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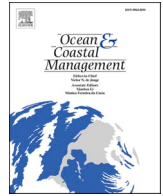
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Marine protected areas and fishing community well-being: An example from statewide socioeconomic monitoring of the California MPA network

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ABSTRACT

As marine protected areas (MPAs) continue to proliferate as an ocean conservation tool, it is important to understand their socioeconomic outcomes, both in the short-term following implementation and in the long-term as they become a more permanent part of the ocean landscape. This paper presents results from an effort to conduct long-term socioeconomic monitoring of commercial fishing communities in relation to California's statewide MPA network, which was fully implemented in 2012 and consists of 124 MPAs covering 16% of state waters. To assess commercial fishing community perceptions of well-being and outcomes from the MPA network, we held virtual focus groups in 18 major port-based commercial fishing communities across California with a total of 85 participants from 2020 to 2021. Focus groups had both quantitative and qualitative components, with participants rating their fishing community and engaging in discussions on topics related to their environmental, economic, and social well-being and MPA outcomes. Results revealed that perceptions of fishing community well-being varied throughout the state, but were overall low. Key areas for improvement included recruitment and retention of participants in the fishing industry, availability and maintenance of key fishing infrastructure, and access to harvestable resources. Fishing community perceptions of the management and outcomes from the MPA network were overwhelmingly low across the state with little variation. Common reasons for participant dissatisfaction included perceptions of negative ecological and livelihood outcomes from the MPAs and a perceived lack of clear MPA management goals in addition to poor communication of those goals. Overall findings highlight the value of collecting community well-being data in coordination with long-term socioeconomic MPA monitoring to understand the greater context in which MPAs are received. A well-being approach to socioeconomic MPA monitoring also broadens policy pathways that could help improve outcomes from and beyond MPAs to support overall fishing community health.

1. Introduction

In recent decades, there has been a global proliferation of marine protected areas (MPAs) as a tool for marine conservation (Clarke et al., 2017; Rees et al., 2014; Russ and Alcala 1996; Voyer et al., 2015). MPAs are designated in an effort to protect enclosed marine environments for improved ecosystem health primarily through the limitation or exclusion of fishing activities (Gleason et al., 2010; Hilborn et al., 2004; Weible 2008). Prominent conservation goals like the Convention on Biological Diversity's Aichi Biodiversity Target 11 for 10% of coastal and marine areas to be protected by 2020, and the 30 × 30 initiative to

protect 30% of global lands and oceans by 2030, have prompted MPA expansion (Carr et al., 2020; Kubiak 2020).

With this movement towards MPA development, scholars and practitioners have increasingly highlighted the importance of understanding human dimensions of MPA implementation processes. Research on the human dimensions of MPAs has found that MPA formation can have social, cultural, and economic implications for resource users affected by MPA implementation (Christie 2004; Cinner et al., 2009; Richmond and Kotowicz 2015). Social science MPA scholarship has also revealed that determination of MPA success, including achievement of conservation goals, relies on social indicators such as perceptions of MPA

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acceptability, legitimacy, and equity among user groups (Bennett et al., 2019; Dehens and Fanning 2018; Gall and Rodwell 2016). Many academics have recognized resource user perceptions of conservation strategies such as MPA processes as a credible measure of their effectiveness (Bennett 2016; Leleu et al., 2012; Mangi and Austin 2008). Accordingly, this body of work goes on to emphasize the importance of examining social factors from the perspective of resource users for effective and just MPA management strategies (Kelly et al., 2020; Picone et al., 2020).

The concept of well-being is prominent in the literature on the health and state of natural resource-dependent communities (Biedenweg et al., 2016; Britton and Coulthard 2013; Humphrey 1995; Stedman et al., 2004; Thomas and Twyman 2005). Scholars have emphasized the importance of understanding the relationship between community well-being and natural resource management because “who controls the resources, who manages the benefits and determines when and how locals participate in resource management, and the conditions of the resources that remain have significant implications for community well-being in the short and long term” (Kusel 2001, pp.376-377). In natural resource contexts, community well-being encompasses “such conditions as access to economic opportunity [...] social interactions, environmental quality, infrastructure, [and] political processes” (Haynes et al., 1996, p.223). Fisheries social scientists in particular have used a well-being approach to examine the social dimensions of MPAs (Ban et al., 2017; Baker et al., 2021; Jones et al., 2020). This research suggests that the combination of well-being assessments with exploration of MPA impacts and outcomes can provide further insights into MPA perceptions, outcomes, and successes, particularly in studies that explore the longer-term implications from MPAs well after they have been established.

In 2012, California completed the largest statewide system of MPAs to date, consisting of 124 MPAs covering 16% of state waters (Saarman and Carr 2013). MPA designation in California followed a regional process in which MPAs along the Central Coast were designated first, followed by the North Central and South Coasts, and culminating with the North Coast region. The process for each region was modified and adapted based on learning in the preceding regions, and each had its own set of political dynamics and level of adherence to science guidelines (Fox et al., 2013). Upon MPA implementation, the state initiated first a “baseline” (2007–2018) then a “long-term” (2019–2022) monitoring program to determine the ecological and social effectiveness of the MPA network and inform the 10-year MPA management review (California Ocean Protection Council, 2019). This paper presents information collected from a California state-funded project to perform socioeconomic monitoring of the MPA network between 2019 and 2021 as part of the state’s “long-term” monitoring program. We held virtual focus groups in 18 major port-based commercial fishing communities across California with a total of 85 participants to answer the following research questions:

1. How do commercial fishermen in California perceive the well-being of their port-based fishing communities along environmental, economic, and social factors?
2. What are commercial fishermen’s perceptions of the environmental, economic, and social outcomes of MPA implementation in state waters?
3. What are the connections between commercial fishermen’s perceptions of well-being and MPA outcomes?

