (Richards, 2018, p 58). Scholarship directs consideration towards both the complexity and realism of SLR risk communication techniques with studies showing that strategies with too much complexity/choice can overwhelm viewers and cloud understanding of risk (Richards, 2019), and studies showing that too realistic and too extreme renderings of SLR can produce "apathy" and mistrust among viewers (Richards and Jacobson, 2022, p 200). Additional studies related to SLR science communication suggest that it can be challenging to engage communities in conversation related to future SLR and adaptation strategies if there is not first a process of knowledge-sharing and trust-building (Schmidt et al., 2014; Douglas et al., 2012).

There has been little research related to the social dynamics within King Salmon and other Wigi communities. The little written about King Salmon and SLR has lacked nuance and described the community as monolithically "resistant" to retreat (Bragg et al., 2021) when, in fact, at the time community members had barely even interacted with SLR projections let alone expressed views on a path forward. Our work draws inspiration from the disaster and SLR social science literature to explore the context of the community of King Salmon in relation to coastal flooding and SLR and, in so doing, provide more nuanced information to residents, planners, decision-makers, and scholars; adding more perspectives from rural, underserved communities in the United States.

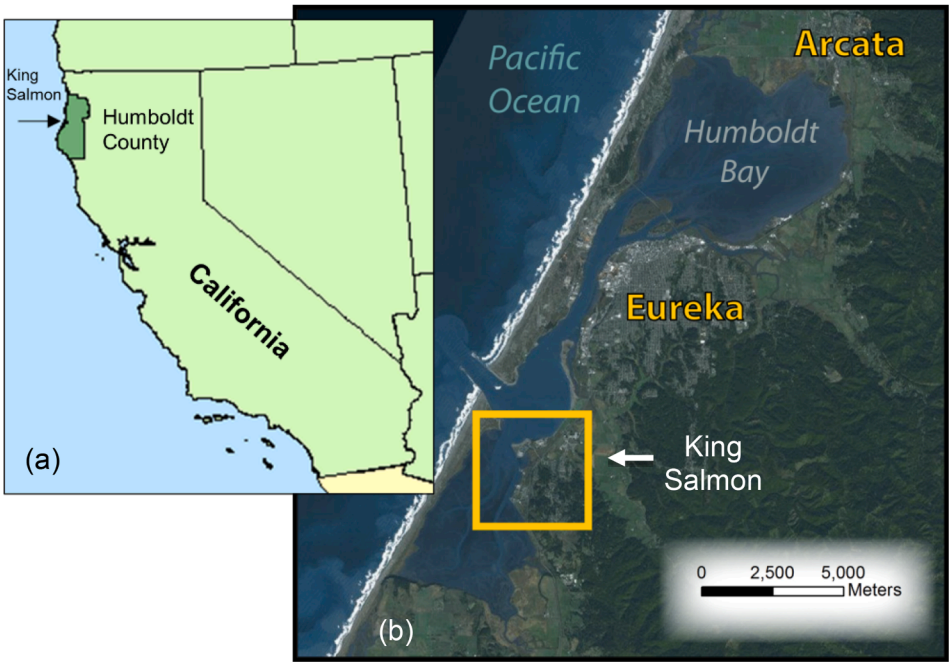

Fig. 1. Location of King Salmon (a) within Humboldt County in the state of California (map: James Graham) and (b) within Humboldt Bay (contained in the yellow box) (map: Kunkel).

3. Methods

3.1. Case study background

King Salmon is a small, unincorporated coastal community in Humboldt County on the California North Coast with 190 residential and commercial parcels encompassing 176 acres (Humboldt County 2018; Fig. 1). King Salmon was, in fact, designed with a porous boundary between the land and sea in mind. It was constructed in 1949, converting a former dredge spoil dumpsite into a "fishing resort'' that had a series of canals enabling house lots to come with docks and water access. It is composed of mostly small residential homes, two trailer and RV parks, one restaurant, one small convenience store, a public beach, and the region's largest privately-owned power generating station. See Supplemental Materials (SM) and Kunkel (2019) for additional photographs, figures, and information relevant to King Salmon's historical and present context. The previous nuclear power plant is still being decommissioned today and nuclear rods are stored on site just upland of the community.

It is difficult to obtain precise population and demographic information for King Salmon because it is smaller than the census tract of which it is a part. Approximately 72 % of residents in the Census tract that includes King Salmon meet the federal definition of economically distressed (U.S. Census Bureau 2017). Housing in the community is considered affordable relative to the standard of the

