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Environmental Justice, Marine Protected Areas & Ocean Access in California

A Group Project submitted in partial satisfaction of the requirements for the degree of
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Client
Channel Islands National Marine Sanctuary

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The Group Project is required of all students in the Master of Environmental Science and Management (MESM) Program. The project is a year-long activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. This Group Project Final Report is authored by MESM students and has been reviewed and approved by:

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Glossary of Acronyms

ACS: American Community Survey
BLM: Bureau of Land Management
BOEM: Bureau of Ocean Energy Management, U.S. Department of the Interior
CCA: California Coastal Act of 1976
CINMS: Channel Islands National Marine Sanctuary, National Oceanic and Atmospheric Administration
COPC: California Ocean Protection Council
DAC: Disadvantaged Community
DOC: U.S. Department of Commerce
DOI: U.S. Department of the Interior
EEJ : Equity and Environmental Justice
EJ: Environmental Justice
EPA: U.S. Environmental Protection Agency
EO: Executive Order
HUD: United States Department of Housing and Urban Development
MPAs: Marine Protected Areas
MLPA: Marine Life Protection Act
NMSs: National Marine Sanctuaries
NMFS: National Marine Fisheries Service, National Oceanic and Atmospheric Administration
NOAA: National Oceanic and Atmospheric Administration, Department of Commerce
NPS: National Park Service, U.S. Department of the Interior
OCAP: Ocean Climate Action Plan
OJS: Ocean Justice Strategy
ONMS: Office of National Marine Sanctuaries, National Oceanic and Atmospheric Administration
OPC: Ocean Policy Committee
OPC: Ocean Protection Council
PAP: Public Access Point
SMCAs-ER: State Marine Conservation Areas for Educational and Research Purposes
SMRs: State Marine Reserves
SMPs: State Marine Parks
SMRMAs: State Marine Recreational Management Areas
USDA: United States Department of Agriculture
USFS: United States Forest Service; United States Department of Agriculture
USFWS: United States Fisheries and Wildlife Service; Department of Interior

Definitions

Climate Change[1]: The long-term shift in oceanic and atmospheric conditions resulting in increased temperature, heat waves, sea level rise, and changes in weather patterns. Climate justice seeks to protect the rights of those most vulnerable to the effects of climate change, recognizing historical marginalization and overburdening of disadvantaged communities.

Disadvantaged Communities[2] [3] [4]: This report uses the definition of disadvantaged communities in the context of environmental justice from CalEnviroScreen: "Disadvantaged communities are those that are marginalized, underserved, and overburdened by pollution. The beta version of the Climate and Economic Justice Screening Tool (CEJST) uses a methodology and datasets that identify communities that are economically disadvantaged and overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care. A community qualifies as "disadvantaged" if the census tract is above the threshold for one or more environmental or climate indicators and the tract is above the threshold for the socioeconomic indicators.``

Distributive Justice[5]: The equitable allocation and distribution of resources and benefits among diverse demographic groups.

Environmental Health Disparities[6]:
Environmental health disparities arise from the interaction of poor environmental quality and social inequities in communities where individuals live, work, learn, and play. These disparities manifest as variations in health outcomes and disease prevalence stemming from the unequal distribution of environmental burdens and social determinants of health, including differences in individual behaviors, cultural influences, access to health services, economic status, and literacy levels. The existence of environmental health disparities underscores the need for concerted efforts to address both environmental quality and social inequalities, aiming to achieve fair treatment and meaningful involvement of all individuals, irrespective of race, nationality, or income, in environmental laws and policies.

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[1] As defined by NOAA.
[2] As informed by "The White House's Climate and Economic Justice Screening Tool: Frequently Asked Questions".
[3] As informed by Executive Order 14008.
[4] As defined by CalEnviro Screen.
[5] Informed by Lamont, Julian and Christi Favor, "Distributive Justice", The Stanford Encyclopedia of Philosophy (Winter 2017 Edition), Edward N. Zalta (ed.)
[6] Informed by National Institute of Environmental Health Sciences.

Environmental Justice[7] [8] (EJ): The fair treatment and meaningful involvement of all people, irrespective of race, color, gender, sexual orientation, national origin, tribal affiliation, religion, disability, or income during the development, implementation, and enforcement of environmental laws, regulations, and policies. This includes but is not limited to;

- Equitable protection from environmental and health hazards,
- Access to a healthy and sustainable environment, and
- Participation in decision-making processes for underserved communities.

Equity[9] [10] [11]: The consistent and systematic fair, just, and impartial treatment of all individuals, including those from underserved communities historically denied such treatment.
Meaningful Involvement: Communities have the opportunity to participate in decisions affecting their environment and health. Their contributions inform NOAA Fisheries' decisions, and community concerns are considered in the decision-making process. Decision-makers actively seek and facilitate the involvement of those potentially affected.

Equity & Environmental Justice (EEJ)[12]: To provide institutional support, training, and resources to implement approaches that prioritize EJ. This includes but is not limited to;

- Ensure policies promote equal opportunities without creating unintended inequities,
- Identify the underserved communities and their needs through research and monitoring,
- Build relationships and improve information sharing with all communities,
- Distribute benefits equitably, and
- Enable meaningful involvement of underserved communities in decision-making processes.

Meaningful involvement[13]:

- Communities have an opportunity to participate in decisions about activities that may affect their environment and/or health;
- The communities' contribution will inform NOAA Fisheries' decisions;
- Community concerns will be considered in the decision-making process; and

[7] Informed by Learn About Environmental Justice | US EPA
[8] Informed by First National People of Color Environmental Leadership Summit Principles of Environmental Justice.
[9] As defined by EO 13985 and EO 14091.
[10] Informed by First National People of Color Environmental Leadership Summit Principles of Environmental Justice.
[11] Informed by Bennett et al., 2021. Blue growth and blue justice: Ten risks and solutions for the ocean economy. Marine Policy, 125.
[12] Informed by NOAA fisheries EEJ Strategy, 2023.
[13] Adapted from the Environmental Protection Agency's Definition.

- Decision-makers will seek out and facilitate the involvement of those potentially affected.

Procedural Justice[14]: The level of participation and inclusiveness of decision-making and the quality of governance processes.

Public Access Point[15]: Any route, roadway, highway, trail, path, road allowance, easement or other similar meaning that provides access through or across municipally owned lands to provide admittance to the shoreline of bodies of water or other natural features.

Recognitional justice[16]: The acknowledgment of and respect for pre-existing governance arrangements as well as the distinct rights, worldviews, knowledge, needs, livelihoods, histories, and cultures of different groups in decisions.

Subsistence Fishing[17] [18]: Fishing for personal, family, and community consumption or sharing.

Underserved Communities[19]: Communities systematically denied full opportunities to participate in economic, social, and civic life, including but not limited to women and girls; Black, Latino, and Indigenous and Native American persons; Asian Americans and Pacific Islanders; LGBTQ+ persons; persons with disabilities; persons in rural or urban areas; and those adversely affected by persistent poverty or inequality. Identification and meaningful involvement with underserved communities are regionally specific and an ongoing, region-specific, long-term commitment. In this report, we use “underserved communities" to refer to broader groups that have been systematically denied opportunities in California, while we use “disadvantaged communities” to refer to spatially explicit communities that face environmental harm.

[14] Informed by Bennett et al., 2021. Blue growth and blue justice: Ten risks and solutions for the ocean economy. Marine Policy, 125.
[15] Adapted from the Law Insider’s Definition.
[16] Informed by Bennett et al., 2021. Blue growth and blue justice: Ten risks and solutions for the ocean economy. Marine Policy, 125.
[17] Informed by Quimby et al, 2020. Identifying, defining and exploring angling as urban subsistence: Pier fishing in Santa Barbara, California. Marine Policy, 121.
[18] Informed by Love, M.S., 2006. Subsistence, Commercial, and Recreational Fisheries. The Ecology of Marine Fishes: California and Adjacent Waters, p. 567-594.
[19] As defined by EO 13985.

Background

Introduction

Coastal California is home to a world-famous network of Marine Protected Areas (MPAs) that aim to protect the state's marine heritage. MPAs typically aim to safeguard marine resources and ecosystems by designating areas that restrict activities that would injure, damage, or take marine resources, which can include restricting fishing activities. The MPA network encompasses a range of state MPAs, each with different management levels. NMSs (National Marine Sanctuaries) is an example of a MPA which typically does not restrict fishing. However, there is limited knowledge about how communities in California interact with MPAs, and how values and well-being relating to accessing MPAs, including fishing for subsistence, are shared among these communities. This report explored ocean access in California by income, race, age, and other factors. Along with a special focus on subsistence fishers, who are typically both marginalized and deeply affected by MPAs. Subsistence fishers fish for personal, family, and community consumption or sharing. The current MPA Management Program may under-serve communities of subsistence fishers. For example, in the U.S., signage for MPAs is presented in English, while some subsistence fishers often speak English as a second language. Subsistence fishers and their communities are often underrepresented in the decision-making process for MPAs. Therefore, the goal of this project is to gain a better understanding of the relationship between MPAs and ocean access for underserved California communities that may face issues of ocean access with a focus on subsistence fishers. To address this goal, we gathered and synthesized existing knowledge in a systematic literature review. We also analyzed baseline demographic information of communities in California, as well as estimated measurements of distance traveled by these communities to access the ocean and the diversity of fish species targeted by subsistence fishers. The National Marine Sanctuary System, California Department of Fish and Wildlife, and the California Ocean Protection Council will use this baseline information on underserved communities of California, their access to the coasts of which includes subsistence fishers to inform management and outreach efforts in California.

In this case, management is defined as supportive services through complying with regulations without inhibiting cultural and traditional fishing methods; community co-management by involving subsistence fishers in managing resources is an example. Outreach in this case is defined as being involved in decision-making processes for fisheries management; including but not limited to educational campaigns regarding the importance behind cultural fishing practices. This information is critical to addressing past gaps identified in the 2018 report on Climate Resilience and California’s MPA Network (Hofmann et al., 2021). The report assessed MPAs as a climate mitigation and adaptation tool and found that there was a lack of data on social and economic provisions, with limited information regarding subsistence fishing. This data gap is significant, and filling this gap could allow California’s policies to better account

for its underserved communities. Moreover, the establishment of MPAs could have exerted adverse effects on subsistence fishers, encompassing challenges related to sustenance provision for their families and livelihoods, inequities triggered by climate change, and the exacerbation of economic disparities between different social classes induced by MPAs. Therefore, our data will be used to understand the social and economic provisions of MPAs and take one step towards addressing equity in ocean management. Our aim is that by addressing Equity and Environmental Justice, the benefits of MPAs in California will be more widely accessible to communities that have been underrepresented which includes subsistence fishers.

Equity and Environmental Justice: Why Does it Matter?

Incorporating Equity and Environmental Justice (EEJ) principles into land-based conservation efforts has been a growing concern for policymakers, managers, and communities. However, the same attention has not been directed toward oceans. Environmental justice (EJ) is a concept rooted in the inequitable distribution of environmental benefits and burdens across all segments of society (Agyeman & Bullard, 2002; Bennett, 2022; Bennett, 2018; Bennett, 2022; Martin, 2019; Dawson, 2018; Gurney, 2021; Parsons, 2021; Jones, 2009; Floyd, 1999; Blount, 2007; NOAA, 2023; OPC, 2022; Lau, 2021; Christensen & King, 2017; Rowland-Shea, 2020; Reineman, 2016; Mascia, 2010; Scott, 2013; Newson, 2022; Garcia, 2017; Landau, 2020). EEJ is an concept that strives for the equal access to principles of equity, participation, and recognition to apply for all members of society, including underserved communities (Mohai, 2009; Bullard, 2001; Agyeman & Bullard, 2002; Gauna & Foster, 2003; Scott, 2013; Christensen & King, 2017; NOAA, 2023; OPC, 2022). Environmental justice emerged in response to environmental inequalities faced by underserved communities. Underserved communities, in this context, refer to groups that have historically experienced disproportionate environmental and social disparities, often due to factors such as lower wealth, education, and social advantages (Executive Order 14096, 2021; OPC, 2022; NOAA, 2022; Newson, 2022; Bennett, 2023). This discipline focuses on identifying and eliminating the social and environmental inequities between underserved communities and the more privileged parts of society (e.g., communities with lower vs. higher wealth, education, and social advantages). Historically, attention to EEJ has focused on the unequal distribution of the health burdens caused by exposure to pollution from the agriculture industry, urbanization, or industrial practices on underserved communities (Bennett, 2023; Martin, 2019; Bullard, 2001; Pellow, 2018; Agyeman & Bullard, 2002; Gauna & Foster, 2003; Mohai, 1992). For example, many EEJ case studies focus on the widespread practice of placing toxic industries (e.g., coal power plants, oil refineries, and factories) in or adjacent to underserved communities (Bennett, 2023; Martin, 2019; Bullard, 2001; Pellow, 2018; Agyeman & Bullard, 2002; Gauna & Foster, 2003; Mohai, 1992). Such biased exposure to toxins leads to a higher risk of cancer and a lower quality of life for adjacent communities compared to other members of society (South, 2018; Mohai, 2009; Bennett, 2023; Bennett, 2018; Pellow, 2018; Bullard, 2001).