2. Literature review

Research on the socioeconomic aspects of MPAs suggests MPAs can have both negative and positive outcomes for individuals and communities who depend on marine spaces and resources managed under MPA regulations (Charles and Wilson 2009; Christie et al., 2017; Clarke et al., 2017; Mascia 2003). Scholars are increasingly using the term

“outcomes” to characterize both impacts and broader change processes associated with MPA implementation (Gruby et al., 2017; Hargreaves-Allen et al., 2017; Ordoñez-Gauger et al., 2018; Warner and Pomeroy 2012). Gruby et al. (2017) posit that MPA outcomes can occur across scales and encompass various domains of change such as community, economic, cultural, and political. The literature identifies common negative MPA outcomes including loss of access to preferred fishing grounds; displaced fishing effort to remaining open areas; and increased crowding, competition, and conflict among fishermen (McNeill et al., 2018; Ojea et al., 2017; Stevenson et al., 2013). Researchers have also found that decreased access to marine resources can increase costs associated with travel to fishing grounds, decrease landings, and lower fishing income, making it harder for fishermen to earn a living (Bennett and Dearden 2014; Pascual et al., 2016; Sowman and Sunde 2018). Findings on positive MPA outcomes indicate increased catch abundance, diversity, and size can arise from MPA recruitment and spillover (Smallhorn-West et al., 2020). MPAs can also lead to greater food security, along with increased community organization around resource management under certain types of MPA governance (Mascia et al., 2010).

Scholarship related to MPA governance processes surrounding initiation, implementation, and ongoing management has consistently highlighted the importance of incorporating participation, communication, and transparency for successful MPA management (Bennett and Dearden 2014; Dalton et al., 2012; Markantonatou et al., 2016; McClanahan et al., 2005; Oyanedel et al., 2016; Scholz et al., 2004). When decision-makers withhold information, resource users can feel “skeptical about the fairness, equity and effectiveness” (Rasheed and Abdulla 2020, p.1) of and “alienated from the management process” (Himes 2003, p.389). Upon improved transparency, D’Anna et al. (2016) detected stronger and more efficient MPA management practices. Communication and transparency often coexist with empowerment, accountability, equity, compliance, and trust, principles that are crucial for effective and socially acceptable MPA management (Bown et al., 2013; Gall and Rodwell 2016; Islam et al., 2017; Ordoñez-Gauger et al., 2018; Weigel et al., 2015). The California MPA implementation process has been heralded for its participatory approach (Fox et al., 2013; Gleason et al., 2010; Kirlin et al., 2013; Sayce et al., 2013), but further exploration of how participants such as fishermen viewed the process and its outcomes may be warranted. Ordoñez-Gauger et al. (2018) found that shortly following implementation, commercial fishermen in the North Coast region had negative views of the process; however, there remains a need to explore fishermen’s perceptions of MPA management on a statewide scale and over time. California’s investment in long-term monitoring of MPAs, including the study that we present here, provides an opportunity to explore how participants’ perceptions of MPA management evolve through time.

There is a growing body of literature exploring MPA outcomes in tandem with the concept of human well-being (Brueckner-Irwin et al., 2019; Gollan and Barclay 2020; Mahajan and Daw 2016; Ngoc 2018; Rees et al., 2014). Scholarship on well-being and MPAs provides insights into interactions between MPA outcomes and well-being across ecological, economic, social, and cultural domains (Baker et al., 2021; de Lange et al., 2016; Jones et al., 2020), though some receive more attention than others potentially due to “the societal importance placed on economic outcomes and the challenges in measuring social [...] and cultural domains” (Ban et al., 2019, p.525). While well-being is gaining traction in the research on MPAs and MPA outcomes, Rasheed (2020) concluded “explicit studies on human well-being from MPAs are limited and empirical studies quantifying these relationships are rare” and reiterated the finding in Ban et al. (2019) that “most MPA papers, including those examining MPA effectiveness, focus on just a few aspects of well-being,” more so ecological and economic rather than social and/or cultural (p.1). A well-being approach to exploring MPA outcomes may be particularly beneficial in the context of long-term monitoring as over time MPAs become more of a background fixture or

presence in fishing community life, interacting with a host of other attributes and issues.

3. Methods

3.1. Data collection

We collected quantitative and qualitative data about California commercial fishing community well-being and MPA outcomes through 18 port/port group-based focus groups (Table 1). Human research activities were approved under Cal Poly Humboldt Institutional Review Board (IRB) number 18–098. Due to pandemic conditions at the time of data collection, we held the focus groups on the Zoom virtual meeting platform. Focus group participation ranged from three to ten fishing community members representative of each port/port group's fishery and demographic characteristics, to the extent possible (see Supplemental Materials (SM) A for more detail on focus group recruitment design and process). While many fishing community members participate in multiple fisheries, focus group participants were also selected based on their participation in state fisheries that interact with the California MPA network. The focus group structure consisted of

Table 1

Focus group location, date, length, and number of participants, ordered geographically from north to south.

Port/port group	Date	Focus group length	Number of focus group participants
Crescent City (CC)	August 6, 2020	3:30:32	4
Trinidad (TR)	October 27, 2020	3:37:01	3
Eureka (EU)	October 8, 2020	3:52:15	8
Shelter Cove (SCV)	October 19, 2020	2:59:00	4
Fort Bragg/Albion (FB)	November 5, 2020	3:33:18	5
Point Arena (PA)	February 1, 2021	3:13:13	4
Bodega Bay (BB) ^a	July 9, 2020	4:18:01	6
San Francisco Area Ports (SF)	October 26, 2020	3:15:35	4
Princeton - Half Moon Bay (HMB)	November 19, 2020	3:15:57	7
Santa Cruz (SCZ)	December 8, 2020	3:46:01	5
Moss Landing (ML)	December 16, 2020	3:30:41	4
Monterey (M) ^b	Not applicable	Not applicable	Not applicable
Morro Bay - Port San Luis (MB)	October 29, 2020	3:31:30	4
Santa Barbara (SB)	August 31, 2020	3:43:04	4
Ventura/Channel Islands Area Ports (VCI)	September 16, 2020	3:30:28	3
Los Angeles/Long Beach Area Ports (LA)	September 4, 2020	3:24:10	6
Orange County Area Ports (OC)	September 9, 2020	3:47:53	6
Oceanside (O) ^c	April–May 2021	Not applicable	3
San Diego Area Ports (SD)	March 2, 2021	2:41:29	5
Total			85

^a Pilot focus group.

^b We were unable to hold this focus group.

^c Due to participant preference, we did not hold this as a focus group but as separate one-on-one conversations with three individuals; therefore, the scores did not as clearly reflect the deliberative component.

participants first rating their fishing community on a five-point Likert scale on topics related to their environmental, economic, and social well-being and corresponding MPA outcomes; ten questions were related to well-being, and five questions were specific to MPA outcomes (see SM B for a full list of focus group questions). After inputting their ratings into the Zoom polling function, participants engaged in a qualitative discussion about why they chose their selected ratings to introduce context to the quantitative data. Following the discussion, participants re-submitted their ratings for the same questions. All figures, tables, and analysis presented in this paper and SM use these second ratings, which we believe reflect a more accurate, collaborative view of the fishing community beyond the individual experiences of focus group participants; Cook et al. (2022) provide additional information regarding the merits of deliberative valuation used in this study.