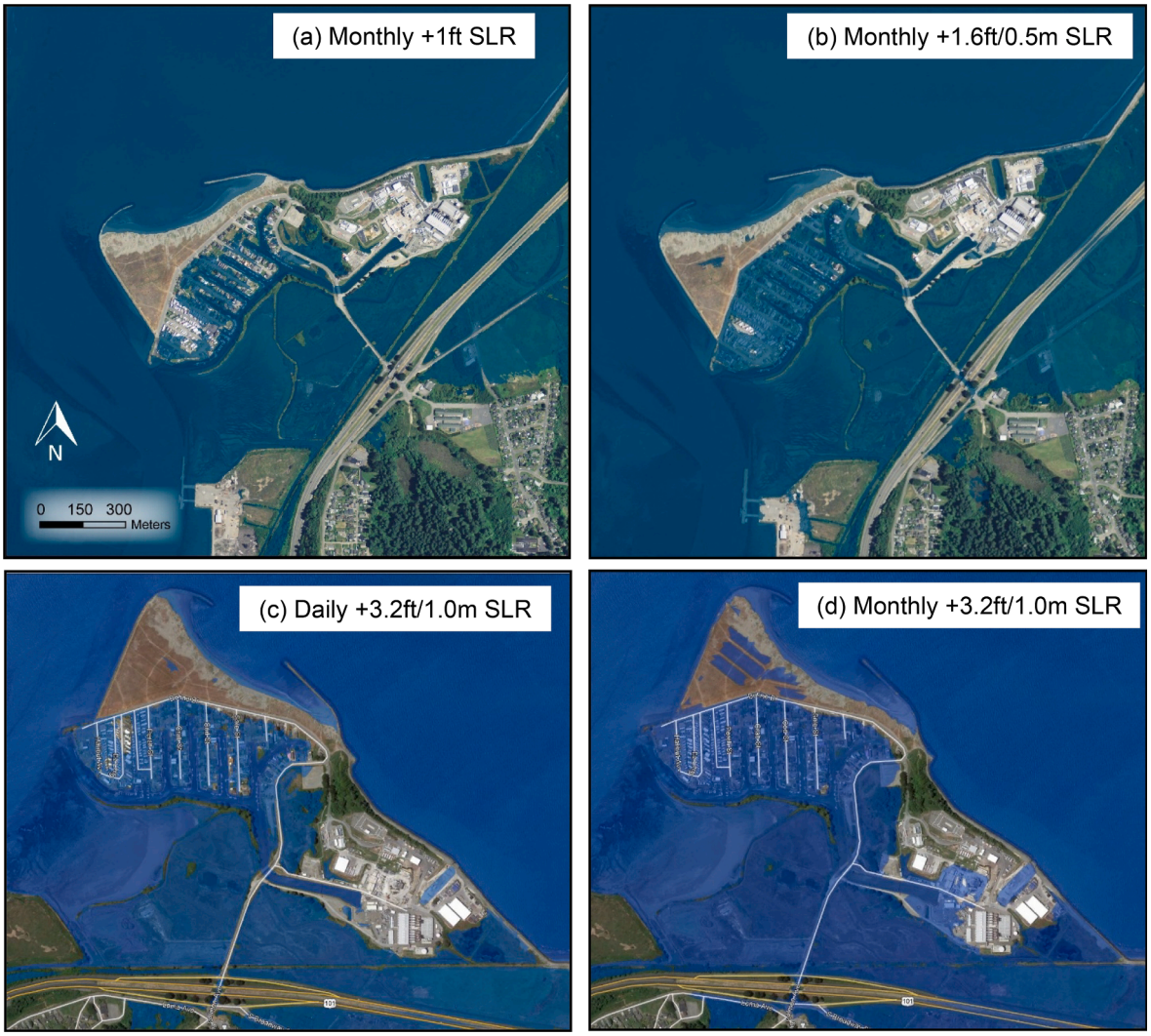

Fig. 2. SLR projections for King Salmon developed in conjunction with this project (a) mean monthly maximum high water (MMMW) with one foot of SLR, 0.5% probability by 2030 – showing monthly inundation in many residential areas; (b) MMMW with 1.6 feet or 0.5 m of SLR, 0.5% probability by 2044 – showing monthly inundation in nearly all residential areas; (c) mean daily maximum high water with 3.2 feet or 1 m of SLR, 5% probability by 2071 – showing daily tidal inundation in nearly all residential areas; (d) MMMW water with 3.2 feet or 1 m of SLR, 5% probability by 2071 – showing near total inundation of residential areas and assets, including of transportation routes in and out of the community, on a monthly basis. Maps a, b: Kunkel; c, d Laird; probabilistic projections based on OPC (2018).

Table 1
Interview respondents by resident type.

Resident Type	Number of Respondents
Renters	1
Resident Homeowners	11
Non-resident Landowners	2
Vacation Home Owners	1
Business Owners	2
Total	**17**

California coast and Humboldt County specifically. In planning materials, the community is described as hosting, "a substantial portion of the County's affordable housing stock" (Coastal Conservancy, 2023) and a real estate website describes King Salmon as, "a unique canal community located in the middle of Humboldt Bay with many affordable waterfront housing options" (Forbes & Associates 2024).