Systematic inequalities between communities encompass persistent structural disparities in societies, perpetuated by policies, institutions, and social norms, notably in economic, racial, and gender disparities (Bullard, 2001; Bennett, 2023). Such inequalities are deeply entrenched in society, affecting access to resources and opportunities and the distribution of burdens for different groups of people. Policies wield significant influence over resource, opportunity, and burden distribution, either exacerbating or mitigating inequalities based on design and implementation (Bullard, 2001; Gauna & Foster, 2003; Agyeman & Bullard, 2001; Pellow, 2018). For example, the funding requirements imposed by financial institutions (e.g., for mortgages) can disproportionately burden specific communities, thereby perpetuating economic and other disparities. Historically, racial discrimination in housing loans (i.e., redlining) and exclusionary zoning (and rezoning) has been a subtle form of using government authority and power to foster and perpetuate discriminatory practices (Mizutani, 2019; Jackson, 2021; Bullard, 2001). For example, when zoning policies prioritize commercial development over the creation of affordable housing, they contribute to gentrification and limit the availability of essential amenities (Bullard, 2001; Mizutani, 2019; Jackson, 2021). Systematic barriers frequently trace their roots to historical injustices, discriminatory policies, or entrenched societal prejudices, all hindering equitable access to resources and services (Bullard, 2001; Agyeman & Bullard, 2002; Pellow, 2018; Mohai, 1992; Mizutani, 2019; Jackson, 2021).Systematic barriers span many dimensions of society and include environmental injustice and racial inequity (Bullard, 2001). Environmental injustice manifests when marginalized communities bear disproportionate pollution and environmental hazards, often due to discriminatory policies and industry practices (Bullard, 2001; Pellow, 2018; Mohai, 1992; Mohai, 2009). Racial inequity permeates various aspects of society, from education to healthcare, with deep-rooted structural biases that disadvantage racial minority groups. Policies are key to addressing these disparities, as they significantly shape burden and barrier distribution (Bullard, 2001).

In addition to the harm that comes from exposure to toxins, there is now a recognition that harm derives from other negative experiences and systemic barriers, including those that prevent specific communities from accessing beneficial natural spaces and other environmental resources (Agyeman & Bullard, 2002). Consequently, EEJ discussions have evolved from an early, narrow focus on reducing environmental harms to a broader perspective that emphasizes the promotion of equity in the access of all people to environmental benefits. Such beneficial resources include high-quality natural environments, such as National Parks and coastlines, and healthy environmental conditions, such as the water quality in areas that subsistence fishers rely on for their activities. Examples of how systemic barriers prevent environmental equity include unequal access to green spaces in urban spaces (Scott, 2013), disparities in funding for parks and recreation facilities in marginalized communities (Floyd, 1999; Garcia, 2017; Scott, 2013), limited access to federal activities, processes, and documents, (OJS, OPC 2023) and limited transportation options to reach natural areas (Reineman, 2016; Christensen, 2017).

The concentration of poverty and affluence has resulted in a two-tier system of publicly funded park and recreation provision in the US (Scott, 2013). This has created a situation where

wealthier communities enjoy superior funding, leading to higher-quality amenities (Scott, 2013; Garcia, 2018). Simultaneously, inner cities and poorer communities experience a deficit in basic funding and historical access to such natural resources, contributing to an enduring imbalance in recreational opportunities (Scott, 2013; Garcia, 2017). The deficit in access to parks qualifies communities as "park poor," a term defined by California law as having less than three acres of parks per thousand residents and being income poor with a median household income below $47,331 (Garcia, 2017). Whereas many park-poor areas are situated in low-income communities inhabited by underserved communities, including ethnic and racial minorities (Taylor et al., 2007; Scott, 2013) and civil rights (Garcia, 2013; Bullard, 2001; Pellow, 2018) issues. The unequal distribution of green spaces in urban areas has an impact on residents' well-being (South, 2018; Jaffe, 2015; Wang, 2005; Rowland-Shea, 2020). In contrast, equal distribution of green areas contributes to healthier ecosystems and fosters stronger community bonds (South, 2018; Jaffe, 2015; Wang, 2005; Rowland-Shea, 2020).

To participate in federal activities, underserved communities may face barriers such as the need for time, transportation, childcare, and access to technology (OJS, OPC 2023; Bennett, 2021). This can result in a disproportionate burden on individuals within these communities. Attending federal processes may require missing a day of work or foregoing pay, unlike federal employees who are compensated for their attendance (OJS, OPC 2023; Bennett et al, 2023; Bennett et al, 2018).

In the case of California, the lack of equitable public transportation to coastal areas and national parks contributes to disparities in the enjoyment of natural resources and open spaces. Despite the California Coastal Act (CCA) passed in 1976, which aims to protect public coastal access for all residents, significant barriers persist (Reineman, 2016; Christensen, 2017). White, affluent, and senior Californians are found to live in closer proximity to public coastal access points and have been found to obstruct public access to beaches unlawfully (Reineman, 2016; Christensen, 2017). Whereas underserved communities are found to reside farther from coastal access points and national parks which results in extended travel distances. The higher travel costs from longer distances exacerbate the burden and inherent inequities in the distribution of public access points, including coastal areas and national parks (Christensen, 2017; Floyd, 1999; Reineman, 2016). Housing in coastal areas tends to be unaffordable, further contributing to systemic barriers and pushing less wealthy individuals towards inland Central California, further away from coastal areas and national parks (Reineman, 2016; Scott, 2013; Christensen, 2017). The inequitable geographic discrepancy has notable implications for EEJ in terms of access to public open space and natural places (Reineman, 2016; Scott, 2013; Christensen, 2017). The failure to uphold EEJ goals within policies perpetuates social and environmental injustices, impeding both community well-being and ecosystem health (Reineman, 2016; Scott, 2013; Christensen, 2017). This spans from the unequal distribution of green spaces to the sustainable management of coastal areas.

The contrast between EEJ and biodiversity conservation often underscores differing priorities and approaches. There is an absence of unanimous agreement among different

stakeholder groups about what constitutes the right thing to do, causing the persistent lack of consensus in biodiversity conservation (Martin, 2017; Folchi, 2019). Historically, the conservation field has featured a dichotomy between 'environmentalism of the poor[20]' and 'Western environmentalism[21]. These ‘poor environmentalists’ often place everything at stake in their attempts to prevent the exploitation of their natural resources and resist pollution (Martin, 2017; Folchi, 2019). Environmentalism of the poor is often motivated by protecting commodity frontiers in developing countries from extractive capital, as exemplified by local farmers in places like India, often putting their lives at stakes such as chaining themselves to trees (Martin, 2017; Jouffray, 2020; Vinyeta, 2016). At the same time, western environmentalism tends to emphasize biodiversity preservation, and ecosystem services for its perceived purity of wilderness and use to humans (Martin, 2017; Folchi, 2019). The diverse motivations extend to the core of conservation efforts, with some focusing on practical human welfare, while others draw inspiration from spiritual connections to the natural world (Martin, 2017; Bennett, 2021; Parsons, 2021).

The current divergence in EEJ and Conservation viewpoints can be traced back to historical figures like John Muir. Muir - who is one of the pioneers of conservation - promoted preservationist viewpoints that regard wilderness as areas devoid of people (Martin, 2017). In contrast, a more equitable and just approach seeks to benefit people and nature mutually (Bennett, 2023). Market-driven elements have influenced biodiversity conservation with practices like park privatization, carbon trading, and biodiversity offsetting. Along with the promotion of green consumerism, offering potential conflict resolution, but also carrying the risk of coercion by local and state governments (Bennett, 2023; Martin, 2017; Jouffary, 2020). Coercion by local and state governments in biodiversity conservation can manifest through the imposition of market-driven practices on local communities, which can overwhelm them, leading to unequal power dynamics, loss of traditional resource rights, and environmental justice concerns (Bennett, 2023; Martin, 2017; Jouffary, 2020; Folchi, 2019; Gosalvez, 2020).

In a contemporary context, a more equitable and just approach seeks to harmonize benefits for both people and nature, recognizing the interconnectedness of human well-being and environmental health (Bennett, 2023; Martin, 2017). This evolution reflects a departure from historical preservationist viewpoints, like Muir's, toward a vision that aligns conservation practices with principles of justice and equity while acknowledging the utilitarian perspectives espoused by figures like Pinchot.

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[20] “the environmentalism of the poor, defense of the environment, far from being motivated by abstract ideals or sentiments towards the environment or nature, constitutes a response on the part of the poor—primarily the indigenous and peasant populations of the global South—to a wholly tangible and entirely materialistic situation: the deterioration of the environment in which they live and the consequent impossibility of subsistence.” (Folchi, 2019)

[21] “Western Environmentalism occurs in affluent societies where they are able to focus on visible expressions, like membership in environmental groups. They do not have to put their lives on line in order to protect their environment. The support for conservation is strongest in more economically prosperous western democracies, and much weaker in the global south” (Martin, 2017).

Due to dynamic conservation perspectives, historical displacement has undergone a notable transformation, shifting from forceful approaches[22] to strategies that prioritize community engagement, particularly since the late 1980s (Folchi, 2019; Jouffary, 2020; OJS, OPC, 2023). This shift is attributed to a growing awareness of the social consequences associated with conservation efforts (Bennett, 2023). Within this evolving landscape, the emergence of 'tragic choices' underscores the dilemma faced by decision-makers who must navigate the delicate balance between conservation imperatives and human rights, particularly in economically disadvantaged regions where underserved communities are disproportionately expected to bear the sacrifices for conservation goals (Martin, 2017).

As the discourse surrounding EEJ has gained prominence in the field of conservation, the historical neglect of EEJ within the field of ocean conservation and management has drawn substantial criticism. The neglect of EEJ includes the failure of ocean leaders to develop awareness and strategies around the systemic barriers that impede underserved communities' access to natural spaces and the meaningful participation of such communities in shaping ocean governance (Bennett, 2023; OJS, OPC, 2023). The resulting diversity in conservation perspectives has, unfortunately, fostered persistent disagreements and conflicts, preventing the attainment of a consensus on 'just conservation' within the field (Martin, 2017; Folchi, 2019).

What is a Nature Gap?

There are well-documented racial and economic disparities in nature access in the United States, depriving these communities of nature's benefits (Landau et al., 2020; Rowland-Shea et al., 2020; Ocean Protection Council, 2022; Reineman et al., 2016; Garcia, 2017; Floyd, 1999). The concept of the 'Nature Gap', highlights such disparities in nature access (Rowland-Shea, 2020; Jones, 2009; Landau et al. in 2020; Bullard, 2001; Agyeman & Bullard, 2001; Boillat et al, 2018; Reineman et al., 2016; Christensen et al, 2017; Scott et al., 2013; Garcia, 2017; Stodolska et al., 2012; Bennett et al, 2023). For example, communities of color are three times more likely to reside in nature-deprived areas compared to white communities, with 74 percent of such communities in the contiguous United States experiencing limited access (Rowland-Shea, 2020). Similarly, this discrepancy is pronounced in low-income communities, where 70 percent of low-income communities grapple with nature-deprived areas, representing a 20 percent higher absence of nature access compared to economically advantaged communities (Rowland-Shea, 2020; Martin et al, 2017; Christensen et al, 2017). The widespread separation from nature near underserved communities exemplifies distributive justice, the concept of understanding the fair distribution of resources and benefits within society (Bennett, 2021; Garcia, 2017). Underserved populations also frequently bear the brunt of declining ecosystem services due to climate change, experiencing reduced recreational opportunities, limited food resources, and diminished access to

[22] Forceful Approaches refers to conservation methods that involve coercion, compulsion, or the exertion of direct authority to implement conservation measures. These approaches might have involved forcibly displacing communities, imposing regulations without community involvement, or using authoritarian methods to achieve conservation goals (Martin, 2017; Bennett, 2021).

fisheries for their livelihoods (Bennett et al, 2023; Landau et al., 2020; Rowland-Shea et al., 2020; Ocean Protection Council, 2022; Reineman et al., 2016; Garcia, 2017; Floyd, 1999).

Income inequality contributes significantly to limited access to recreational resources. In southern California, in areas where children have less access to outdoor spaces for physical activity, there tends to be a higher prevalence of overweight and obese children (Garcia, 2017). The issue of nature gaps illuminates the complex factors contributing to reduced access within underrepresented communities, often emphasizing the need for a science-based understanding of the elements that influence minority engagement with nature (Floyd, 1999; Ocean Protection Council, 2022; NOAA, 2023; Executive Order 14096; Bennett et al., 2018). Common obstacles hindering participation include safety concerns, financial constraints, and site accessibility issues (Stodolska et al., 2012; Crellin, 2022; Scott et al., 2013; Garcia, 2017). While there is a wealth of data and information available highlighting the lack of access to land-based areas among racial and ethnic minorities, there remains a significant gap in understanding access to coastal areas and oceans. Research in this area is relatively scarce and represents a newer frontier in the exploration of equitable access to natural resources.