We decided to use a hybrid quantitative-qualitative focus group approach because we felt that other methods such as in-person, online, or mail-in surveys either faced challenges of low response rates, did not sufficiently capture rich contextual information, or were too expensive to implement, especially considering the large scale of a state like California (Hackett et al., 2017; Pollnac et al., 2015). Further details and discussion on the study methods can be found in Cook et al. (2022), including the rationale for developing and implementing this approach, existing frameworks and indicators we considered for well-being and MPA question development, and the collaborative approach we took to finalizing the focus group questions which incorporated input from fishing community members, management officials, and academics.

3.2. Data analysis

We used Statistical Package for the Social Sciences (SPSS) to analyze the quantitative data from the second ratings. We ran frequencies, and developed two indices per focus group related to perceptions of fishing community well-being and perceptions of MPA outcomes. Index development consisted of combining responses to focus group questions that were relevant in content. We created three sub-indices for well-being (environmental, economic, social) and three for MPAs (MPA ecological outcomes, MPA livelihood outcomes, MPA management) after assessing their internal coherence using Cronbach's alpha; the results indicated that they are reliable (Bennett et al., 2019; see SM C). We summed and normalized the well-being and MPA sub-indices to obtain an overall well-being and MPA index, respectively (Table 2; see SM D for all focus group well-being and MPA sub-index and composite index values).

For further analysis, we used non-parametric testing to compare

Table 2

Focus group question topics and their relationship to well-being and MPA sub-indices and composite indices.

Focus group question topic	Sub-index	Composite index
Marine resource health - present	Environmental	Well-being
Marine resource health - future concerns	Environmental	Well-being
Access to harvestable resources	Economic	Well-being
Income from fishing	Economic	Well-being
Markets	Economic	Well-being
Infrastructure	Economic	Well-being
Labor/new participants	Social	Well-being
Job satisfaction	Social	Well-being
Social relationships - internal	Social	Well-being
Social relationships - external	Social	Well-being
MPA ecological outcomes	MPA ecological outcomes	MPA
MPA livelihood outcomes	MPA livelihood outcomes	MPA
MPA management	MPA management	MPA
MPA monitoring	MPA management	MPA
MPA enforcement	MPA management	MPA

demographic and fishery data with focus group data, particularly composite well-being and MPA index values and economic well-being sub-indices. Select demographic variables for analysis included total ex-vessel value (EVV) per port, number of active fishermen in the port, average EVV per fishermen per port, and average age in the port; all demographic and fishery data were retrieved from the California Department of Fish and Wildlife (CDFW) database. We did not observe statistically significant differences in the composite well-being and MPA indices and economic sub-index values based on total EVV, number of active fishermen, EVV per fishermen, or average age. Additionally, when examining if the composite MPA index values were associated with the composite well-being index values, testing with the Spearman's correlation test did not suggest a statistically significant relationship between perceived MPA outcomes and perceived well-being. Outputs from the statistical analysis can be found in SM C. Given the lack of statistical significance in these analyses, the results section focuses primarily on findings from the descriptive statistics and qualitative data.

We recorded and transcribed all focus group conversations, and analyzed focus group transcripts in Dedoose. We coded the transcripts for 15 themes related to the focus group question topics (Table 2). This paper presents key findings from the quantitative and qualitative analysis. Quotes from focus groups are indicated with the port/port group abbreviation and year. Additional findings and study details, including detailed summaries of each focus group, can be found in Bonkoski et al. (2021) or the project website: <https://mpahumanuses.com/>.

4. Results

4.1. Commercial fishermen perceptions of fishing community well-being

In focus groups, commercial fishermen were asked to rate the well-being of their fishing community or port related to ten facets of well-being. Fig. 1 shows the statewide distribution of responses for each well-being facet, along with the average statewide rating for each well-being question ordered from highest to lowest. The quantitative ratings revealed that commercial fishermen in California tended to have low perceptions of their community's well-being attributes overall. Seven well-being questions had an average rating below neutral (3.0) while only three questions had a rating above neutral. No questions had an average rating higher than a 3.4 on a scale of 5. A full breakdown of the statewide Likert responses to each of the well-being questions can be found in SM E. Qualitative discussions reflected these trends and provided more nuance and detail about the reasons why, overall, focus group respondents tended to rate aspects of the well-being of their fishing communities so low.

4.1.1. Perceptions of environmental well-being

The present health of marine resources was discussed with some optimism among focus group participants who also shared concerns related to potential future threats to resource health. Forty-four percent of participants rated present marine resource health as high or very high, 43% as neutral/medium, and 13% as low or very low. They clarified their assessment of present marine resource health was an average across fisheries, and that "it depends which resource you're talking about. Some species have been quite good, but others we are pretty worried about" (O, 2021). Participants highlighted several species they believed were currently healthy, including nearshore and deeper nearshore rockfish, which they reported size and abundance had increased in recent years to the point where "their populations are probably fully rebuilt to what they were before the [19]80s" (ML, 2020). Participants also perceived sufficient abundance of Dungeness crab, lingcod, spot prawn/shrimp, halibut, rock crab, and California sheephead to support the fisheries.

Participants expressed overarching concerns about salmon and sea urchin populations and kelp forest declines. They discussed the uncertainties that they believed fishermen from their ports were worried

about, including the effects of climate and political change on the resource. Participants shared concerns about increasing water temperatures, ocean acidification, and sea-level rise. They also questioned whether changing ocean conditions were cyclical, or if warmer ocean temperatures along with habitat loss would become the new normal. One commercial fisherman said, "the thing that I'm concerned about is more just ocean or climate change and its effect on the fisheries [...] if the warm waters persist and the kelp is just at a lower level in my lifetime than it was in a previous fisherman's lifetime" (VCI, 2020).

4.1.2. Perceptions of economic well-being

With regard to economic aspects of their fishing communities, fishermen reported interlinked challenges related to sufficient access to harvestable resources and income from fishing. Many participants stated that income from fishing alone was not sufficient to support their or their families' livelihoods and that they needed to pursue an additional source of income or rely on income and/or health benefits from a partner. Many believed that a fishing portfolio was essential to earning a sufficient living from fishing. As one participant stated, "I'm one or two regulations [away from fishing not being] profitable, and you just can't live on one fishery alone. You have to be in multiple fisheries in order to make [it in the fishing industry]" (BB, 2020).