Given its low elevation and adjacency to the water, flooding in King Salmon is not a new phenomenon. Archival data shows that this community has a long, recorded history of flood experiences over the past century (Bird, 2003; Faulk, 2005; Holmblad, 1982a,1982b,1982c,1984; Unknown, 1977; SM). This tumultuous history of flooding and erosion is now compounded by the twin threats of tectonic subsidence and SLR, potentially increasing flood risk both from water intruding from the bay and rising groundwater below. Fig. 2 shows SLR projections for King Salmon. Projections from the California Ocean Protection Council's (OPC) 2018 SLR Guidance show that both the frequency and extent of flooding is likely to increase over time. Even projections for 1 foot of SLR (0.5 % probability by 2030) show substantial flooding in residential areas on a monthly basis, while projections for one meter or 3.2 feet of SLR (5 % probability by 2071) show nearly complete flooding of residential areas on a daily basis with the road in and out of the community being overtopped on a monthly basis.

King Salmon is located within California's coastal zone, which, according to the California Coastal Act, means that any new development in the community requires the issuance of a Coastal Development Permit (CDP). As a result, development in the area is overseen jointly by Humboldt County Planning & Building and the California Coastal Commission (CCC) who issues CDPs for the area (Laird, 2018). Generally, the CCC cannot prevent new development in the King Salmon area, but they can and have issued restrictions on development related to flood and SLR risk (e.g. CCC, 2019, 2023). The CCC has required most new developments and buildings to be constructed with all living spaces restricted to a second, elevated story (CCC, 2019). Prior to this study neither the county nor the CCC had engaged in any sort of strategic long-range planning for King Salmon in relation to SLR; SLR had only been considered on a case-by-case, project-by-project basis. At the time of the study, no SLR adaptation plan for King Salmon existed.

3.2. Research methods

Findings from this research draw from two primary approaches: semi-structured interviews and public meeting observation. The research team also conducted archival research related to the history of the King Salmon site, but this information was primarily used to understand the case study background and is not incorporated into the results section (see SM for more detail).

3.2.1. Semi-structured Interviews

One project team member conducted all semi-structured interviews with 17 residents, property owners, and business owners in King Salmon in 2018 (Table 1). King Salmon is an insular community with less access to technology, so recruitment focused on making personal connections and seeking to build trust and rapport with residents. Participants were recruited through in-person visits to businesses in the area, mailers to landowners, and snowball sampling. Interview lengths varied between thirty minutes and three hours, depending on the engagement and interest of each participant. Interviews followed an interview guide with four key topical areas: background information, connection to King Salmon as a place and a community, perceptions of historic and current flooding, and responses to/perceptions of SLR projection maps for the area. Interviews were recorded with documented participant consent. In part due to the demographics of the area, interviewees tended to skew older. One interviewee was from the 'younger generation' from ages 30–49; seven were from the 'middle generation' from 50 to 64; and nine were from the 'advanced generation' of ages 65 +. We cite interview data with a participant number. Interview guide and projection maps included in SM.

3.2.2. Public meeting observation

The County of Humboldt's Long Range Planning Division of the Planning and Building Department received a grant from the California Coastal Commission to facilitate public workshops in three coastal communities at high risk of SLR impacts, including King Salmon (Laird, 2018). The public workshop targeting the 'communities at risk' (CAR) of King Salmon and nearby Fields Landing took place in August 2018. All parcel owners in King Salmon and Fields Landing received an invitation to the workshop in the mail. The workshop team distributed physical flyers in the communities and shared a press release in the media. In addition, our research team provided King Salmon stakeholders with workshop information during semi-structured interviews. More than sixty people attended the workshop. Demographic information was not collected on attendees, but during the question and answer period, some attendees identified themselves as King Salmon residents, Fields Landing residents, local elected officials, and utility representatives from Pacific

Fig. 3. Photo of Humboldt County's Communities at Risk workshop for residents of King Salmon and Fields Landing on August 7, 2018. Photo: Kunkel.

Gas and Electric (PG&E) or Humboldt Community Services District. The workshop included maps posted on the walls of localized tidal and SLR inundation, a scientific presentation, and a conversation about future planning (Fig. 3). We observed and recorded the meeting to explore participant reactions to the scientific presentation and the conversations about future planning. Quotes and information gleaned from this workshop are cited with CAR.

3.2.3. Data Analysis

One project team member transcribed the interview and public meeting recordings and two project team members participated in data analysis and synthesis. We used standard qualitative data analysis methods to develop findings related to this content. We coded the interview and public meeting transcripts for a set of emergent themes or codes with an aim to show the range of viewpoints in each theme as well as highlight perspectives that were the most prevalent in the data. Key themes included sense of place, experiences with flooding, perceptions of and reactions to SLR projections, current and future adaptation responses, climate change beliefs, and generational differences.

4. Results

4.1. Sense of place & community

> *"It's important that I live here. I don't plan on ever going anywhere. I think this is my retirement place forever. Well, until it's underwater" (P14).*

Even though all respondents interviewed reported adverse flooding experiences, they generally appeared to have a strong and positive connection to their physical surroundings and their homes and a desire to stay even in the face of flood risks. Most interviewees reported moving to King Salmon purposefully to be near the water. All respondents enjoyed recreational activities that only a waterfront community can provide. Many became passionate when discussing their feelings of attachment to King Salmon. One resident affectionately called King Salmon "an oasis", declaring, "This is my place, I belong here" (P1). Another resident explained, "When I bought this house many years ago, one of my kids is going 'Mom!' and my friends are going 'Really?', but I just felt like it was worth it just to be here, you know, just to hang out" (P6). Some residents moved to King Salmon because it reminded them of a place they previously lived (P5, P6, P7). Many reported that living by the sea was a primary part of their identity. Some respondents noted that given rising real estate prices, King Salmon was one of the few places left on the California coast where they could actually afford to live (P7, P13). For example, one homeowner said, "Living here, yeah, it makes economic sense for me" (P13).