Safety concerns and fears of people of color for spending time in natural areas are grounded in a history of exclusion of businesses and violence against individuals. For example, in Manhattan Beach, CA, in the 1920s, a black-owned seaside resort was dismantled by racist city council members, and the family was forced to flee the city (CEO, 2022). Black individuals who were recreating in natural areas have been threatened or attacked by racist white individuals. Examples include Christian Cooper, a Black birder in Central Park who had the police called on him by a white woman when he asked her to follow park rules, and Ahmaud Arbrey, a Black runner, who was murdered by three white men while on a run outside (Chaudhury, 2020; Yankah, 2021).

There has been historical underrepresentation of racial and ethnic minorities in national parks due to the diverse factors that impact outdoor recreation participation within minority communities (Floyd, 1999; Scott, 2013; Gosalvez, 2020; Dawsons, 2018; Gurney, 2021; Jones, 2009). Poorer Americans are significantly less likely to utilize publicly funded park and recreation resources. Affluent individuals are three times more inclined to visit national parks, and similar patterns are observed for state, regional, and local parks (Scott, 2013; Rowland-Shea, 2020; Floyd, 1999). Preferences and motivations for engaging with nature can vary significantly among different cultural and racial groups, with an emphasis on factors such as convenience, community engagement, and the availability of amenities (Floyd, 1999; Scott, 2013; Reineman, 2016; Christensen, 2017). Hispanic and African American visitors to national parks tend to prioritize developed facilities, larger group sizes, and the social benefits of outdoor activities compared to their white counterparts (Floyd, 1999; Scott, 2013; Christensen, 2017). Tailoring outdoor recreation and park access initiatives to the diverse needs and interests of minority communities promotes greater inclusivity and enhances the overall enjoyment and utilization of natural spaces by a wider range of the population (U.S. Department of the Interior 1997:55; Floyd, 1999; Rowland-Shea, 2020; Scott, 2013; Reineman, 2016; Christensen, 2017).

In the case of beaches in California, identifying these distinctions is the key. The concentration of poverty and affluence within the state has led to the same two-tier system of publicly funded park and recreation provisions mentioned earlier. That is where wealthier communities enjoy better-funded, accessible, and higher-quality amenities on the coast, while inner cities and poorer communities lack basic funding and historical access to such resources (Scott, 2013; Rowland-Shea, 2020; Floyd, 1999). Recognizing and addressing these economic disparities is essential to achieving a more equitable and inclusive outdoor recreation landscape.

Notably, EJ has often overlooked the unique challenges faced by disabled people in their interactions with nature. Other fields, such as disability studies and accessibility advocacy, have focused on addressing gaps in access that are specific to individuals with disabilities (Lau, 2021; Martin, 2017; Bennett, 2021). This entails addressing a spectrum of needs, including providing sign language interpreters for deaf individuals during guided nature tours, improving accessibility in national parks to accommodate wheelchair users on uneven terrain, and making information accessible through braille materials for blind individuals, among other accommodations (Lau, 2021; Martin, 2017; Bennett, 2021; Floyd, 1999; Rowland-Shea, 2020; Scott, 2013; Gosalvez, 2020). To attain a comprehensive and impartial approach to environmental justice, incorporating the perspectives and requirements of the disabled community will help (Lau, 2021; Martin, 2017; Bennett, 2021).

Marine Protected Areas (MPAs)/ National Marine Sanctuary: Definitions and Types

Understanding the conservation efforts and the role of Marine Protected Areas (MPAs) is essential for examining their impact on marine ecosystems and the broader social environment. In California, MPAs showcase a diverse array of classifications, illustrating the adaptability of this conservation strategy to the state's coastal and marine environments, including State Marine Reserves (SMRs), State Marine Parks (SMPs), State Marine Conservation Areas for Educational and Research Purposes (SMCAs-ER), and State Marine Recreational Management Areas (SMRMAs). These MPAs include National Marine Sanctuaries (NMS), managed by NOAA, which are designed to safeguard significant marine environments, from pristine coral reefs to historical shipwrecks, often imposing restrictions on activities like fishing and prohibiting oil exploration to protect their ecological and historical value (NOAA, 2023; CINMS, 2023). In addition, California features a variety of state MPAs, such as State Marine Reserves (SMRs) that strictly prohibit extractive activities, State Marine Parks (SMPs) designed to balance conservation with recreational activities, and State Marine Conservation Areas (SMCAs) aimed at protecting and conserving marine habitats and ecosystems while allowing certain recreational and commercial fishing activities (CDFW, 2023; CINMS, 2023; NOAA, 2023). The state also incorporates State Marine Conservation Areas for Educational and Research Purposes (SMCAs-ER) that support scientific research and environmental education, along with State Marine Recreational Management Areas (SMRMAs) striving to harmonize conservation with recreational fishing by promoting sustainable fishing practices (NOAA, 2023; Bennett, 2021; Mascia, 2010; Garcia, 2018; CDFW, 2023).

Ecologically, these MPAs offer numerous advantages, including habitat restoration, support for overexploited fish stocks, and the protection of imperiled species (NOAA, 2023; Bennett, 2021; Garcia, 2018). On the socioeconomic front, they promote sustainable fisheries management, stimulate local economies through tourism, and provide vital educational resources for environmental awareness and conservation ethics (Jones, 2009; NOAA, 2023; Christensen & King, 2017; OPC, 2022). In summary, California's comprehensive system of MPAs, spanning both National Marine Sanctuaries and various state MPA types, plays a pivotal role in preserving marine ecosystems, ensuring the welfare of marine life, and strengthening coastal communities.

Equity & Environmental Justice in Context of Marine Protected Areas

An examination of the intersection between EEJ and MPAs reveals fundamental questions about the fair distribution of benefits within the realm of marine conservation. While MPAs in the US, Canada, and many other countries primarily aim to preserve biodiversity and enhance ecosystem health, their establishment and management can unintentionally perpetuate environmental injustices (Jones, 2009; De Santo, 2013; Masica, 2010; Garcia, 2017). For example, Indigenous and underserved communities have often been excluded or faced marginalization during MPA decision-making processes, pointing to issues of recognitional and procedural justice (Bennett, 2023; De Santo, 2013; Garcia, 2018; Parsons, 2021). This marginalization can be attributed to a combination of historical, social, and economic factors (Jones, 2009). Historical injustices, such as land dispossession and colonization, place Indigenous communities at a socio-economic disadvantage which further limits their effective participation in MPA decision-making - a reflection of distributive justice concerns (Jones, 2009; Parsons, 2021). Systemic racism within decision-making structures further perpetuates the marginalization of these communities, as discriminatory practices limit their involvement and influence in MPA designations (Bennett, 2023). Inadequate representation within decision-making bodies often results in the neglect of their interests and needs, including gender-specific concerns, which highlight the challenges in achieving procedural justice (De Santo, 2013).

Economic interests, often favored by dominant groups - particularly white men - can take precedence during MPA decision-making, exacerbating gendered impacts and diminishing the rights and interests of Indigenous and underrepresented communities, which opposes procedural justice (Mascia, 2010; Parsons, 2021: Jones, 2009; Gurney, 2021). Power imbalances also play a significant role, with dominant groups typically exerting more influence and neglecting the concerns and needs of women and gender-diverse individuals in these communities (Parsons, 2021; Mascia, 2010; Jones, 2009; Gurney, 2021).

The implications of MPA establishment and management on EJ are far-reaching, necessitating a focus on inclusion and representation to address gendered impacts and the lack of procedural justice (Parsons, 2021). In California's dynamic coastal environment, stakeholders, including Indigenous groups, local communities, government agencies, and environmental organizations, play various roles in MPA designation. Noting that the level of inclusion and

participation varies among these groups (Arnstein, 1969; Bennett, 2021). Indigenous communities are gradually becoming integrated into the MPA processes, often in the form of co-management, reflecting elements of tokenism (Arnstein, 1969; Bennett, 2021; Parsons, 2021). Local communities do have opportunities for participation but often face limitations in their involvement, thus reflecting the non-participation rung of Arstein's ladder, which can only go so far (Arnstein, 1969). Government agencies and environmental organizations also contribute to the MPA designation process by collectively creating a complex landscape of interactions and potential improvements in the relationship between MPAs and EJ (Masica, 2010; Bennett, 2021). It is vital to recognize the gendered impacts of spatial enclosures on resource access and acknowledge that even in cases where ecosystem services programs aim to address unequal distribution, local communities and Indigenous people rarely benefit from such projects- again reflecting tokenism, procedural and distributive justice (Arnstein, 1969; Parsons, 2021; Bennett, 2021; Gauna & Foster, 2003).

Disparities in Ocean Access and Coastal Resources/ Application of Equity to Oceans

The oceans, covering over 70% of the Earth's surface, hold a wealth of resources that sustain livelihoods, ecosystems, and countless species. The importance of the ocean to humans is suggested by the fact that 40% of the U.S. population that lives within 100km of the coast (NOAA National Coastal Population Report, 2020) and 40% of the world's population live within 100km of the coast (United Nations, 2017). However, persistent disparities in access and benefits are evident across coastal regions. Underserved communities face pronounced challenges in accessing beaches, fishing grounds, and other marine and coastal amenities, leading to disparities documented by various researchers (Martin, 2017; Christensen & King, 2017; Mascia, 2010; Bennett, 2023; Parsons, 2021; Giakoumi, 2018; Reineman, 2016; Rowland-Shea, 2020; Garcia, 2018; Crellin, 2022; Floyd, 1999). These disparities are often shaped by socioeconomic, racial, and geographic factors (Clinton, 1994; Agyeman & Bullard, 2002; Bullard, 2001; Pellow, 2018; Landau, 2020; Reineman, 2016; Bennett, 2023; Giakoumi, 2018; Mascia, 2010; Mohai, 2009; Gauna & Foster, 2003; Jouffray, 2020; Newson, 2022; Parsons, 2021). Socioeconomic factors, notably income disparities, and issues of equity and race, frequently influence participation in ocean-related activities and the receipt of associated benefits (Scott, 2013; Rowland-Shea, 2020; Bennett, 2023; Boillat, 2018; Blount, 2007; Lau et al, 2021; Clinton, 1994; Agyeman & Bullard, 2002; Bullard, 2001; Rowland- Shea, 2020; Landau et al, 2020; Reineman, 2016; Martin, 2017; Christensen & King, 2017; Mascia, 2010; Stodolska, 2012; Garcia, 2017; Mohai, 2009; Newson, 2022; Gauna & Foster, 2003). The establishment of Marine Protected Areas (MPAs) in the Florida Keys had minimal economic impact but significantly affected various user groups, leading to heightened social-psychological impacts (Mascia, 2010; Dobryznski and Nicholson, 2001). This situation resulted in escalated conflicts and concerns among user groups, including commercial and subsistence fishers, the tourism industry, and recreational divers and snorkelers regarding access to the MPA (Mascia, 2010; Dobryznski and Nicholson, 2001. The primary issue revolves around perceived inequity, with

snorkelers and divers enjoying privileged access over commercial and subsistence fishers (Mascia, 2010; Dobryznski and Nicholson, 2001).

In the case of the Gulf of Mexico, a survey conducted from Texas to Key West examined the perspectives of fishermen on the potential of the establishment of MPA (Masica, 2010; Thomas, 1999). The primary concern identified was the economic impact resulting from displacement from their traditional fishing areas (Mascia, 2010; Thomas, 1999). In the Florida Keys case, fishermen expressed secondary concern related to the vital importance of social equity for resource access and fair enforcement in MPA management (Mascia, 2010; Thomas, 1999; Blount, 2007). The apprehension about enforcement centered around the potential lapses that could lead to economic and access inequities within the MPAs (Mascia, 2010; Thomas, 1999; Blount, 2007; Garcia, 2017; Jones, 2009). The cases serve as compelling examples of how unequal resource allocation, economic disparities, and issues of equity and race can impact communities and user groups differently, resulting in both economic and social consequences.

As for racial and geographic factors, the demographic compositions of different coastal areas highlight the complexity of disparities in ocean access. Various beaches and marine sites may attract diverse or homogeneous crowds based on factors such as residential patterns, availability of amenities, perceived inclusiveness, community proximity, and historical visitation patterns (Floyd, 1999; Scott, 2013; Garcia, 2017; Garcia, 2018; Stodolska, 2012). These dynamics are intricately linked to a historical legacy of discrimination (Crellin, 2022; Mohai, 2009; Mohai, 1992, Floyd, 1999; Scott, 2013; Garcia, 2017; Garcia, 2018; Stodolska, 2012). Similarly, discriminatory policies such as EO 9066 of 1942 by President Roosevelt called for Japanese Americans' forced relocation and internment during World War ll. Effectively disrupting Japanese American communities and impacting their access to coastal areas and its resources which was prominent in California, later shaping its dynamics (Spickard, 2009; NPS, 2000). In a similar context, in the 1930s, repatriation disproportionately affected Mexicans and Mexican-Americans, with half a million individuals becoming targets of one of the largest mass removal operations sanctioned by the US government, leading to the destruction of entire neighborhoods and communities in California and all over the United States (Guerin-Gonzales, 1996). This period of immigration and repatriation left a lasting impact, instilling a constant fear of expulsion and disrupting the lives and dreams of Mexican immigrants and Mexican-Americans, shaping their experiences in coastal regions like California and beyond (Guerin-Gonzales, 1996).