Focus group participants also shared concerns about a lack of consistent, diverse, and local markets to sell their catch. Twenty percent rated markets in their communities as good or very good, 39% as neutral/acceptable, and 41% as poor or very poor. Participants across California highlighted availability of sufficient and well-maintained infrastructure like ice, fuel, haul-out facilities, processors, hoists, piers, and gear storage as a key concern, although examination of quantitative ratings at the focus group-level suggested that perceptions of infrastructure quality were uneven across ports/port groups (see SM E). Sixty-six percent of participants rated the state of infrastructure and services that supported commercial fishing in their ports as poor or very poor, 19% as neutral/acceptable, and 15% as good or very good. One participant said, "It used to be—it wasn't too long ago—any port [in California] you went into, there was always the infrastructure to keep you going. And it's pretty much fallen apart up and down the whole coast" (ML, 2020). Another participant emphasized that "without the infrastructure, you can't have the fishing. And if you don't have the fishing, you can't have the [funding to support] infrastructure" (EU, 2020). Many participants reported a lack of at least one or more crucial pieces of fishing infrastructure in their ports. Even ports with self-reported available and reliable infrastructure expressed a desire for more funding and support for infrastructure development and maintenance.

4.1.3. Perceptions of social well-being

Focus group participants reported strong internal relationships within their ports but described weaker relationships with external groups who could help support community needs. While some participants identified low levels of trust and leadership in their ports, most indicated that fishermen were willing and ready to help each other regardless. One commercial fisherman said, "I think we all try to get along as best we can. Of course, at times we all have our issues, but as far as trying to work together ... if something was to happen to somebody else, oh, we're right there on top of it. We're going to go help somebody else; there's no doubt in my mind" (OC, 2020). In contrast, many participants discussed feeling a lack of support for the fishing industry from external groups. A fisherman highlighted the influence they believed external bodies' views of the commercial fishing industry had on support for the fleet: "In terms of the agencies, it's very hard to educate them about how important the commercial fishery is. I think they hear a lot of stuff from NGOs that don't like us and don't want to see us fishing, or want us to fish in the manner that they approve of, which would mean that we would all go out of business" (SF, 2020).

Across California ports, participants cited the ability to recruit new

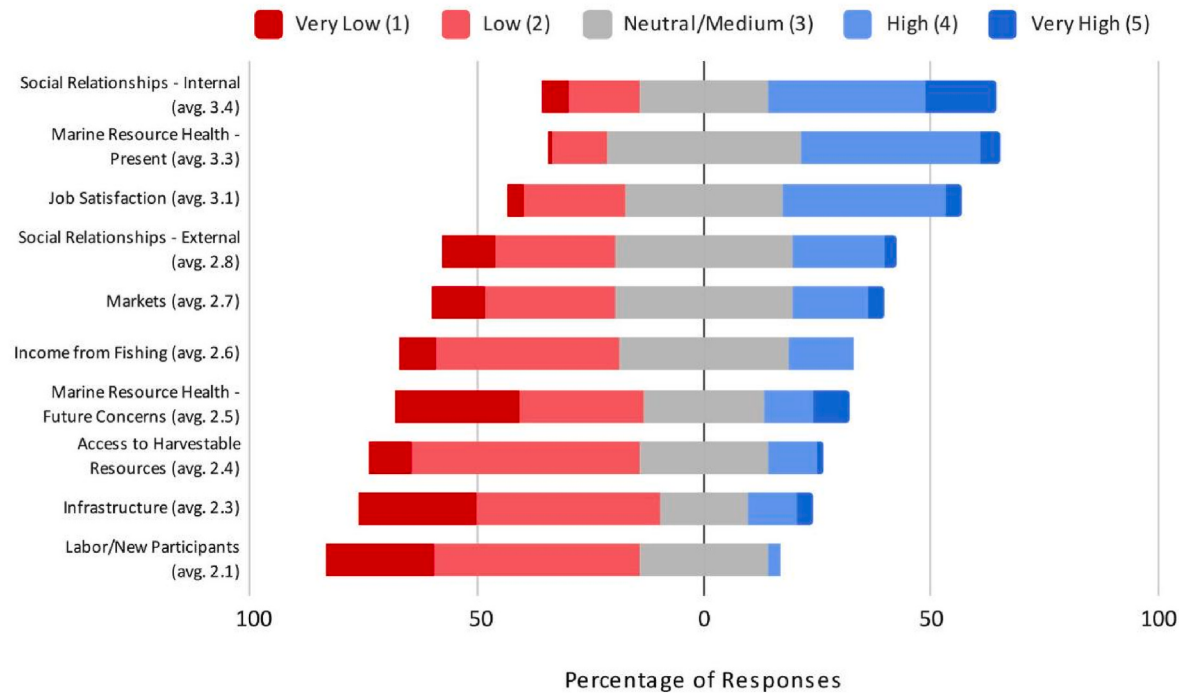
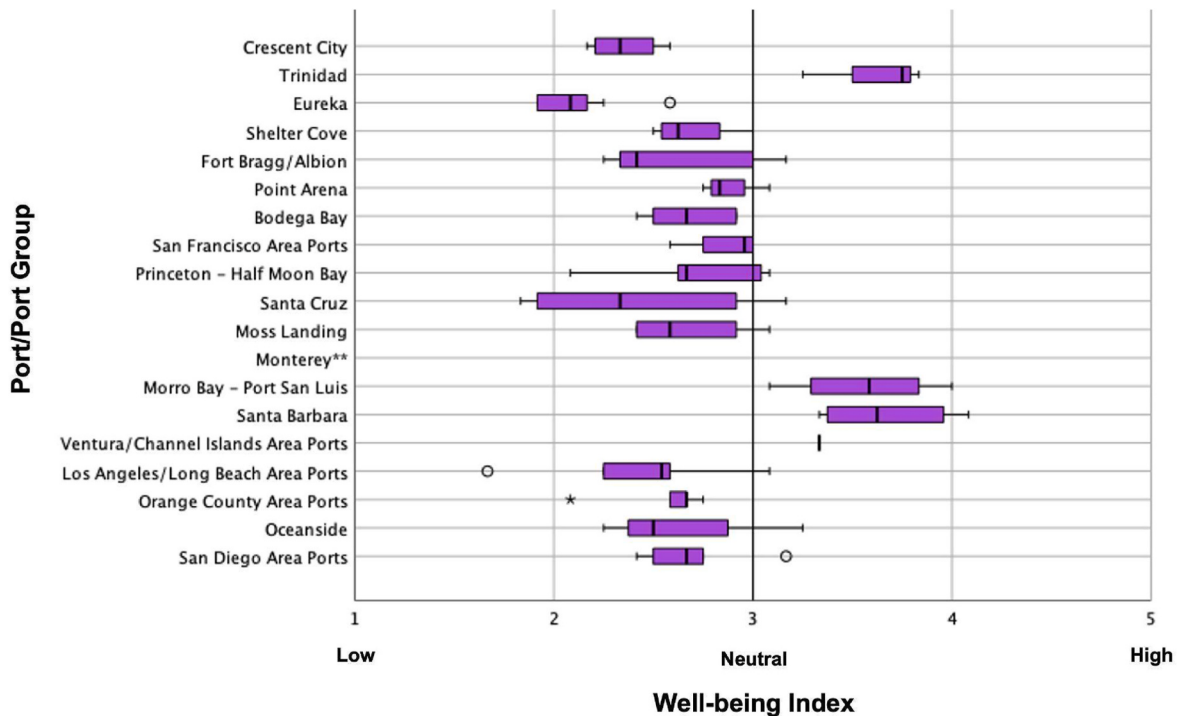