Respondents reported a sense of community and connection with their neighbors while also describing some challenges related to community cohesion. Respondents repeatedly described King Salmon as a community where "everybody knows everybody" (P3, P5, P14). One resident expressed a feeling of "friendship and cordiality…'if you love this place like I love this place then I love you', it seems to be the King Salmon way of doing things" (P7). One resident exclaimed, "We never go without fresh fish because our friends just bring it to our door!" (P6). Another described, "Our little street here, we watch out for each other and there's several people that we're especially concerned about because they are having a health issue or something" (P5). Some residents believed that the sense of community had diminished in recent years and acknowledged some negative interactions among community members. One resident described that the sense of community has changed overtime:

> But the people over time now, you know, it's changed… It's not the fishing community that it once was. Back in the early 70 s, there were community parties like Fourth of July festivals at Johnny's Marina and over time this has become like more of a low-rent district than sport fishermen that used to own the places (P12).

An issue with crime was mentioned by a few residents. One participant actually left the community due to perceptions of high crime. He explained, "We had this joke where we had this million-dollar view out of our kitchen and bedroom window. We had this 35 cent view across the street because it was awful and we were always calling the police. That's one of the reasons we moved out" (P10). This resident later moved back to King Salmon, describing that he still felt a connection to the community even during the gap when he was away. These interviews shed light on some of the economic disparity within King Salmon, with wealthier residents occupying the nicer waterfront homes and poorer residents in more dilapidated homes and the RV park. Some residents indicated that while they were close with those who lived on their street, they knew few residents that lived just a street or two over. While there were reports of community connection, interviews also painted a view of the community as somewhat siloed.

Interviewees indicated that the community was not very politically organized or engaged. Residents were unaware of any community organizations or groups. One resident responded that she believed it would be difficult to organize the community, explaining, "as far as this community, it's kind of like full of independent people. They're not real followers. It's hard to get a group to, you know in my experience, to agree on anything much" (P6). Another resident was more hopeful, explaining, "I think I'm banking on the community loving the place enough that we will work together enough to save enough of it" (P7). Comments made by residents in interviews and the workshop showed that residents tended to believe that they have been forgotten or overlooked by the government and local authorities, particularly when it comes to maintenance and flood management. Many described the community as either mistrustful or lacking faith in government and other external groups. Some expressed a belief that the community has become apathetic or disengaged partially because they have felt that their interests or comments had gone unaddressed so often in the past.

4.2. Past experiences with Flooding

> *"Like sometimes if I do have someplace I have to go during the flooding, I've got hip waders. I'll just park the car over there, take the waders over there, you know, throw them in a plastic bag put on my shoes and go" (P13).*

Interviews reveal that King Salmon residents already live with the context of flooding. The community has been implementing adaptation strategies to protect their homes and belongings from flooding for many years (Fig. 4). All interview respondents described storing important items on cinder blocks, pallets or similar raised structures. Sandbags were a frequently mentioned necessity. "It's a good thing I got lots of storage for sandbags," said one resident (P7). Sandbags were not only used on personal property, but also to prevent flooding of critical utilities and infrastructure. Moisture barriers (typically plastic or foil sheets placed in walls, ceilings, and floors to protect structures from water damage) and sump pumps were also popular adaptation strategies (P7, P2). One person even routinely parked his car on cinder blocks in preparation for high tides or storms (P13). Two respondents mentioned using hard stabilization techniques to protect their homes, including physically raising their entire home (P10, P13) or installing a concrete seawall around a personal property (P2).

Resident experiences with flooding differ from the scenes from unexpected hurricane or rain-induced flash floods often depicted in the news. Coastal flooding in King Salmon only takes place at certain tide levels that occur a handful of times a year and can be predicted ahead of time with a simple tide chart. Additionally, the flood waters are temporary and drop after a few hours when the tide recedes. Most residents reported that they monitor tide tables to plan their activities in order to safely cohabit with the floodwaters. One resident installed a sonic tide gauge to alert him via text message when the canal's water reaches likely flood levels (P13). He also schedules appointments around the tides to ensure he can exit his home to travel, but expressed concern that an ambulance would be unable to reach his aging parents in the case of an emergency. One resident distributes a monthly newsletter to warn neighbors of

Fig. 4. (a) Canal overtopped in King Salmon during king tides, January 20, 2019. Photo: Kunkel (b) Pallets used by a King Salmon resident to protect belongings from floodwaters. Photo by interview participant, used with permission.

potential flooding dates (P13; SM). A property manager explained that he educates his new tenants often: "I've had tenants call me that are new… and say 'Hey, do you know you're flooding over here? Is there a pipe broken?' I say no, that's the ocean" (P14). One respondent recalled staff from a local business wearing waders during an extreme flood event and carrying customers through the floodwaters to their cars (P16).