In light of these historical injustices, the consequences continue to shape current challenges in accessing the California Coast. The constrained access to recreational resources along the California Coast poses a growing concern due to its function as a common pool of natural resources, along with increasing limitations due to climate change and the growing population (Reineman, 2016; Christensen, 2017; Martin, 2017; Garcia, 2018). The issue of access to the California coast raised concern among 62 percent of California resident voters. Public transportation accessibility was considered a barrier by 68 percent of respondents (Rowland- Shea, 2020; Christensen & King, 2017; Landau et al, 2020; Garcia, 2017; Stodolska,

2012). Notably, in California Central Valley, African-American residents are found to visit the coast less frequently, with 39 percent and 33 percent, respectively, visiting less than once a year (Rowland- Shea, 2020; Christensen & King, 2017; Landau et al, 2020; Garcia, 2017; Stodolska, 2012).

Income also impacts coastal visits, as those earning over $60,000 annually are more likely to visit, while the cost of visiting the coast particularly affects individuals aged 30 to 39 and families with children (Scott, 2013; Rowland-Shea, 2020; Christensen & King, 2017; Landau et al, 2020; Garcia, 2017; Stodolska, 2012). Additionally, 75 percent cited a shortage of reasonably priced overnight accommodations as a significant issue, with Latino voters and families with children expressing even greater concern (Rowland-Shea, 2020; Christensen & King, 2017; Landau et al, 2020; Garcia, 2017; Stodolska, 2012). Additionally, the lack of affordable overnight accommodations is a greater concern for the respondents aged 18 to 39 and families with children, while limited affordable parking options troubled 78 percent (Reineham, 2016; Christensen & King, 2017; Landau et al, 2020). (Rowland- Shea, 2020; Christensen & King, 2017). The information is based on a statewide survey of California voters conducted in October 2016 by UCLA's Institute of the Environment and Sustainability and the Field Poll and from a database assembled by the California Coastal Commission (Christensen, 2017; Reineman, 2016).

Understanding the nuanced preferences and challenges of diverse beachgoers, as revealed through the statewide poll and beach surveys (Christensen, 2017), sheds light on a spectrum of needs expressed by different demographics (Christensen, 2017; Rowland-Shea, 2020; Landau et al, 2020; Garcia, 2017; Stodolska, 2012). Young beachgoers visit solo, rely on public transportation, and worry about expenses (Christensen & King, 2017). Families prioritize child-friendly areas and accommodations, while Latino and African-American beachgoers seek amenities but share concerns about costs and safety (Scott, 2013; Rowland-Shea, 2020; Christensen & King, 2017; Landau et al, 2020; Garcia, 2017; Stodolska, 2012). Older beachgoers value parking and have similar cost concerns. Visitors traveling longer distances visit less often and mainly worry about expenses (Rowland-Shea, 2020; Christensen & King, 2017). Exploring the needs and preferences of additional demographics, such as Indigenous and Asian communities, would contribute to a more comprehensive understanding of the diverse beach-going population in California.

However, the insights into the diverse needs and challenges faced by different beachgoers underscore the pervasive problem of racism on beaches (Crellin, 2022; Bennett, 2023; Mohai, 2009; Mohai, 1992, Floyd, 1999; Scott, 2013; Garcia, 2017; Garcia, 2018; Stodolska, 2012). For instance, the culture surrounding surfing, often portrayed as a transformative and connective space, has historically excluded non-white participants (Crellin, 2022). This exclusion perpetuates the dominance of white individuals in the surfing community, limiting opportunities for surfers of color. This aligns with the belief that surfing is rooted in white neoliberal ideals of individualism, self-reliance, risk-taking, and progress (Crellin, 2022). For example, the exclusionary aspect of the surfing world was exemplified when Andrew Sherlock Mills, an

African American surfer in Jupiter, Florida, had his board stolen and nailed to a tree by a group of white surfers. This racist act was reminiscent of a lynching, as detailed by the Instagram account Black.surfers (Crellin, 2022; Pierson, 2023). Surfing has a troubling legacy of some individuals like the famous surfer Mickey Dora known as “the King of Malibu”, who promoted white supremacy and divisive beliefs within the surfing community. Such examples serve as stark reminders that racial discrimination has seeped into various aspects of beach and coastal culture (Crellin, 2022). Further highlighting the importance of conducting a thorough examination and fostering inclusivity and equity for all beachgoers and surfers, regardless of their racial background.

Subsistence Fishing: Coastal Traditions and Environmental Disparities

The coastal regions of California possess a rich tradition of subsistence fishing. For generations, these seaside communities have relied on the ocean's resources as a primary means of securing food for personal consumption (Love, 2006). Subsistence fishing is defined as fishing for personal, family, and community consumption or sharing (NOAA Fisheries, 2023). Subsistence fishers emerge as a group facing heightened vulnerability on the California coast and may come from disadvantaged communities (DAC). DAC, often characterized by a higher presence of minority and low-income residents, bear a disproportionate burden of environmental degradation and associated health risks (Bluestein, 2023). This longstanding tradition faces significant challenges as marine resources are increasingly at risk from anthropogenic and environmental threats (Harley et al., 2006). One of these major threats impacting the coast of California is ocean-based pollution, which is defined as pollution from commercial ships and ports (Halpern et al., 2009). This pollution not only threatens the populations of marine species in coastal California but also can lead to health risks for subsistence fishers who rely on these species for food (Hunter et al., 2005). To ensure food security and well-being for subsistence fishers, it is imperative to understand which species they are targeting, the species range, and the imminent threats they may confront. Limited research focuses on identifying what marine species subsistence fishers target and the social implications of these anthropogenic impacts along the California coast. In addition, little information is known about subsistence fishers in California regarding the demographic groups they come from.

Significance

This research will provide the NMS System and the California Ocean Protection Council (OPC) with information about ocean access and EEJ for underserved communities in California. Such information will feed directly into management and outreach efforts by State and Federal Agencies. A federal agency, NOAA recognizes climate change as an issue of EEJ due to its disproportionate impacts across different regions (NOAA EEJ Strategy, 2023). Within this context, underserved communities' vulnerability is exacerbated by heightened exposure to environmental hazards and lack of resources to mitigate or adapt to challenges of climate change. The proposed project responds directly to specific needs articulated by the 2018 report on Climate Resilience and California's MPA Network, which states that among barriers to improving understanding of the capacity of MPAs to serve as climate change mitigation and adaptation tools, "the largest information gap [is] related to the social and economic service provision of MPAs" (Hoffman et al., 2021). As the authors articulate, there is a lack of research documenting what species and habitats are considered significant to different stakeholder groups, and without this "critically important social baseline information," it will remain challenging to quantify prospective connections between MPAs and social resilience, both now and with future climate change. The case study on subsistence fishers will fill this gap by studying the species and habitats that are considered significant for this stakeholder group. The results of the study will feed into a broader project conducted by the NMS System and OPC looking at the capacity of MPAs to serve as climate change and mitigation tools.

Ensuring that the benefits of healthy and sustainable ocean ecosystems are equitably distributed throughout society is an enduring management challenge (Hicks et al., 2016; Bennett et al. 2020). Despite resource managers` best intentions, established management and governance structures often function to enhance access and benefits for certain locations, demographics, and user groups at the expense of others (Friend & Moench, 2015; Morris et al. 2020). Nowhere are such environmental justice challenges more evident than in coastal California. Across the region, significant effort has been made to engage commercial and sport fishers and tourism operators in the Marine Life Protection Act (MLPA), NMS, and other collaborative coastal management processes and MPAs (Klein et al. 2008). In contrast, the social values and priorities of stakeholders from minority and low-income populations and Tribal communities have received substantially less attention (Sayce et al., 2013; Hoffman et al., 2018; Stevenson et al. 2012; Quimby et al., 2020; Parsons, 2021).

The need to expand the benefits of MPAs to a wider and more diverse population is increasingly critical because of the exclusionary nature of MPAs (Bennett et al. 2020). For example, attempts at conservation have been made without the consideration of social justice, which has led to the displacement of communities that rely on the areas for their cultural significance, access to resources, and sustenance (Bennett et al. 2020). Improving social considerations is necessary not only to address equity considerations but also to increase the ability of MPAs to meet stated ecological objectives by increasing the strength and extent of

community knowledge, support, and compliance. California and Federal MPA climate mitigation and adaptation planning may represent a valuable opportunity to redress previous shortcomings and enhance procedural, recognitional, and distributional equity (i.e. Equity and Environmental Justice). Such work can be more strategic if managers have baseline information about (1) whether MPAs are serving subsistence fishers and (2) how the environmental justice indicators of current users compare to the general population of states where MPAs and NMS are located. To date, there have been only limited efforts to quantify the diversity of MPA users because establishing baselines for human uses in MPAs is quite difficult. However, through the project, we can begin to develop a deeper understanding of the EEJ dimensions of MPAs and discover the baseline for subsistence fishing uses in MPAs.

Impacts of Ocean Access Disparities on Communities

Amidst the challenges posed by racial discrimination in coastal communities, equitable access to coastal spaces is pivotal. An array of consequences from limited ocean access affect mental and physical health, recreational opportunities, cultural practices, and socioeconomic livelihoods. Equitable access to coastal spaces is pivotal for fostering community cohesion, preserving cultural heritage, and facilitating healthy recreational activities (Martin, 2017; Christensen & King, 2017; Mascia, 2010; Bennett, 2023; Parsons, 2021; Giakoumi, 2018; Reineman, 2016; Rowland-Shea, 2020; Garcia, 2018; Crellin, 2022; Floyd, 1999). The issue lies in the need for policies to recognize and consider the profound intrinsic value and cultural significance these areas hold for particular groups (Martin, 2017; Christensen & King, 2017; Mascia, 2010; Bennett, 2023; Parsons, 2021; Giakoumi, 2018; Reineman, 2016; Rowland-Shea, 2020; Garcia, 2018)

The economic significance of beach recreation, which contributes billions annually to a state's economy, underscores the critical need for equitable access for marginalized communities. For example, A 2005 estimate indicates a contribution of beach recreation at around $2.25-$7.50 billion annually in California (Pendleton & Kildow, 2006; Rehinman, 2016). For instance, surveys of beachgoers found that the average value of a day trip to the beach based on economic demand is $36.74, and the average cost of traveling to the beach and returning home—excluding expenses such as parking, food, and activities—was $22.09 (Christensen & King, 2017). This cost and time of travel to the beach limits beach access, especially for those who live more than a 10-mile radius or an hour away- a reflection of unequal distributive justice (Rehinman, 2016). This cost - estimated in 2017 - has assuredly risen due to inflation. The economic lens emphasizes the concept of distributive justice, urging California to pursue an equitable distribution of economic contributions, considering factors such as wealth, income, and social status (Rehinman, 2016; Christensen, 2017). The challenge of limited coastal space, coupled with the impact of rising sea levels and climate change, demands that access to coastal resources remains equitable as coastal landscapes change and population increases (Christensen & King, 2017; Rehinman, 2016; Martin, 2017; Mascia, 2017; Garcia, 2018; Bennett, 2023, Bennett, 2021).

Conflicts over conservation often pit relatively affluent groups against economically disadvantaged ones (Martin, 2017), highlighting the complexity of achieving conservation goals while ensuring equitable access to coastal resources - a case of both distributive justice and procedural justice. Consider the disparities faced by user groups in the Key West MPA, where conflicts over conservation have arisen, pitting economically disadvantaged user groups, such as subsistence fishers, against more affluent stakeholders, like recreational divers, snorkelers, and the tourism industries (Mascia, 2010; Dobryznski and Nicholson, 2001). For example, economic and social environments (e.g., urban neighborhoods in Los Angeles county[23] underserved communities like those in historically discriminated against Mexican American areas far away from coastal areas) are often related to poverty and disadvantaged social status. The case reveals the coupled issue of the lack of distributive justice and procedural justice. Such conditions significantly constrain the recreation behavior of ethnic and racial minorities (Floyd, 1998; Floyd, Bocarro, & Thomson, 2008; Sanders-Phillips, 2000; Stodolska, 2012; Shinew, Acevedo, & Izenstark, 2011). In the US, disparities in access to nature are evident, with African-American, Latino, Asian, Native American, and low-income families more likely than white families to inhabit regions lacking the benefits of natural spaces, such as nearby safe outdoor areas, clean water, unpolluted air, and diverse wildlife (Rowland-Shea, 2020). The distributive justice issue extends to housing disparities, as coastal areas are often associated with unaffordable housing, exacerbating challenges for marginalized communities in securing not only natural spaces but also the broader benefits of coastal living (Martin, 2017; Christensen & King, 2017; Mascia, 2010; Bennett, 2023; Parsons, 2021; Giakoumi, 2018; Reineman, 2016; Rowland-Shea, 2020; Garcia, 2018; Crellin, 2022; Floyd, 1999). This underlines the interconnectedness of economic well-being and equitable access to coastal resources.