Fig. 1. Diverging stacked bar chart showing the statewide distribution of responses for each well-being question (n = 85), ordered by statewide average rating (avg.) from highest to lowest. See Table 2 for the well-being type (environmental, economic, social) associated with each question topic.

captains and crew to the commercial fishing industry and retain current participants as a key challenge. Labor/new participants was the lowest rated well-being question across focus groups, with 69% of participants

characterizing recruitment and retention as poor or very poor, 29% as neutral/acceptable, and only 2% as good. Participants were worried about “the [high] cost to get into the industry” (EU, 2020); they reported



**No data for Monterey

Fig. 2. Boxplot showing the distribution of individual participant composite well-being index values, organized by focus group and ordered geographically from north to south. Each box contains the values in the first quartile, median, and third quartile, with the bold line representing the median. The left whisker is the minimum value (excluding outliers), and the right whisker is the maximum value (excluding outliers). The circles represent outliers, and the asterisks represent extreme values.

start-up costs, including prohibitively expensive limited entry permits, had created hurdles for young people to enter and survive in the industry. They noted it was very difficult to enter the industry without financial inheritance or other forms of monetary support. While participants noted some bright spots of younger fishermen entering and making it in the industry, many expressed concerns about the so-called graying or aging of the fleet. One participant said, “to be honest, you got to be almost crazy to get into this industry right now. It’s financially irresponsible. [...] You’re gambling, big time” (TR, 2020). Participants across focus groups also expressed the belief that regulatory and other financial burdens that prevented new fishermen from entering represented an existential threat to the future of young people entering the commercial fishing industry.

4.1.4. Comparison of well-being perceptions across California ports

Perceived well-being varied across focus groups, indicating that not all ports may have been experiencing the same type or extent of challenges (Fig. 2). When we combined the responses to the well-being questions into an overall index (see SM D for composite well-being index values), four ports reported an overall well-being above neutral (3.0)—Ventura/Channel Islands Area Ports, Morro Bay - Port San Luis, Trinidad, and Santa Barbara—and 14 ports reported an overall well-being lower than neutral, with Los Angeles/Long Beach Area Ports, Santa Cruz, Crescent City, and Eureka having rated themselves the lowest.

4.2. Commercial fishermen perceptions of outcomes from the MPA network

Focus group responses suggested fishermen across California were dissatisfied with and perceived negative effects from the MPA network (Fig. 3). All five MPA questions had a statewide average rating below neutral (3.0). Among them, perceptions of MPA management and MPA monitoring received the lowest ratings across the state. Participants only rated MPA ecological outcomes above a 2.0. A full accounting of Likert responses to MPA outcomes questions can be found in SM E.

4.2.1. Perceptions of ecological outcomes from the MPA network

A majority of participants’ perceptions about MPA effects on marine resource health fell below positive, with 43% reporting strongly negative or negative and 50% reporting no effect/neutral. Only 7% of participants rated MPA effects on marine resource health as positive.

Participants brought up concerns related to potential negative ecological effects from MPA implementation. Fishermen expressed concerns that closures of more ocean areas have contributed to the concentration of fishing effort into increasingly smaller spaces. They believed displacement of fishing effort outweighed potential positive effects of MPAs on the resource, and had resulted in ecological harm and contributed to localized depletions. A participant said, “when I was younger [...] we used to fish those areas a lot, so the pressure was spread out and you weren’t just hovering over the same rock every time. And as soon as [the] MPAs were put into place, [myself and other fishermen] would go try to take everything we could in the open areas within our quota. And then our friends would come in the next day and do that after. So I believe that the MPAs are more negative than positive” (SCZ, 2020). Participants also expressed concerns related to MPAs and the urchin fisheries, worrying that the closures which prevent urchin harvest could have contributed to the creation of urchin barrens where urchins dominate the environment, consuming kelp and contributing to kelp ecosystem decline.¹ Several participants offered the suggestion for

managers to rotate or periodically open MPAs to particular fisheries as a means to improve their efficacy.

Many participants expressed a belief that MPAs did not have either a positive or negative impact on marine resources overall. Some expressed the sentiment that the ocean and marine life were healthy before MPA implementation and, as a result, felt MPAs had not done much to improve resource health. Fishermen noted that they saw no effect from MPAs on several key commercial fisheries in the state including Dungeness crab and California spiny lobster. Many participants stated that they did not have enough information to make a determination. Participants also expressed concerns that the MPAs do little to protect ocean areas and fisheries from threats outside of fishing such as pollution, warming oceans, and ocean acidification (SB, 2020).

On several occasions, participants described potential positive ecological outcomes. Some participants identified rockfish, lobster, and sea cucumber as species whose abundance and/or size may have benefited from MPAs. Regarding sea cucumbers, a participant said, “those animals have to aggregate really densely to spawn, and it’s good to have some areas [such as MPAs] for them to do that [and] get no pressure whatsoever. So for that fishery, I would lean towards the neutral to positive” (VCI, 2020).

4.2.2. Perceptions of livelihood outcomes from the MPA network

Across the board, focus group participants reported experiencing negative livelihood effects from the MPA network. Eighty-eight percent rated MPA livelihood outcomes as negative or strongly negative. Eleven percent of participants said the MPA network had no effect/neutral outcomes on their fishing livelihoods, and only 1% said MPAs had positively affected their ability to earn a living from fishing. No participant rated MPA livelihood outcomes as strongly positive. Results indicated impacts tended to be more acute for ports in earlier MPA implementation regions like Central and Southern California where MPAs were designated closer to ports and in greater quantity compared to Northern California (see SM E).