Many residents described flooding events in a nonchalant manner. The flood events did not appear to elicit fear and, in fact, were often recalled with a laugh or joke. For example, one resident explained, "well last time there was some gal, had an inflatable raft, pumped that up, got in a bathing suit with a little umbrella and a drink and she's floating around there" (P5; SM). Another resident described friends who didn't understand the regularity of flooding in King Salmon:

> And it's made national TV, you know, like I'll get a friend's call saying 'God, are you okay, are you okay?' I go, 'Yeah, it's only tidal! It will come down. It's just gorgeous. It'll be gone in 15 min!'…I mean, if you're not used to it, it could be scary (P6).

4.3. Resident reactions to SLR Projections

"Well, we knew this was happening, but we reckoned that we would be by that time not living there and too old or dead" (P12).

All interview respondents were shown potential SLR inundation maps to gauge their initial reactions. A table of the initial responses from 15 of the interviewees can be found in SM. Upon seeing the projection maps, many residents' first reactions were to provide a quip or a joke such as, "Well, let's see. How long can we tread water?" (P3). The majority of respondents expressed at least a partial belief that the SLR projections shown on the maps would come to fruition at some point in time. Fourteen of the interviewees believed that the climate was changing which would lead to higher seas - of those 12 believed that climate change was human-caused, while two did not believe climate change/SLR was anthropogenic; one stated that the sea level "might be rising. I don't think it's man-made" (P15). Respondents also expressed questions about the timeline over which SLR would occur, with several believing SLR would not occur as quickly as suggested by the maps and one predicting the rising water might come even sooner.

A recurring finding was that residents accepted the current risks of living in an area vulnerable to SLR, flooding, and potential tsunamis, but hoped that they would not live long enough to have to deal with more severe risks in the future. Ten of the seventeen interview respondents expressed this sentiment, and all ten were 65 years or older indicating a strong generational component to the response to SLR. Five respondents specifically said they believed they would be dead before the impacts occur. One interview respondent expressed his sympathy for future generations:

> Well, we knew this was happening, but we reckoned that we would be by that time not living there and too old or dead. But I mean, I feel sorry for your generation. I wish you the best, I really do, keep your chin up… I don't want to live in denial but there's a level to, a level I can take, too much information, I can't worry about that, so your generation, you need to worry about that (P10).

Several respondents expressed concerns about how future SLR would affect their ability to pass the value from their home down to the next generation. One stated, "I'll tell my kid if she inherits the house, sell quick" (P8).

Most respondents indicated that they would probably prefer to stay and adapt to SLR, but they were not exactly sure how to achieve this. For example, one interview respondent said, "I really like living here, I want to stay and enjoy it 'til I'm dead" (P8). Several expressed interest in hard stabilization, particularly strengthening or protecting their existing residential structures, in order to stay. For example, one resident explained, "I might need to move which I'd hate but ideally, I'd like to raise the house and stay, but I don't know if that's possible" (P8). Another interview respondent indicated that she might need to build up her existing retaining wall, "which might obstruct my view of the canal a little […] there are things I might have to do that make it less attractive or more inconvenient, but it's worth it to be here" (P7). Numerous interview respondents suggested planners look toward other communities for inspiration (P6, P7, P13). Specific suggestions included building gated holding areas for floodwaters, moving out of first stories, and lifting homes up on stilts.

Although they loathed the idea, some presumed the relocation out of King Salmon would be an eventual necessity. For example, one resident explained, "I might have to move and I'm just keeping my fingers crossed. I don't want to move. I don't know how many years I have to go or how soon it's going to be […] I'm assuming at some point, everybody's gonna have to move out of here" (P8). A few respondents brought up the idea of buyouts, a form of managed retreat. For example, one resident explained, "If it became a real bad place for people to live, if it was completely condemned […] just give people enough money to start again somewhere else" (P5). Some specified interest in staying in their home until they passed, and buyouts were thought of as a supplement for their heirs, not a solution for now (P8). Most of the residents interviewed were 65 years or older which may explain this view.

4.4. Dynamic at communities at risk workshop

The County's Communities at Risk workshop for residents of King Salmon and Fields Landing began with a presentation by a consultant who conducted the SLR analysis. He provided a detailed presentation that clearly walked participants through SLR projections for the two areas, providing maps of inundation at different frequencies – daily, monthly, and annually. The projections presented a grim picture showing that over time the current nuisance flooding in King Salmon a few times a year would become more frequent and by as soon as 2044 most of King Salmon could experience flooding on a monthly basis and by as soon as 2071 most could experience flooding on a daily basis – making maintaining transportation and utilities like water and sewer exceedingly difficult. Near

the end of the presentation he outlined general ideas for what type of infrastructure could be put into place to protect King Salmon from these rising waters, discussing ideas such as raising dikes, elevating areas, and even filling in the canals adjacent to the houses to prevent water from coming in. After describing these broad ideas, he cast doubt on the long-term viability of such solutions, stating, "But ultimately the barriers aren't a solution in the long term. Just think further ahead. It's the rising groundwater that's being pushed up by the rising tide elevations that ultimately ends up flooding low-lying regions. That's really something that is going to be difficult to engineer a solution for" (CAR).