Social Equity Analysis of Subsistence Fishers & Characterizing Their Target Marine Species

The objective to characterize the demographics of subsistence fishers in California and the marine species they harvest the most stands as a groundbreaking endeavor with far-reaching significance by intricately weaving together ecological insights and social considerations in the context of subsistence fishing along the California coast. Limited research focuses on identifying what marine species subsistence fishers target and the social implications of these anthropogenic impacts along the California coast. In addition, little information is known about subsistence fishers in California regarding the demographic groups they come from. Therefore, this objective aims to fill this gap in knowledge. Through meticulous hotspot analyses, the identification of the top five harvested marine species not only aids conservationists and managers in prioritizing resources for critical species but also underscores the interconnectedness of ecological health and human livelihoods. The spatial mapping of species richness overlaid with ocean-based pollution

[23] "In 2021, Los Angeles County had the state's highest poverty rate, with more than a quarter of residents living in poverty (using the California Poverty Measure). That amounts to more than 2.5 million people. The county's "deep poverty rate," encompassing the poorest of the poor, is also the state's second highest, at 6.7 percent. Other high‑poverty regions include Orange County and the Central Coast." (CATO, 2021).

impacts provides a nuanced understanding of the vulnerable regions, where both marine species and the subsistence fishers reliant on them face heightened threats. This dual-faceted approach goes beyond conventional environmental studies, delving into the social fabric by mapping disadvantaged communities of subsistence fishers. By doing so, the research highlights the often-overlooked demographics of those engaged in subsistence fishing. The results can be utilized to advocate for the inclusion of subsistence fishers in decision-making processes by empowering them with knowledge of environmental impacts. Characterizing targeted marine species can aid state and federal agencies in developing management strategies that encompass these species. The study's significance extends beyond the scientific realm, emphasizing the need for equitable conservation planning that addresses both ecological preservation and the well-being of the communities dependent on marine resources. As we navigate the complexities of environmental challenges, this work paves the way for a more inclusive, informed, and sustainable approach to resource management, bridging the gap between environmental conservation and social justice.

Objectives

The overall objective of the project was to explore the intersection of ocean ecosystems, MPAs, ocean access, and climate change for underrepresented communities, including subsistence fishers in California. The goal of this project was to help establish baseline information about ocean access, as well as subsistence fisheries, for coastal California and its interaction with the state's MPA network and National Marine Sanctuaries.
Objectives, in order of implementation:

1. Conducted a review and developed a database related to primary and secondary literature focused on equity and environmental justice considerations (e.g., ocean access) relevant to the adaptive management of California's MPA network and Sanctuaries.

2. Conducted spatial access that gives average time traveled to entries to MPAs with consideration to disadvantaged communities.

3. Conducted a review and developed a database related to primary and secondary literature focused on subsistence fishing in California.

4. Analyzed and mapped out the demographics of subsistence fishers to gain an understanding of the ecological and socio-economic aspects of coastal areas.
    a. Created a spatial analysis to assess the targeted species richness overlaid with coastal threats.

Methods

Objective 1: EEJ Literature Review & Database

In this narrative analysis, our literature review delves into the multifaceted realms of Equity, Environmental Justice, and Blue Justice, with a focus on the use and accessibility of the Marine Protected Areas (MPAs) and National Marine Sanctuaries, with an emphasis on nature gap. Beginning with foundational definitions and core principles, we explore the historical emergence of Equity and Environmental Justice as a distinct field of study. The narrative navigates through the intricate landscape of nature benefits, ecosystem services, and the concept of the "Nature Gap". We critically examine disparities in ocean access and coastal resources, addressing environmental injustices faced by underserved populations with few case studies based in California. Within the context of MPAs, our narrative dissects the varied types and designs, providing insights into strategies for promoting equitable access and design. The exploration culminates in actionable recommendations for future steps in fostering Blue Justice and environmental equity. The approach incorporates a lens that prioritizes the experiences of underserved communities, employing a narrative analysis to uncover nuanced perspectives and emphasize the importance of environmental justice in marine conservation. Our analysis is enriched by a system examination of over 100 primary and secondary literature sources, each meticulously cataloged and interconnected through a robust data structure, ensuring a comprehensive understanding of the complexities surrounding EEJ and Blue Justice in the realm of marine conservation.

EEJ Literature Review Screening Process

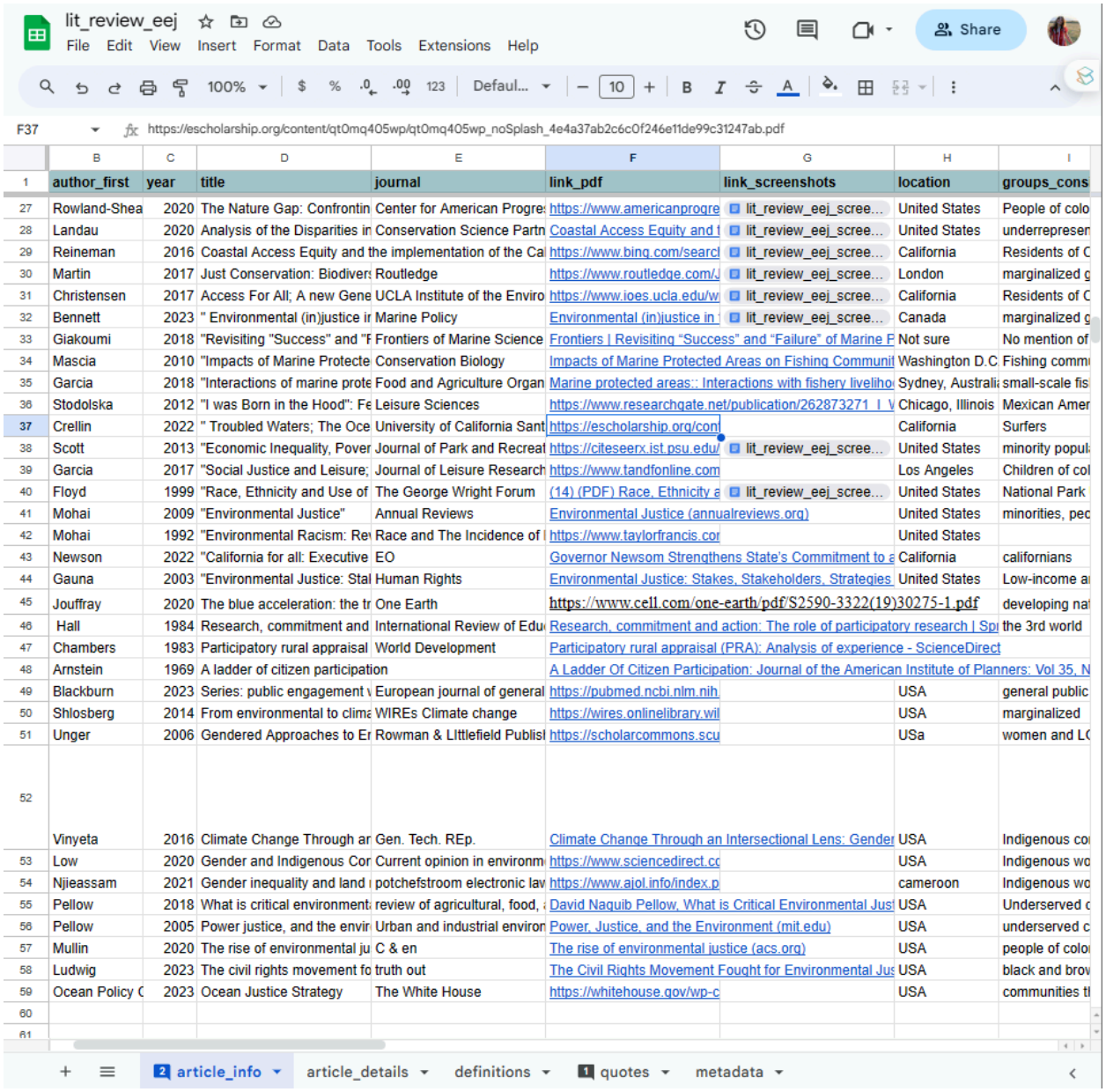
In this study, a systematic screening process was employed to identify and select relevant literature for the comprehensive literature review on Blue Justice, Environmental Justice, and Equity considerations within the context of Marine Protected Areas (MPAs) and National Marine Sanctuaries. The screening process involved a multi-step approach, beginning with the definition of clear inclusion and exclusion criteria. Initial searches were conducted across reputable databases, utilizing predefined keywords such as 'blue justice,' 'environmental justice,' 'equity,' 'marine protected areas,' 'nature gap,' 'underserved populations,' and 'ocean access.' Duplicate records were meticulously removed, ensuring each unique study was considered only once.

The remaining studies underwent title screening to assess their relevance, followed by abstract screening using the specified keywords to further narrow down the selection. Full-text assessments were then conducted for the retained studies, with a detailed evaluation against the predefined criteria and continued consideration of the identified keywords. Quality assessments were integrated where applicable to gauge the reliability and validity of the selected literature.

The final stage involved the extraction of relevant data from the chosen studies for subsequent synthesis and analysis.

For the exploration of federal and state uses of the term EEJ, Inclusion criteria were judiciously crafted to capture studies and documents that delved into the core dimensions of environmental justice, including distributive justice, procedural justice, and recognitional justice. The temporal scope of the literature search, starting from the year 2000 to encompass a notable 21-year policy gap, aimed to unveil the dynamics and shifts in environmental justice policies over time. The screening process prioritized various types of publications, including research articles, policy documents, executive orders, equity plans, and reports from federal and state agencies, fostering a holistic understanding of the subject. Furthermore, the geographical scope was considered to ensure the inclusion of diverse locations, acknowledging the unique challenges and opportunities faced by different regions.

A critical lens was applied to prioritize literature that addressed intersectionality, inclusivity, community involvement, and affordability in environmental initiatives. The screening process also emphasized a comparative analysis of EEJ commitments across federal and state agencies, aiming to unravel variations in definitions, scopes, and interpretations. Additionally, the review sought recent literature, especially post-2021, to shed light on the resurgence of EEJ policies and the factors influencing this renewed emphasis. The screening process culminated in a nuanced selection of literature that not only explored the principles and challenges of environmental justice but also delved into the practicalities of policy implementation, community engagement, and the potential transformative power of educational initiatives. This systematic screening process facilitated the identification of a robust set of literature, ensuring that only studies meeting rigorous criteria and aligning with the specified keywords were included in the comprehensive analysis of Blue Justice, Environmental Justice, and Equity in the context of MPAs and National Marine Sanctuaries.