Participants most often highlighted loss of access to historically important/profitable fishing grounds as a main concern regarding the MPA network. One participant said, “loss of fishing area is a major factor. It is frustrating, the fact we lost the area, and we don’t know if [the MPAs are] working. [...] My income was reduced by one third when [the MPAs were] put into place. In Cardiff, I can’t fish my traditional grounds, because they are closed” (O, 2021). Many participants reported decreased income opportunities for the Dungeness crab, salmon, rockfish, and urchin fisheries due to MPA restrictions on fishing activity. They emphasized the compounding effects of MPAs with other spatial restrictions. Many participants were concerned about increased crowding and competition along/outside MPA boundaries due to lost access to fishing grounds. Participants also reported lower catches and emotional distress associated with the MPAs which, together, they said had made fishing more difficult.

Participants stated the MPAs had increased travel distance to fishing grounds, which they believed had cascading effects on risk and costs associated with fishing. They shared the perspective that inclement weather near ports along with restrictions on anchoring in MPAs had led to increased safety hazards. Participants also noted increased costs of doing business since MPA implementation due to increased fuel expenses and the need to plan for multi-day trips. A Moss Landing participant (2020) explained:

Well, I think the guys are still able to fill their quota. It takes longer: more fuel to burn, more time on the ocean ... you’re still able to do it if you fish hard. These guys fish every day, [...] so they’re still making a living, but of course, they’re spending a lot more going. So it just takes longer, and they are fishing the areas harder than they would if the areas were still open where we saw fish.

4.2.3. Perceptions of management outcomes from the MPA network

Participants expressed dissatisfaction with MPA management

¹ It is important to note that there are two main species of sea urchin in California, red and purple. Red urchin is the primary target of commercial fisheries. Purple urchins are the species observed to overtake kelp ecosystems, creating urchin barrens and contributing to kelp decline.

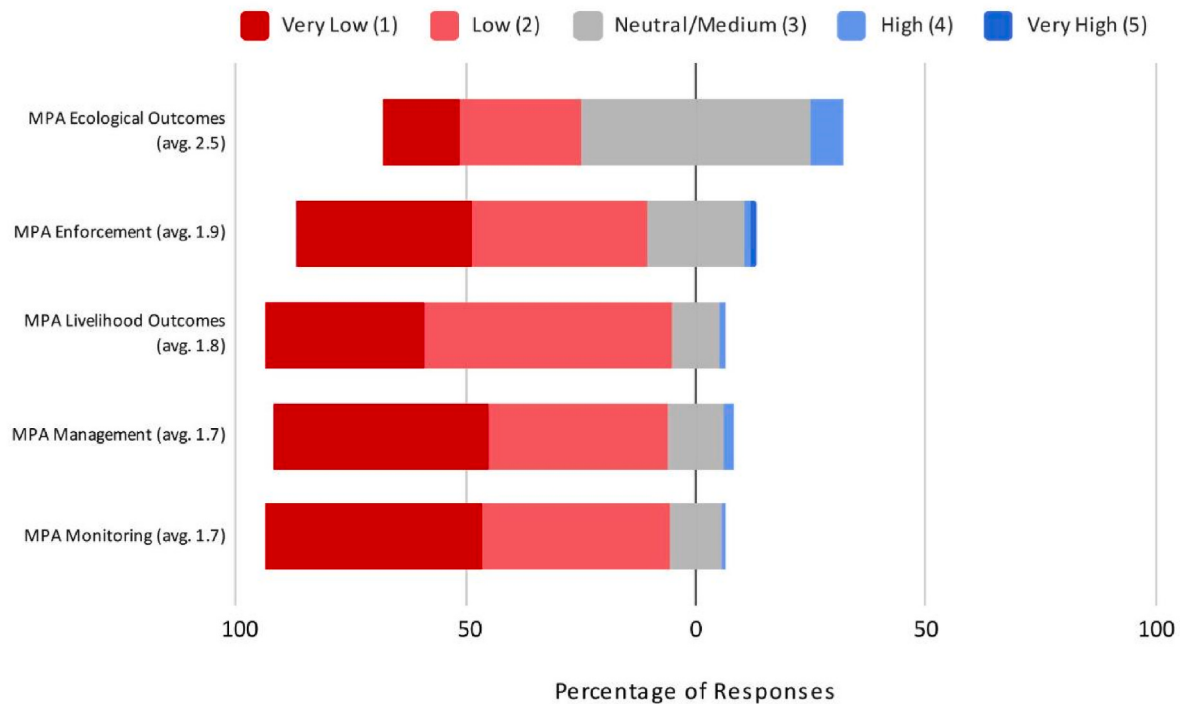


Fig. 3. Diverging stacked bar chart showing the statewide distribution of responses for each MPA question ($n = 85$), ordered by statewide average rating (avg.) from highest to lowest.

(including the MPA planning process), MPA monitoring, and MPA enforcement. Eighty-six percent of participants were dissatisfied or very dissatisfied with MPA management, 12% characterized their perceptions of MPA management as neutral/neither, and only 2% said they were satisfied; no one reported they were very satisfied with MPA management.

Participants shared the perspective that strong, lasting feelings of betrayal during MPA implementation continued to degrade fishermen's trust in other fisheries policy processes. They perceived the MPA process to have been driven by politics and special interests that continued to influence fishermen's doubt and skepticism surrounding MPA and fisheries management more broadly. One participant said, "it's hard as a fisherman not to be distrustful of the process. It just feels like all we do now is suffer. [...] Every day, there's a new heavy-handed thing coming down on us [...], and it just gets to be less and less satisfying to deal with" (HMB, 2020).

Many participants expressed dissatisfaction with current MPA management due to a perceived lack of clear MPA goals, communication of information and decisions, and opportunities for fishermen involvement. They recalled not being told the purpose of the MPA network upon implementation which, from their perspective, had contributed to lasting negative feelings of—and unanswered questions about—MPA management. One participant said, "the objective of the MPAs is something that's always been in question in my mind. [...] Are we looking at utilizing this as a method of improving the resource and then allowing the resource to be accessed by the fishermen, or are we looking at closing the area forever? [...] What's the end goal?" (BB, 2020).