Staff from Humboldt County planning department followed with a description of the purpose of the workshop and what they hoped to do with the community feedback. They described efforts of the county to develop a plan and/or policy related to SLR for the communities and to present the outlines of that plan to the planning commission by the end of the year, about four months after the workshop. They expressed intentions for the plan to be community-engaged, stating, "it's really important to know that this is your plan and it needs to come from the community" (CAR).

During the question and comment period several residents expressed concern and/or bafflement about having to come up with suggestions related to a SLR strategy, when for many of them, this was the first time they were even learning about the extent of the issue. One said, "Well I for one – have not really thought about this. I don't have a plan in my head […] that long-range planning and specific ideas that we would present to you right now seems very sudden" (CAR). Others expressed concerns that they did not have the sufficient expertise to come up with plans or viable strategies. One resident brought up strategies they had read about from googling the issue and researching examples in the Netherlands, but they questioned, "Of course not being a land use planner I can't just think of these things on short notice. […] I don't know if this is what you want from us. These sort of back of the envelope ideas" (CAR). Commenters asked questions about what it would take to develop SLR protection measures: how they would be paid for, how they might affect property taxes, and how effective they would be over what timeline. Many of the suggested strategies or ideas were presented as more of a question; for example, one commenter asked if it would, "be possible to put a series of pumps and maybe interior canals to divert the rising groundwater?" (CAR).

From the start, the county staff appeared to go out of their way to dismiss retreat as an option or focus of the discussion. One county staff member said, "relocating King Salmon, Fields Landing, I don't know - that's - I don't even want to think about that" (CAR) and another said, "what should be the strategy for existing development? I think it should be to protect that development however we can […] I would want to stay in my home for as long as I could" (CAR). However, the one-on-one interview responses along with public comments at the workshop suggest that residents may have been more open or at least resigned to the idea that retreat from those areas could be a necessary eventuality. A few residents suggested relocating the community or showed an interest in relocating on their own. One person expressed that they would consider relocating if it meant protecting the coastal environment stating, "We live here because we love the coast and if we need to go away so it can stay – I mean I wouldn't like that – but I could – if that would be the right thing to do. I wouldn't like it but I would do it" (CAR). Another person asked, "Can't the school and homes and structures be moved? What's the point of building a barrier if groundwater will flood the area anyway?" (CAR). Others questioned the relative value of areas like King Salmon and Fields Landing and whether they could really see the county investing to protect them:

> I'm trying to find out from the bigger community point of view what there is to save here. So the PG&E [power] plant seems significant to the county. My house does not seem significant to the county. So the idea that all of these resources would be put into building a barrier that might protect my house. I mean I appreciate that everybody's thinking about that but I'm trying to understand what are the resources that are valuable to the larger community in these communities. (CAR)

As the workshop proceeded, county staff themselves began to bring up relocation at least as a backup idea to consider with one staff member asking: "How do we protect it for as long as we can and then how do we gracefully retreat? Because if SLR does happen in a way that we can't stand against it anymore then there should be kind of a plan B" (CAR).

In the workshop, residents brought up concerns related to general maintenance in King Salmon and Fields Landing, describing issues they perceive that the county has long neglected that could help alleviate challenges with flooding, at least in the present. One person brought up a drainage ditch installed in the 80 s that the county had promised to clean out every year, but that they believed still hadn't been cleaned. This comment received strong verbal agreement from the crowd, with another attendee bringing up a flood gate that "for all the fifty years I have lived there, [it] has never worked" (CAR). When a county representative told the group they were writing down complaints and would take them into consideration, a woman audibly scoffed and said they had been "asking for this for fifteen years" (CAR). A man echoed "longer than that!" (CAR). When asked to provide suggestions for actions the county could take, one person suggested that they could start to address these maintenance issues in the present, saying they're "talking about things that are relatively inexpensive and would be fairly easy to get done, it seems kind of crazy that they haven't been done. One thing that could happen at this meeting is people could take it upon themselves to make sure these things get done" (CAR).

Near the end of the workshop, a few of the attendees asked questions related to the planning process, its timeline, and how their input would be sought and incorporated throughout. One person asked for more specifics about the county's idea for a SLR 'plan' for the areas, stating "It seems so general – a plan. Is it going to be dikes, is it going to be riprap, is it going to be removal, how can this happen by the end of the year?" (CAR). Another person asked for information about how community members could follow the planning process and provide more input along the way. The county responded by providing the audience with the email and phone number for one staff member where they could submit any future comments.