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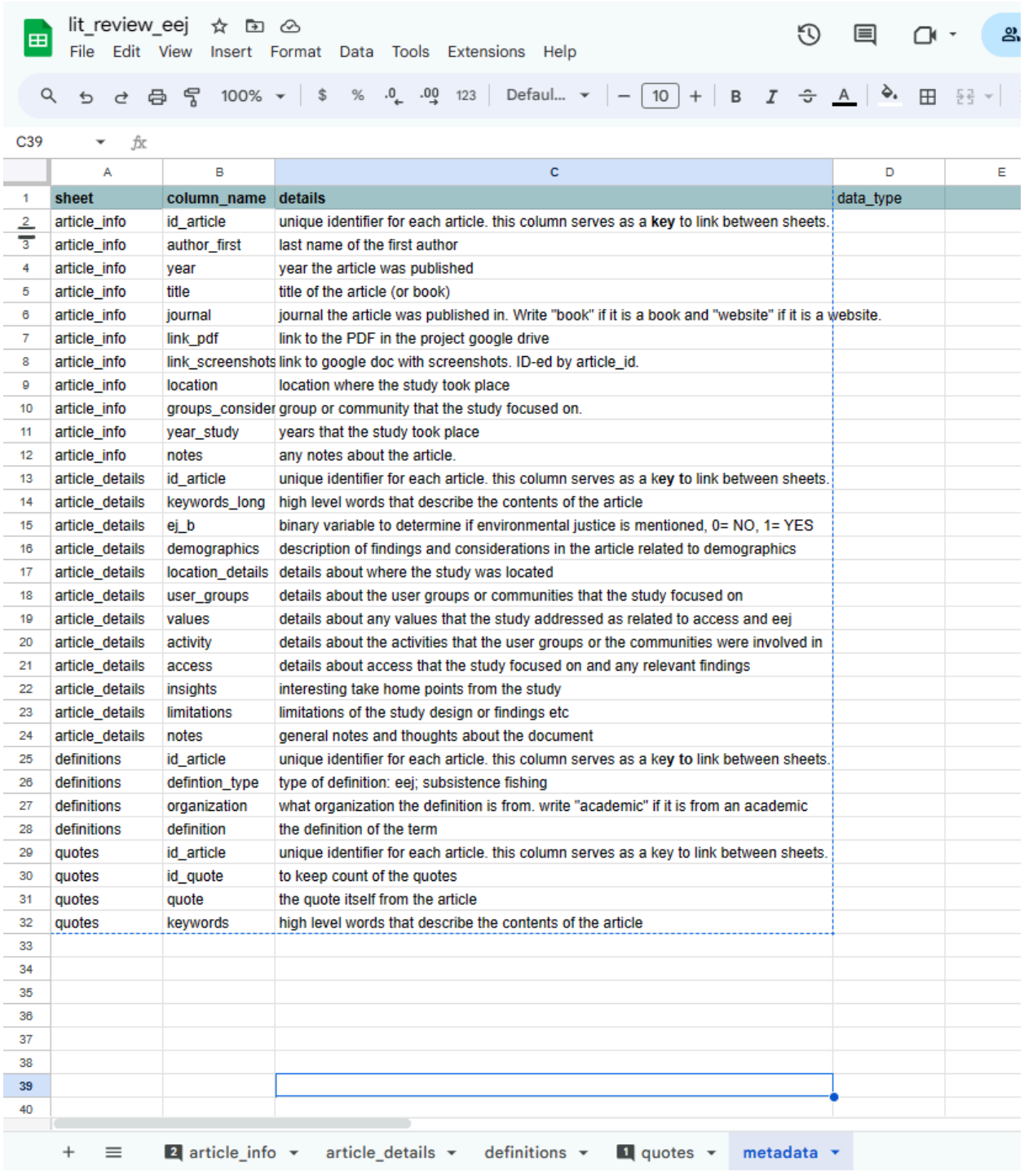
1	author_first	year	title	journal	link_pdf	link_screenshots	location	groups_cons
27	Rowland-Shea	2020	The Nature Gap: Confrontin	Center for American Progre	https://www.americanprogre	lit_review_eej_scree...	United States	People of colo
28	Landau	2020	Analysis of the Disparities in	Conservation Science Partn	Coastal Access Equity and	lit_review_eej_scree...	United States	underrepresen
29	Reineman	2016	Coastal Access Equity and the implementation of the Cal		https://www.bing.com/searcl	lit_review_eej_scree...	California	Residents of C
30	Martin	2017	Just Conservation: Biodivers	Routledge	https://www.routledge.com/J	lit_review_eej_scree...	London	marginalized g
31	Christensen	2017	Access For All; A new Gene	UCLA Institute of the Enviro	https://www.ioes.ucla.edu/w	lit_review_eej_scree...	California	Residents of C
32	Bennett	2023	" Environmental (in)justice ir	Marine Policy	Environmental (in)justice in	lit_review_eej_scree...	Canada	marginalized g
33	Giakoumi	2018	"Revisiting "Success" and "F	Frontiers of Marine Science	Frontiers | Revisiting "Success" and "Failure" of Marine F		Not sure	No mention of
34	Mascia	2010	"Impacts of Marine Protecte	Conservation Biology	Impacts of Marine Protected Areas on Fishing Communit		Washington D.C	Fishing comm
35	Garcia	2018	"Interactions of marine prote	Food and Agriculture Organ	Marine protected areas:: Interactions with fishery livelihoo		Sydney, Australia	small-scale fis
36	Stodolska	2012	"I was Born in the Hood": Fe	Leisure Sciences	https://www.researchgate.net/publication/262873271_I_V		Chicago, Illinois	Mexican Amer
37	Crellin	2022	" Troubled Waters; The Oce	University of California Sant	https://escholarship.org/con		California	Surfers
38	Scott	2013	"Economic Inequality, Pover	Journal of Park and Recreat	https://citeseerx.ist.psu.edu/	lit_review_eej_scree...	United States	minority popul
39	Garcia	2017	"Social Justice and Leisure;	Journal of Leisure Research	https://www.tandfonline.com		Los Angeles	Children of col
40	Floyd	1999	"Race, Ethnicity and Use of	The George Wright Forum	(14) (PDF) Race, Ethnicity a	lit_review_eej_scree...	United States	National Park
41	Mohai	2009	"Environmental Justice"	Annual Reviews	Environmental Justice (annualreviews.org)		United States	minorities, pec
42	Mohai	1992	"Environmental Racism: Re	Race and The Incidence of	https://www.taylorfrancis.cor		United States	
43	Newson	2022	"California for all: Executive	EO	Governor Newsom Strengthens State's Commitment to a		California	californians
44	Gauna	2003	"Environmental Justice: Stal	Human Rights	Environmental Justice: Stakes, Stakeholders, Strategies		United States	Low-income a
45	Jouffray	2020	The blue acceleration: the tr	One Earth	https://www.cell.com/one-earth/pdf/S2590-3322(19)30275-1.pdf			developing nat
46	Hall	1984	Research, commitment and	International Review of Edu	Research, commitment and action: The role of participatory research | Spr			the 3rd world
47	Chambers	1983	Participatory rural appraisal	World Development	Participatory rural appraisal (PRA): Analysis of experience - ScienceDirect			
48	Arnstein	1969	A ladder of citizen participation		A Ladder Of Citizen Participation: Journal of the American Institute of Planners: Vol 35, N			
49	Blackburn	2023	Series: public engagement v	European journal of general	https://pubmed.ncbi.nlm.nih.		USA	general public
50	Shlosberg	2014	From environmental to clima	WIREs Climate change	https://wires.onlinelibrary.wil		USA	marginalized
51	Unger	2006	Gendered Approaches to Er	Rowman & LIttlefield Publisl	https://scholarcommons.scu		USa	women and LC
52	Vinyeta	2016	Climate Change Through ar	Gen. Tech. REp.	Climate Change Through an Intersectional Lens: Gender		USA	Indigenous co
53	Low	2020	Gender and Indigenous Cor	Current opinion in environm	https://www.sciencedirect.cc		USA	Indigenous wo
54	Njieassam	2021	Gender inequality and land	potchefstroom electronic lav	https://www.ajol.info/index.p		cameroon	Indigenous wo
55	Pellow	2018	What is critical environmenta	review of agricultural, food,	David Naguib Pellow, What is Critical Environmental Just		USA	Underserved c
56	Pellow	2005	Power justice, and the envir	Urban and industrial environ	Power, Justice, and the Environment (mit.edu)		USA	underserved c
57	Mullin	2020	The rise of environmental ju	C & en	The rise of environmental justice (acs.org)		USA	people of colo
58	Ludwig	2023	The civil rights movement fo	truth out	The Civil Rights Movement Fought for Environmental Jus		USA	black and brov
59	Ocean Policy C	2023	Ocean Justice Strategy	The White House	https://whitehouse.gov/wp-c		USA	communities th
60								
61								

Figure 1. Screenshot of the EEJ literature database.



	A	B	C	D	E
1	**sheet**	**column_name**	**details**	data_type	
2	article_info	id_article	unique identifier for each article. this column serves as a **key** to link between sheets.		
3	article_info	author_first	last name of the first author		
4	article_info	year	year the article was published		
5	article_info	title	title of the article (or book)		
6	article_info	journal	journal the article was published in. Write "book" if it is a book and "website" if it is a website.		
7	article_info	link_pdf	link to the PDF in the project google drive		
8	article_info	link_screenshots	link to google doc with screenshots. ID-ed by article_id.		
9	article_info	location	location where the study took place		
10	article_info	groups_consider	group or community that the study focused on.		
11	article_info	year_study	years that the study took place		
12	article_info	notes	any notes about the article.		
13	article_details	id_article	unique identifier for each article. this column serves as a key to link between sheets.		
14	article_details	keywords_long	high level words that describe the contents of the article		
15	article_details	ej_b	binary variable to determine if environmental justice is mentioned, 0= NO, 1= YES		
16	article_details	demographics	description of findings and considerations in the article related to demographics		
17	article_details	location_details	details about where the study was located		
18	article_details	user_groups	details about the user groups or communities that the study focused on		
19	article_details	values	details about any values that the study addressed as related to access and eej		
20	article_details	activity	details about the activities that the user groups or the communities were involved in		
21	article_details	access	details about access that the study focused on and any relevant findings		
22	article_details	insights	interesting take home points from the study		
23	article_details	limitations	limitations of the study design or findings etc		
24	article_details	notes	general notes and thoughts about the document		
25	definitions	id_article	unique identifier for each article. this column serves as a key to link between sheets.		
26	definitions	defintion_type	type of definition: eej; subsistence fishing		
27	definitions	organization	what organization the definition is from. write "academic" if it is from an academic		
28	definitions	definition	the definition of the term		
29	quotes	id_article	unique identifier for each article. this column serves as a key to link between sheets.		
30	quotes	id_quote	to keep count of the quotes		
31	quotes	quote	the quote itself from the article		
32	quotes	keywords	high level words that describe the contents of the article		
33					
34					
35					
36					
37					
38					
39					
40					

Figure 2. Screenshot of EEJ Literature Review Metadata.

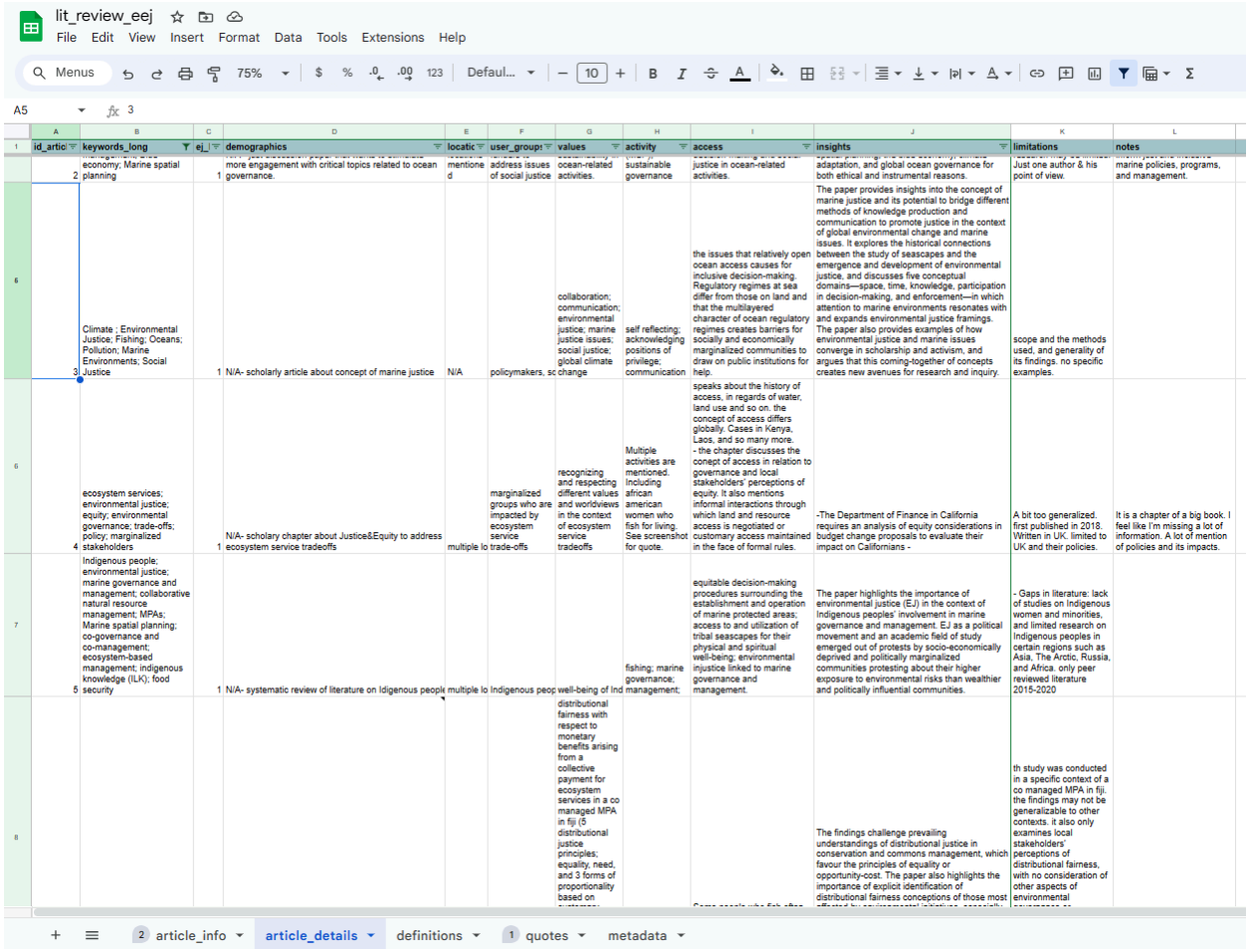


Figure 3. Screenshot of EEJ Literature Review article_details.

Over 100 primary and secondary literature related to Equity and Environmental Justice considerations (e.g., ocean access) relevant to the adaptive management of California's MPA Network and Sanctuaries were reviewed. In the "article_info" sheet, information about each article is cataloged. This includes a unique identifier ("id_article") serving as a key for inter-sheet linkage, details such as the first author's last name, publication year, title, publication source (journal, book, or website), PDF link in Google Drive, and a link to screenshots in a Google Doc identified by article ID. Additional details encompass the study's location, focused groups or communities, study years, and any pertinent notes.