Several participants shared that poor communication by managers about MPA information and decisions had led them to believe MPA management was not occurring. Some participants believed there needed to be more meaningful recognition and inclusion of fishermen's expertise in both MPA management and MPA monitoring, with one participant suggesting "that the [MPA management] agency isn't recognizing the historical body of knowledge of people who have been [fishing] here in the same [areas] for the last 20 or 30 years" (FB, 2020). Many participants were unaware about how or whether the MPA

network was monitored, including MPA monitoring research, outcomes, or findings. Participants desired greater collaboration with the fishing fleet in both the design and implementation of MPA monitoring studies.

Participants characterized MPA enforcement as inconsistent, unfair, and ineffective. Seventy-six percent of participants were dissatisfied or very dissatisfied with MPA enforcement, 22% neutral/neither, and 2% satisfied or very satisfied. While some participants recounted instances of enforcement activity, many perceived a lack of MPA enforcement for non-commercial fishing interests. They shared that they continued to see illegal fishing activity occurring in the MPAs, often among the sport fishing fleet. Several participants questioned why, from their perspective, MPA rules and regulations disproportionately affected commercial fishermen compared to sport/recreational fishermen.

4.2.4. Comparison of perceptions of MPA outcomes across California ports

Perceptions of MPAs were low across the state, with only minor variations between ports (Fig. 4). When we combined the responses to the MPA questions into an overall index (see SM D for composite MPA index values), all 18 ports reported an MPA perceptions index score below neutral (3.0). Fort Bragg/Albion, Shelter Cove, and Oceanside had the highest MPA perceptions index, while Los Angeles/Long Beach Area Ports, Trinidad, and San Diego Area Ports had the lowest, although there was not a lot of distinction between them all.

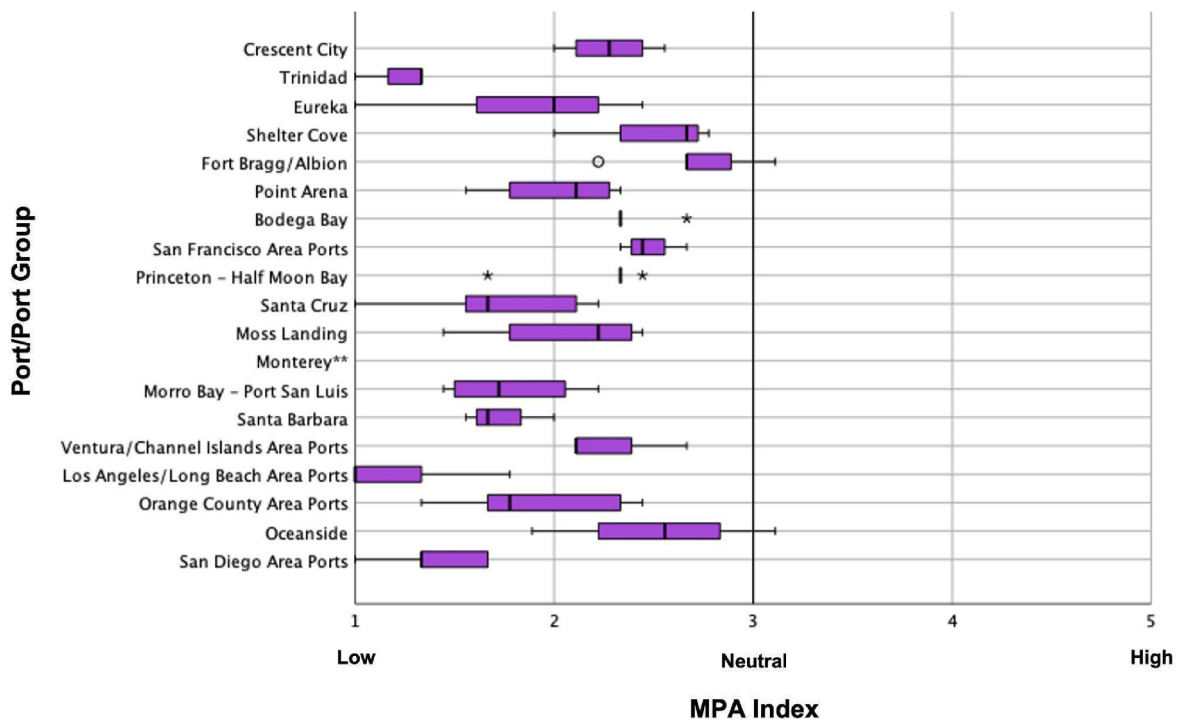
5. Discussion

5.1. Findings and recommendations

Overall, the results from this study point to three key findings. We present these findings below, along with recommendations or suggestions for how managers and practitioners within California and beyond can seek to address these issues.

5.1.1. Alleviating fishing community well-being challenges

Finding: Results from this study indicate that commercial fishing communities across California were experiencing challenges in their



**No data for Monterey

Fig. 4. Boxplot showing the distribution of individual participant composite MPA index values, organized by focus group and ordered geographically from north to south. Each box contains the values in the first quartile, median, and third quartile, with the bold line representing the median. The left whisker is the minimum value (excluding outliers), and the right whisker is the maximum value (excluding outliers). The circles represent outliers, and the asterisks represent extreme values.

environmental, economic, and social well-being. Results varied at the port/port group level, though overall findings suggested that key areas for improvement across the state included: recruitment and retention of participants in the fishing industry, availability and maintenance of key fishing infrastructure, and ability for commercial fishermen (particularly nearshore and small-scale) to access the resources needed to support fisheries. These well-being concerns reflect challenges observed in other studies of commercial fishing communities in California and the broader United States (Cramer et al., 2018; Pomeroy et al., 2011; Richmond et al., 2019).

Recommendation: Encourage state and federal governments, foundations, and private industry to make long-term investments in strategies to help improve fishing community well-being. Conduct strategic planning related to long-term fishing community well-being on a state scale, perhaps modeled after the Fishing Community Sustainability Plans that many individual California ports have developed (Richmond et al., 2019). Seek to expand and implement actions that have been shown to be successful, including: low income loan programs for commercial fishermen, developing additional small-scale and sustainable open access fisheries (such as that within the West Coast Groundfish fishery), strategic investments in working waterfront infrastructure, and commercial fishing apprentice programs that help to recruit and train a new generation of fishermen (California Sea Grant, 2019; Cullenberg et al., 2017; Island Institute et al., 2013). Investment in fishing community well-being activities could be specifically incorporated into the long-term management of MPA networks as a means to offset potential negative impacts from area closures and restrictions.