It has now been nearly four years since the workshops. Follow-up with the community after the workshop has been fairly minimal. We are aware of one follow-up email being sent to participants in the workshop that included links to a SLR vulnerability assessment report (Laird, 2018) and a SLR adaptation planning report (Laird, 2019). These reports detailed much of the SLR assessment work presented in the workshops, provided a summary of workshop findings, and presented a range of SLR adaptation options that could be

considered for the communities. The outreach also invited community members to participate in planning commission public hearings related to SLR but did not provide specific information on dates and times of meetings. There were several county planning commission meetings held on the topic of SLR adaptation, however these were sparsely attended with little to no community involvement.

5. Discussion

This research highlights the important role that local context can play in community perceptions of flooding, SLR, and possible solutions. When community members were shown SLR projections, they generally seemed to agree that higher waters were coming in the future, but many first responded with a quip or a joke. This relative nonchalance could be linked to the flood-experienced context of the community. Residents had been living with flooding as a normal part of their lives, so the notion of flooding from future SLR may not have elicited as much of a sense of fear. Through their words and actions, community members seem to resist a crisis-based framing of SLR and a depiction of themselves as vulnerable – reflecting discussions from Marino (2015) and Hardy et al. (2017). Even the title of the workshop "communities at risk" depicts a passive framing that belies the independence and ingenuity of the community who have already been creatively living with and managing flooding.

The generational make-up of the interviewees and community in general also appears to have influenced community perceptions of SLR and could have played a role in some of the more casual responses to the projections. Many interviewees who were older than 65 hoped that the worst of the effects would not occur until after they were dead – several hoped that it would hold off long enough so they could live in the community until they passed. The main concern for many in this generation was the ability to pass their house onto their children – an important means for passing down wealth particularly in low-income communities like King Salmon. This highlights an important environmental justice concern; King Salmon is a relatively inexpensive place to live on the California coast in part because of the flood risk.

Much of the literature and reporting related to SLR planning has highlighted controversy, conflict, and resistance by community members to the notion of managed retreat or relocation of homes out of flood prone areas (e.g. Xia, 2019; Bragg et al., 2021). Given the small sample size and limited scope of the workshop, it is too early to determine exactly how residents, landowners, and business operators feel about the notion of retreat; but the workshop and one-on-one conversations in King Salmon clearly did not exhibit the same sense of hostility described in many other locations. In the workshop, many brought up ideas of relocation on their own even as the county staff seemed to dismiss it. Some commenters seemed to express incredulity at the notion that the county or state would actually invest in infrastructure like levees or walls to protect their houses. One workshop attendee stated that due to her love of the coast, she would consider relocating if it meant protecting it. Her sense of and love for place instilled a morality towards considering relocation. This reaction differs from a lot of the discourse related to relocation which posits that a strong sense of connection or attachment to place makes residents less likely to consider retreat (e.g. Bonaiuto et al., 2016; Hino et al., 2017).

It is possible that relative privilege plays a role in the more muted responses of King Salmon residents to the notion of retreat when compared to many wealthier communities (Xia, 2019; Bragg et al., 2021; Bromhead, 2022). King Salmon residents themselves may have internalized some of the cost-benefit analysis logic described by Marino (2018) – doing the internal math and not imagining that protection measures for their low-income areas would pencil out. Additionally, residents' long history of distrust and feeling of neglect from the government may also have colored their views. It might be difficult to imagine that a county government which has not maintained certain basic drainage infrastructure functions since the 1980s would suddenly mobilize to invest millions in new protection measures for their communities.

Even the measures or remedies that residents suggested at the workshop and during interviews were humble in scope. For example, one workshop attendee asked if the county could pick up basic background maintenance and one interviewee hoped that if the area became condemned due to flooding the government could "give people enough money to start again somewhere else" (P5). The more moderated response to relocation combined with the generational demographics of the community could play into considerations about possible solutions or responses to long-term SLR. The community may be a good candidate for a program of voluntary buyouts or rolling easements such as that proposed in the vetoed (2022) California Senate Bill 1078: Innovative Financing for Communities Threatened by Sea-Level Rise. In these types of programs, the government purchases SLR-risk homes or businesses and leases them back to the owner until the risk becomes too high or the tenant passes away; then the land can be converted away from residential or commercial use, and towards wetland habitat that better supports rising waters. These policy mechanisms could help to support relocation away from areas at risk of SLR inundation while addressing inequality and concerns from property owners about being able to pass down wealth from their homes to their children. However, it is important to consider how programs and actions like these might shape the long-term future and demographics of the coast. If lower-income or more marginalized communities end up being targeted for retreat or relocation – either through less community resistance/political power or due to cheaper buyout rates and cost-benefit calculations – planning processes for SLR could further solidify coastal living in California as a bastion for only the wealthy.