The "article_details" sheet delves further into the specifics of each article. It utilizes the article identifier for linkage and includes high-level keywords, a binary variable indicating the mention of environmental justice, demographic considerations, location details, information about user groups or communities, addressed values related to access and environmental justice, activity details, access considerations, notable study insights, limitations, and general notes. Meanwhile, the "definitions" sheet offers a repository for various definitions. The unique article identifier links definitions to specific articles, and each entry includes the type of definition (e.g.,

"eej" or "subsistence fishing"), the organization providing the definition (academic or otherwise), and the actual definition of the term.

Lastly, the "quotes" sheet tracks quotes extracted from articles, with the article identifier linking them. Each quote is assigned a unique quote identifier ("id_quote"). High-level keywords are also associated with the quotes, providing a snapshot of the content's essence. This metadata structure facilitates a comprehensive organization of article-related information, from basic article details to in-depth insights, definitions, and extracted quotes, all interlinked through unique identifiers for seamless navigation and reference.

Objective 2: Analyzing EJ Indicators for Ocean Access in California

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Spatial Analysis of Public Access Points

This analysis was completed using datasets and ArcGIS Pro 3.2 to satisfy our objectives. The spatial analysis used zip code, census tract, and block group datasets as well as a dataset representing all access points to respective California MPAs and NMSs. These datasets include zip code population-weighted centroids – taken from the Office of Policy and Development and Research via the United States Department of Housing and Urban Development (HUD), census tract and block group population-weighted centroid data taken from US Census Bureau, MPA, and NMS shapefiles data taken from a shared Google Drive folder originally supplied from NOAA Channels Island National Marine Sanctuary client and public access points from this GoogleDrive folder in geopackage (gpkg) format. The folder contains various public access points after buffers were used to isolate points, (i.e. public access points around MPAs only). The folder also contains a “Routes” file which displays a line feature data layer representing the overall analysis of Travel times to the nearest public access points. Datasets from CalEnvironScreen were also taken, with the main EJ indicators used being poverty, children <10, pop 10-64 years, elderly > 64, Hispanic, white, African American, Native American, and Asian American.

Data Description

Zip code, census tract, and block group Population Weighted Centroids allow researchers and analysts to estimate the center of population in a given geography rather than the geometric center (HUD, 2020). We downloaded and imported the origin points, however, given that the network analyses can only conduct a maximum of 5000 analyses per run so (census_tract 9000 and block_group 25000+) need to be divided and run separately. It was determined for this project that the analysis would focus completely on zip codes as the environmental justice data used from CalEnviroScreen were categorized by zip code.

Then, importing the MPA access and NMS access used for analysis. NMS came from “main.ch_access_250m_pt” (ch stands for Chumash Heritage) both available by uploading the data file “access_buf_mpa_nms_pt_250m (2).gpkg” which was used for MPA and NMS access

points. Finally, importing “main.beach_access_ca” used for a subset all access analysis and “main.ferries” used for a subset ferry analysis via uploading the data file “access_ca2.gpkg” used for all_access and ferries analyses.

In terms of the EJ data from CalEnviroScreen, one of the indicators used was poverty which reflects the percent of the population living below two times the federal poverty level. Another accessed age and was broken up into three categories: Children < 10, pop 10-64 years, and elderly > 64 which explains the 2019 American Community Survey (ACS) population estimates of the percent per census tract of children under 10 years old, people between 10 and 64 years old, and elderly 65 years and older respectively. Lastly, race was an indicator with 5 categories (i.e. Hispanic, white, African American, Native American, and Asian American) all of which give 2019 ACS population estimates of the percent per census tract of those who identify as said given race.

Network Analysis

We conducted a network analysis in ArcGIS Pro to determine and map the distances and travel times between different parts of California (operationalized as zip codes) and (a) coastal access points, (b) piers and jetties, (c) MPAs, and (d) Sanctuaries. This allows us to represent the fastest routes from each zip code/census tract/block group to access points of MPAs and NMSs. This process was completed by going to the “analysis” tab and clicking on “Network analysis”, then “Closest Facility”. This is what outputs the fastest routes. Next, we clicked on the “Closest Facility Layer” and clicked on “Import Incidents”. This opens an engine to input a location (the zip points data layer) as the origin point. Once that occurred, we joined the import incidents layers with “Name” for each first table and “STD_ZIP5” for the second. Next, we clicked on “Import Facilities” another engine to input a location (The mpa data layer) as the endpoint. Once done, we joined the import facilities layers with “Name” for the first table and “id_pap” for the second. After, in the “Closest Facility Layer” we went to “Date and Time” and changed the settings to June 25, 2022, at 11:00 AM. This was chosen because it represented a time when the least likelihood for outliers (i.e. Holidays, work hours, etc.) would occur. Finally, in “Tools” we used “Create SQLite Database” to create a geopackage by selecting the geopackage option “GeoPackage (equivalent to GeoPackage 1.3)”, then in “Contents” right clicked “Routes” to export the data to the geopackage given by our clients in the GoogleDrive named “routes_gpkg”.

The data from these “Routes” shp. files were exported to Excel and changed to attribute tables that clearly listed the zipcodes, public access points (i.e. all access, ferries, MPAs, NMSs), and Total Travel Time (min). They were then joined together with the three EJ indicators (poverty, age, and race) by zip code.

Statistical Analysis

To achieve an accurate analysis of ocean access happening within the state of California and certain equity discrepancies among demographics, compiling an array of socioeconomic indicators can denote areas of general similarity in access and in the type, quality, and quantity of

environmental resources needed for policy prescriptions. The indicators serve as a spatial framework for the research, assessment, management, and monitoring of environmental justice and equity.

This data was locatable from the network analysis that was conducted by our clients from NOAA Channel Islands, where data was collected on the total time travel in minutes by car from each zip code in California. Using ArcGIS Pro software, The data was uploaded and joined to CalEnviroScreen 4.0 data. CalEnviroScreen 4.0 data is in the form of a .csv file, a spreadsheet showing raw data and calculated percentiles for individual indicators and combined CalEnviroScreen scores for individual census tracts with additional demographic information (OEHHA, 2024). This newly created table was then exported from ArcGIS, and uploaded to RStudio.

To make the assessment, the first step was using RStudio software– running statistical analyses using the EJ indicators (i.e. income, age, and race) to determine the effects of ocean access (i.e. time traveled) to the coast. Specifically for income and age, filter() was used to separate the data into zip codes with a total travel time of 70 minutes and higher or below 70 minutes. We then ran a linear regression for income using an independent variable "poverty" – denoting the percent of population living below two times the federal poverty level. We also ran two linear regression tests for age: One with an independent variable of "Youth_65" which is the percentage of people below the age of 65, and one with an independent variable of "Elderly_65" which is the percentage of people 65 and older. The dependent variable for both regression tests is total travel time. To plot the graphs, we then used ggplot().

For race, we used a two-way ANOVA test also called the Kruskal-Wallis test, which is used for determining statistically significant differences among multiple independent variables on a dependent variable. This test was used because the data was nonparametric. In order to run this test, we first needed to turn numeric data into categorical data. We manipulated the data by creating a new column called "Race" that abided by a condition stating if a given zip code had a racial group (i.e. White, Hispanic, African American, Asian American, Native American, Pacific Islander, Other races) with a population of above 40% it would then be designated to represent that racial category in the new column. Due to a low sample size of zip codes for Native Americans and Pacific Islanders (two and zero occurrences respectively) these groups got absorbed with the Other races creating a "No majority" category. Lastly, we calculated the mean total travel time for each racial group and graphed the data using ggerrorplot().

Objective 3: Subsistence Fishing Literature Review & Database

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We reviewed over 20 primary and secondary literature focused on subsistence fishing in California over the winter break and a portion of the winter quarter. The metadata encompasses details related to articles, their details, definitions, and quotes. SF stands for Subsistence Fishing. In the "article_info_sf" sheet, the "id_article" serves as a unique identifier linking between sheets. It includes information such as the first author's last name, publication year, article title,

and the type of publication (journal, book, or website). Links to the PDF and screenshots in the project Google Drive are also provided, along with details on the study's location, the groups considered, study years, and any additional notes. Notably, the "groups_considered" field may include information on subsistence fishing if relevant.

The "article_details_sf" sheet further elaborates on each article's content, covering keywords, demographic considerations, location details, user groups, values, activities, access, insights, limitations, and general notes. If any of the articles specifically address subsistence fishing, this information would likely be captured in the "demographics," "user_groups," "values," or "activities" fields.

In the "definitions_sf" sheet, definitions are categorized by type (e.g., "eej," "subsistence fishing"), organization source (e.g., academic), and the actual definition of the term.
Lastly, the "quotes_sf" sheet includes quote-related information, with each quote linked to its corresponding article through the "id_article" column. Keywords describing the article's content are also provided for each quote, which may include terms related to subsistence fishing if applicable.

Screening Process of Subsistence Fishing Literature Review

In conducting this comprehensive literature review on the "History of Subsistence Fishing and Inequities in California," a meticulous and systematic approach was employed to gather, analyze, and synthesize relevant information. The research initiated an extensive literature search across multiple databases, utilizing specific keywords such as 'subsistence fishing,' 'marine conservation,' 'environmental justice,' and 'MPAs' to identify studies relevant to the historical transitions in California's marine ecosystems. Inclusion criteria were defined, specifying the focus on subsistence fishing practices, the geographical context of California, and a consideration of environmental justice implications. The data collection process involved the extraction of key themes, historical events, and environmental justice considerations from selected studies.

An integral aspect of this literature review was the examination of a stakeholder engagement study conducted to understand how subsistence fishers interact with MPAs and ocean access in California. This study included a survey of 3,030 pier anglers over a 12-month period, emphasizing the inclusion of non-White/Euro-American anglers to capture diverse perspectives. The analysis of the executive order from 1994, "Federal Actions To Address Environmental Justice," revealed gaps in public participation and information dissemination, particularly affecting subsistence fishers who predominantly speak English as a second language. A critical evaluation of the identified gaps in policy underscored the need for alternative outreach approaches, exemplified by a targeted survey to engage subsistence anglers.

Additionally, the literature review incorporated an analysis of the socioeconomic impacts of MPAs, recognizing the potential positive and negative effects on consumptive users, regional economies, and tourism. The integration of local ecological knowledge (LEK) in policy processes was explored as a valuable complement to scientific information, emphasizing its role

in enhancing community participation and empowerment in governing marine resources. The review also highlighted the pilot study's innovative use of geospatial analysis tools and participatory methods to incorporate socioeconomic and biodiversity information from underrepresented communities, ensuring the inclusivity and effectiveness of MPA planning processes in California. Acknowledging potential limitations, this literature review sets the stage for future research to address historical gaps, refine methodologies, and deepen the understanding of subsistence fishing history and environmental justice issues in California.

Objective 4: Social Implications of Targeted Species Threats

For our analyses, we utilized a variety of datasets and ArcGIS Pro 3.2 to satisfy our objectives. Our hotspot analysis incorporated three different datasets from several reputable sources. These included Aquamaps, data records from the California Department of Fish and Wildlife (CDFW)/California Recreational Fisheries Survey (CRFS), and supplementary data from the Halpern et al. 2009 paper; “Mapping cumulative human impacts to California Current marine ecosystems”. Our social equity analysis drew upon data sourced from the CDFW/CRFS, as well as information provided by CalEnviroScreen.

Data Description

Aquamaps is an online tool designed to visualize the predicted occurrences of marine species’ spatial distributions (Kaschner et al., 2019). Using this tool, we downloaded the NetCDF file of the species richness range for each of our target species and the Map Data CSV file with probability measurements. Additionally, the CDFW/CRFS data was provided to us by our client, a researcher from the NOAA Channel Islands National Marine Sanctuary. This dataset contained sensitive information on subsistence fishers. For our analysis, we omit any information that would impact the livelihoods of those individuals or divulge any vital information to connect back to them. Using R, we filtered the data to only include the zip codes of where they are from, the species they caught, and the number of each species caught. Our additional dataset of threats came from the Halpern et al. 2009 paper. This dataset included 25 various threats along the California Current, including ocean acidification, beach access, and coastal engineering, to name a few (See Appendix, Table 2). For our analysis we only looked at pollution data which in the paper they state was retrieved from CalTrans, WADOT, and Halpern et al. (2008c). We also used a dataset called “all species richness” from Aquamaps which contained distributions for all marine species in the California Current. Our final dataset used for this analysis was CalEnviroScreen, an online data tool that identifies the California communities most affected by pollution burdens. There are a total of 21 environmental justice (EJ) indicators from four different indicator groups that CalEnviroScreen uses to measure these pollution burdens. These included exposure indicators, environmental effects, sensitive populations, and socioeconomic factors (CalEnviroScreen, 2021). Each of these indicators is assigned specific metrics and criteria for evaluation. The scores derived from these indicators are then consolidated into a cumulative

impact score (CIScore), providing a comprehensive overview of the overall pollution burden borne by each region. This score is used to determine whether a community is a disadvantaged community (DAC) and to what extent.