5.1.2. Relationship between MPAs and fishing community well-being

Finding: Results indicated MPAs were not the sole cause of well-being challenges, many of which have arisen from long-term structural challenges in the state's fisheries. However, focus group data suggest that MPAs have interacted with and in many cases compounded these existing well-being challenges and, according to fishermen accounts,

have made it more difficult and stressful for California fishermen to earn a living and thrive in their careers.

These results also highlight the value of collecting community well-being data in coordination with long-term socioeconomic MPA monitoring as this effort can uncover trends or challenges beyond the MPA sphere and speak to broader policy pathways to improve overall fishing community health. This study also underscores the importance of incorporating more in-depth socioeconomic information, including perceptions data, into fishing community and MPA monitoring. Much work on indicators of fishing community health tends to draw from readily accessible economic indicators of fisheries such as EVV, landings, and vessel and port size (Anderson et al., 2015; Jepson and Colburn 2013; Smith et al., 2019; Van Holt et al., 2016). But in our study, these commonly-used economic indicators lacked notable statistical relationships with overall perceptions of community well-being. The findings suggest that reliance on existing economic data alone may not present an accurate picture of fishing community health. Fishing community well-being is likely linked to a number of complex and context-driven social, cultural, and economic factors best assessed through approaches that involve listening to and learning from fishing community members themselves.

Recommendation: Consider incorporating baseline and long-term socioeconomic monitoring that explores both MPA outcomes and fishing community well-being into MPA implementation and management processes (Ban et al., 2019; Rasheed 2020). For the California MPA network, we recommend the state continue to conduct socioeconomic monitoring by holding port community focus groups every three to five years to evaluate MPA performance and the overall well-being of fishing communities over time.

5.1.3. Addressing the fishing community's negative perceptions of MPA processes in California and beyond

Finding: A majority of participants expressed negative views on all topics regarding outcomes and satisfaction with the management of the

California MPA network. Focus group participants overall did not believe the MPAs had contributed to improved resource health, with most expressing neutral or negative views. Many participants also perceived negative livelihood outcomes as a result of the MPA network. Dissatisfaction with MPA management tended to stem from many sources. A common reasoning that drove participant dissatisfaction was a perceived lack of clear MPA management goals in addition to poor communication of those goals. Interestingly, negative views of MPA implementation were reported years after the process, which could affect resource users' willingness to participate in other management efforts. For example, principal investigators experienced some difficulties recruiting fishing community members to participate in this study due to negative views of MPAs overall and their mistrust about how data might be used.

Recommendation: These findings further reinforce conclusions from MPA governance scholarship that highlights the importance of inclusion, transparency, and community within MPA implementation processes (Bennett and Dearden 2014; Dalton et al., 2012; Markantonatou et al., 2016; McClanahan et al., 2005; Oyanedel et al., 2016; Scholz et al., 2004). The California MPA network was established with an adaptive framework in mind. The state's 2023 decadal management review provides an opportunity to reassess management structures and approaches. Findings from this study point to a need for more open, transparent, and two-way channels of communication between California MPA managers and fishermen and for the development of a long-term MPA governance structure that meaningfully includes fishermen participation. This could be achieved through the development of a fishermen's advisory body related to MPA management and decision-making (example: North Pacific Fishery Management Council Advisory Panel) and through efforts to partner with fishermen on research and monitoring (examples: California Collaborative Fisheries Research Program and International Pacific Halibut Commission Fishery-Independent Setline Survey).

5.2. Study limitations

We anticipated there to be challenges in our attempt to assess aspects of perceived fishing community well-being and MPAs on a statewide scale with over 19 key port/port groups. As detailed in Cook et al. (2022), we sought to develop an approach that could capture port-specific insights and concerns while offering a statewide view about well-being and MPA outcomes, all the while working within the budget and time constraints of a study that was grant-funded. Overall, we believe this approach balanced both localized and broader views of fishing community well-being and MPAs, and provides managers and fishing community members with valuable insights into the circumstances captured at the time of study. In particular, incorporating a qualitative component to the study elicited rich, contextual information that may have been lost in a survey-based approach. However, that does not mean this study was without limitations. The study measured fishermen's perceptions of MPAs, and there is always the possibility participants could have been incentivized to exaggerate their perceptions (such as negative impacts/outcomes from MPAs) as a means to achieve their policy goals; however, we addressed this by focusing the ratings on specific attributes of MPAs and community well-being followed by detailed, specific discussions. Focus group participation ranged from three to eight fishing community members; considering that port/port groups in California can have upwards of 50 different vessels with captains, crew, and associated industries, three to eight participants could be considered low when attempting to encapsulate the views of entire ports. We sought to overcome this by selecting demographically diverse individuals and recruiting participants who were deeply embedded within the port and could provide views beyond their own experiences. We also tried to address this issue by asking participants to rate their ports twice for each focus group question, once before and once after the discussion. We believed the second, deliberative ratings

would better reflect a more consensus or overall view of the port and, as a result, used these in the analysis; however, there is a possibility that bias among participants may have influenced these second ratings. Although it was beyond the scope of this study, it could be valuable to conduct a representative survey of fishing community members in select port(s) and compare the results with findings from the focus groups (including the pre- and post-discussion ratings for each question) to see how the focus group responses compare to overall perceptions. Future iterations of this approach may consider incorporating such a measure. Overall, scholars and managers should keep in mind both the benefits and limitations of this approach when drawing upon data and findings from the study.

6. Conclusion

Assessing fishing community well-being and MPA outcomes in a single study demonstrated the ways in which MPAs interacted with community contexts across well-being domains. Results from this monitoring study show how fishermen have adapted to and been affected by MPAs over time, particularly within the broader context of the health of their fishing communities. Overall, this work reveals the importance of monitoring the socioeconomic attributes of MPAs over time, including the broader fishing community context. Combining MPA monitoring with evaluation of fishing community well-being allows long-term monitoring programs to examine MPA perceptions and outcomes as well as explore effects associated with any new and emerging issues, enabling MPA monitoring to support overall fishing community and fishery health.

CRediT authorship contribution statement

Samantha Cook: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Laurie Richmond:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Joice Chang:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Formal analysis, Conceptualization. **Kelly Sayce:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Jon Bonkoski:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Cheryl Chen:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Jocelyn Enevoldsen:** Writing – review & editing, Writing – original draft, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Rachelle Fisher:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Denise Chin:** Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Methodology, Formal analysis, Conceptualization. **Mikayla Kia:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Investigation, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ocecoaman.2024.107199>.

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