Humboldt County should be commended for voluntarily seeking out funding and opportunities to engage residents of communities facing SLR. Observation of these workshop dynamics provides insights for future planners looking to engage with communities on SLR risk. First, we observed the importance for workshop leaders to keep options for possible solutions or adaptation measures open, rather than coming in with predetermined ideas about what types of measures would be preferred. In this case, planners seemed to rule out managed retreat before the workshop even started but participants seemed more open to the idea. Second planners may want to give care to the type and timeline of projections they present to community members. Extreme, far out, and/or low-probability projections, such as those shown with 4.9 feet of SLR – a 5 % possibility in 2100 – which depicts the entire community underwater on a monthly basis, could elicit fear or a sense of giving-up which may not always be helpful to productive dialogue or planning. Indeed, a recent study of user reaction to SLR projections found that users exhibited "a general feeling of apathy toward sea level rise when met with

images of extreme inundation" (Richards and Jacobson, 2022, p 200).

Future planners may want to give consideration to the structure of such workshops. In this case, consultants presented community members with detailed information about projections and then asked attendees to let them know what adaptation measures they would like to pursue. Many of the attendees were flummoxed by this line of questioning and did not feel prepared or knowledgeable enough to be able to make valid suggestions about adaptation measures. A challenge with the King Salmon workshop was that organizers asked community members to go straight from awareness – learning for the first time about the scope and time scale of the issue – to problem-solving and decision-making by trying to make suggestions and decisions about what should happen next. A longer and more complex education, knowledge-sharing, and co-production process may need to be developed before community members can become true collaborators in decision-making around the future of the community in the face of SLR. Findings from SLR risk-communication research could inform design of such approaches, including suggestions for strategies that incorporate narrative and video of user experiences (Richards and Stephens, 2022; Stephens and Richards, 2020) as well as approaches that involve community members in the design of visualization tools (Stephens et al., 2015).

This study had several limitations, many of which could be addressed in future work. Due to the insular nature of the community, the research team was only able to interview 17 residents. It would be valuable to continue to build more relationships and capture more views. Additionally, basic demographic information like the number of residents in King Salmon is missing, and it could be useful to devise approaches to capture this information. Assessment of the dynamics from the public meeting was drawn primarily from observation of the meeting and analysis of the transcript. It could be worthwhile to follow-up with residents who attended the workshop to capture their perceptions of it. The maps shown to residents drew from OPC (2018) which is being updated in 2024. In addition, the maps show static water level responses to SLR which may not be as accurate as those drawing from additional hydrological modelling techniques (Vivyan, 2023). It may also be worthwhile to update the maps based on the revised projections and if possible, to seek partnership with engineers and hydrologists to gain even more specific inundation information and projections to share with residents and gauge their responses.

Overall, this work highlights the need for a massive mobilization of education and empowerment initiatives with communities living in blue zones on the SLR inundation maps. The workshop planners expressed the lofty goal of making a SLR plan that comes from and has "broad support in the community". However, follow-up with the community following the one workshop was minimal. It is almost as if community members were dropped off a cliff – shown these very scary projections and given virtually no follow-up about continuing the conversations and developing plans or solutions. There are many valid reasons why the county staff has not been able to continue the conversation, not the least of which is lack of staff time and capacity. However, this case along with other research (e.g. Douglas et al., 2012) makes it clear that much more investment is going to be needed into developing community education and engagement processes related to SLR – particularly for low income and/or marginalized communities. In an op-ed in the Washington Post, New Orleans planner Aron Chang (2018) stated that current climate adaptation and resilience projects devote just 2 to 5 % of their budgets to community engagement processes with no funding towards education. He suggests that 40 to 50 % of project budgets should be devoted to community engagement and education in order for these efforts to be effective, sustainable, and equitable.

6. Conclusion

We can now return to the imagery in generic SLR inundation maps – like those in the New York Times "What Could Disappear" mapper (NYT, 2016) – with fresh eyes. The encroaching blue on the maps evokes a sense of whole land areas being absorbed underwater. The images feel apocalyptic. One can almost visualize schools of fish swimming around sunken houses or crabs scattering across submerged streets – whole cities and towns, abandoned and underwater. But a dive into the flood experiences in King Salmon as well as SLR assessments done by planning consultants show that this is not exactly how SLR will proceed. Depending on the assumptions of the map-maker, the blue zones do not represent areas that will be underwater all the time; they show areas that will be temporarily flooded by tidal or storm inundation – with increasing frequency as seas rise. Residents of communities like King Salmon understand the nature of tidal flooding, both how it occurs now and how it might proceed in the future. Scientists, community members, and planners may need to work and learn together to push past this one-dimensional depiction of SLR processes and to understand and grapple with the complexity of coastal flooding and its effects.

Lastly, we can focus our attention on another prominent feature of SLR maps – the often white land areas being overtaken by the translucent blue. Aside from a few names of major cities or landmarks, a few roads, the white land areas are nearly featureless. They appear almost as abstract spaces – free from humans, from culture, from friction. The color is even, masking difference, inequality. It is then the job of social scientists and geographers to push back against this simplistic mental model of areas affected by SLR. They can do this by partnering with communities and governments to help unearth and communicate the complex, dynamic, and surprising nature of these places and how they receive and interact with SLR knowledge and planning.

Credit authorship contribution statement

Laurie Richmond: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Kristina Kunkel:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

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Data availability

The data that has been used is confidential.

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Appendix A. Supplementary data

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