Social Equity Analysis

For our second objective, we implemented a comprehensive social equity analysis to assess the distribution of subsistence fishing communities and the degree to which they are disadvantaged. To achieve this, we integrated the CDFW/CRFS data with disadvantaged community EJ indicators from CalEnviroScreen.

To create the map of all disadvantaged communities in California, we first downloaded the EJ indicators dataset from the CalEnviroScreen website and uploaded them into ArcGIS Pro. We then applied the Feature Class to Feature Class tool to remove -999 values in the CIScore column (See Appendix, Image 7). Lastly, we changed the symbology of the data using a quantile method with four classes and set the field to CIScore. The class with the lowest values was labeled as disadvantaged, the second class as moderately disadvantaged, the third class as highly disadvantaged, and the fourth class as severely disadvantaged.

After analyzing the DAC communities by their CIScore, we then wanted to look specifically at those zip codes that included where subsistence fishers were coming from. We joined the CDFW/CRFS that included a column of the total subsistence fishers per zip code and the CalEnviroScreen data using the Join Features tool (See Appendix, Image 5). With a one-to-one join, we linked them using zip codes as our target field and obtained an output combining the two files. Following this, we used the Feature Class to Feature Class tool to create an output based on the cumulative impact score from CalEnviroScreen. In this tool, we input our combined data file and used an expression where the CIScore is not null (See Appendix, Image 6). We then symbolized using a quantile method with four classes and labeled each class to reflect the degree to which they were disadvantaged. We also created a map visualizing the number of subsistence fishers per zip code by setting the field in the symbology tab to the column called num_subfish. This was set to quantiles with four classes. We changed the color scheme where darker pink regions indicated a greater number of fishers.

Hotspot Analysis of Threats to Target Species

We conducted a hotspot analysis in ArcGIS Pro to map out the ocean-based pollution impacts on the top 5 target marine species. This allowed us to obtain a spatial understanding of the species' ranges relative to this threat. For this analysis, we worked with the threats data and all species richness dataset from Lab 2: Mapping Hotspots of Diversity, the spatial species richness data retrieved from Aquamaps, and the CDFW/CRFS data provided by our client.

We first determined the top 5 marine species most harvested by subsistence fishers to run this analysis based on the CDFW/CRFS data. This dataset included the species names and the number of each species harvested by subsistence fishers, therefore, in R we subset the data into a table that only includes the top 5 harvested species (See Appendix, Image 1). To do this, we

summed up the total number of each species caught by all subsistence fishers and then ranked them from most to least caught. We then selected the top 5 most caught species. Our analysis assumed that a higher number of catch reflected that the species is of higher importance to subsistence fishers. Therefore, we made the executive decision to run this analysis on the top 5 most harvested species to gain a baseline understanding.

Using Aquamaps, we downloaded the spatial species richness data (NetCDF file) and associated Map Data CSV file with probability measurements for each of these marine species. In ArcGIS Pro, we loaded the NetCDF file and ran the Make NetCDF Raster Layer tool, keeping all the default parameters the same, to transform the data into a raster layer (See Appendix, Image 2). We then ran the XYTable to Point tool with the species Map Data CSV file as the input, the X field as long, and the Y field as lat. Since the Aquamaps data did not have a spatial reference we ran the Point to Raster tool. The inputs were the species Map Data CSV file and the all species richness dataset from Lab 2. We set the value to overall probability, and in the environments tab we set the coordinate system, extent, and snap raster to the all species richness dataset. We then ran the Set Null tool on the output, where the value is less than or equal to 0 (See Appendix, Image 3). We applied the Reclassify tool to that output, setting the classify tab to quantile with 5 bins and flipped the values in the values column where 1 indicates the highest richness and 5 indicates the lowest richness (See Appendix, Image 4). This gave us an output of a layer visualizing the areas of highest species richness.

We then determined which threat we wanted to analyze from Lab 2. For our analysis, we chose the ocean-based pollution threat, defined as pollution from commercial ships and ports (Halpern et al., 2009). We chose this threat since subsistence fishers primarily fish in regions near ports and piers. We loaded the pollution threat file into ArcGIS Pro and first applied the Set Null tool where the value was set to less than or equal to 0 (See Appendix, Image 3). We then applied the Reclassify tool to this output, classifying it into 5 quantiles and setting the values where 1 is the highest impact and 5 is the lowest impact (See Appendix, Image 4). Lastly, we used the Raster Calculator to add the reclassified output of the species richness with the reclassified output of the pollution to get the hotpot layer. We then changed the symbology to classify to group the data by classes and inverted the color value. These steps of tools in ArcGIS were repeated for each of the top 5 marine species.

Results

Objective 1: EEJ Literature Review & Database

Key theoretical frameworks and perspectives related to EEJ.

Our investigation of key theoretical frameworks and perspectives related to EEJ involves analyzing the language employed in federal and state executive orders, including federal and

state of California agencies dealing with natural resources. We apply the practical applications of the EEJ principles in governance and policy making, acknowledging the notable shifts in policy and definitions over time. To provide context, we present three appendices:

- Appendix 1: The Federal and State of California Executive Orders
- Appendix 2: Federal agencies tasked with overseeing various aspects of environmental protection, including pollution, oceans, and natural resources.
- Appendix 3: California's natural resources agencies.

Federal and State of California Executive Orders

Each Executive Order maintains a distinct focus and scope, with some concentrating on climate-related impacts and others addressing the disproportionate effects on minority and low-income populations while emphasizing meaningful involvement in decision-making processes. They all recognize the importance of addressing the cumulative impacts of environmental hazards, the legacy of racism, and systemic barriers that have contributed to existing disparities. The initial Executive Order (EO) 12898, enacted in 1992, set a narrow precedent for EEJ due to vague directives and limited enforcement mechanisms. The EO urged federal agencies to incorporate EJ (Environmental Justice) into their missions, identify adverse effects on minority and low-income populations, and to establish an Interagency Working Group on EJ (EO 12898, 1992). The order lacked specific directives for agencies, leading to lenient and varied approaches along with inconsistent enforcement and accountability; the focus on procedural aspects, such as the Interagency working group, overshadowed tangible actions. There is a noticeable gap of 21 years, from 2000 to 2021, during which there was no federal EO specifically targeting environmental justice.

The recent resurgence of EEJ policies, beginning with EO 13985 in 2021, marks a renewed emphasis on the issue of EJ (Appendix 1). EO 14008 set a broader precedent for EEJ by establishing the Justice40 initiative, aiming to channel 40 percent of federal investments' benefits to underserved communities (OJS, OPC 2023; EO 14008, 2021). The following EOs' were able to build off EO 14008, paving the way for executive branch agencies to integrate EJ into their missions through EO 14091, which charges the federal government with advancing equity for all, addressing persistent poverty and inequality (OJS, OPC 2023; EO 14091, 2023). The later orders highlight climate justice; climate injustice is that those who have contributed the least to climate change are often the ones who suffer the most from its consequences (Schlosberg and Collins, 2014; Bennett, 2021; Avakian, 2021). In EO 14096 enacted in 2023, the latest definition also recognizes the legacy of racism and systemic barriers in alignment with evolving understandings of EJ over time. Climate justice, an extension of environmental justice, seeks to address the unequal distribution of climate change impacts, particularly focusing on marginalized communities (Schlosberg and Collins, 2014; Bennett, 2021). Climate justice closely aligns with this evolving definition, emphasizing equitable treatment and just involvement, particularly for marginalized communities, as required by EO 14096 (Appendix 1).

EJ definitions have evolved since then spanning publication years from 1994 to 2023, reflecting the evolving understanding of environmental and climate justice. In contrast, Federal and State Executive Orders from 2021 significantly shift the EJ focus by introducing a broader interpretation of EJ (Appendix 1). For example, recent EJ EOs incorporate climate-related impacts and climate change considerations, thus elevating the principles of climate justice (Schlosberg and Collins, 2014; Bennett, 2021; Martin, 2017; Mascia, 2010). California's EO N-16-22 stands out as a notable development in EJ for its innovative approach to introducing state-level involvement. The EO concentrates on embedding equity considerations within the state's agencies and departments, marking a stride toward the integration of EJ principles into the state's governance (EO N-16-22, 2022).

In conclusion, the analysis of Appendix 1 reveals a dynamic landscape in the evolution of EJ definitions. The observed patterns, from the narrow focus of early orders to the broader interpretations introduced in recent years, reflect the responsiveness of governance to changing societal and environmental priorities. The emphasis on climate justice in newer EO signals a recognition of the urgent need to address climate-related impacts on vulnerable communities. There appears to be a noticeable gap in relating EJ principles to ocean-related matters and ensuring equitable access to natural resources until later EO's drafted in 2023.

Federal Agencies Tasked with Overseeing Various Aspects of Environmental Protection, Including Pollution, Oceans, and Natural Resources

The federal agencies dealing with pollution, oceans, and natural resources have committed to EJ in a manner that only informs inclusivity, equitable protection, and meaningful community involvement (Appendix 2). Regardless of their distinct missions, these agencies have provided uniform definitions that emphasize the fair and meaningful engagement of all individuals, irrespective of race, color, national origin, gender, sexual orientation, tribal affiliation, religion, disability, or income, in shaping environmental laws, regulations, and policies. Common objectives across agencies' EJ definitions include equitable safeguarding against environmental and health hazards and ensuring access for all communities to a sustainable and healthy environment which aligns with the broader framework of distributive and procedural justice.

EPA is an agency that was established in 1970 by President Nixon. The definition of environmental justice did not originate until 1992 and is now uniformly being used across agencies and governments (EPA, 2023). However, the definitions vary in scope, in part reflecting the distinct missions and priorities of each agency (Appendix 2). The Department of Commerce (DOC) adopts EJ principles by highlighting their role in economic growth, environmental data stewardship, and property protection. The DOC's focus aligns with distributive justice by striving for the equitable distribution of environmental benefits and burdens across communities. The branch agencies' definitions have also evolved, mirroring the changing priorities within these federal agencies. While they all share common themes, these variations underscore the agencies' diverse roles and responsibilities in addressing EEJ issues within their domains.

For example, agencies under DOC and within NOAA (e.g. CINMS, ONMS, NMFS, OPC) encompass all three dimensions of EJ by emphasizing equitable protection, access, and opportunity for underserved communities during the development, implementation, and enforcement of environmental laws. While the Ocean Policy Committee is not directly under NOAA, they share the idea of just treatment and meaningful involvement of all people in federal agency decision-making related to the ocean - an element of recognitional justice.

On the other hand, agencies under the Department of Interior (DOI) (e.g. BLM, NPS, BOEM, USFWS) prioritize ecological, economic, cultural, and social impacts for outstanding management of natural and cultural resources with a sustainable, inclusive, and accessible approach. USDA stands out with its procedural and distributive justice approach focusing only on governmental programs by emphasizing the opportunity for all populations to comment, share benefits, and avoid disproportionate impacts from government programs affecting health or the environment. While USFS is not directly under DOI, they share the same message of emphasizing equal access to the decision-making process for a healthy environment. The approach of DOI indicates a multi-dimensional approach that incorporates aspects of both recognitional and distributive justice.

California's Natural Resources Agencies

The EJ definitions among California natural resource agencies show both commonalities and differences, demonstrating a shared commitment to fairness and inclusivity with room for organizational priorities. Established in 2018, the California Natural Resources Agency, California Department of Conservation, and California Department of Water Resources base their definitions on common legal foundations of recognitional justice, emphasizing fair treatment across different demographics in environmental law matters. This legal basis suggests a unified approach to framing EJ principles.California agencies (Appendix 3), including the California Environmental Protection Agency, reinforce the EJ commitment. Their definitions stress fairness regardless of race, color, national origin, or income, highlighting community involvement in shaping laws for natural surroundings. These definitions collectively highlight diverse approaches and priorities in the pursuit of equitable environmental protection and access.

Despite this unity, differences emerge in the emphasis and scope of agency definitions. The California State Lands Commission stresses that traditionally disadvantaged groups should not be excluded. California State Parks adds rare core values of cultural diversity and accessibility, emphasizing everyone's right, including persons with disabilities, to access recreational opportunities. Each agency introduces nuanced language, specifying fair treatment scope and prevention of disproportionate environmental consequences. While most agencies established their definitions in 2018, the California Fish and Wildlife Commission (2021), California Ocean Protection Council (2022), and California Environmental Protection Agency (2023) showcase timeline diversity, indicating evolving priorities.

Additional Considerations

Additionally, the rarity of equity plans in both federal agencies like the California Ocean Protection Council and NOAA Fisheries (Appendix 2; Appendix 3) and state agencies signifies a noteworthy commitment to a comprehensive approach in addressing environmental justice concerns. The publication years of state EJ definitions span from 1992 to 2023, reflecting the evolving understanding of EJ. References to specific executive orders underscore the legal frameworks guiding these federal and state agencies. However, an expectation of the USFS's definition established in 1997 sets it apart (Appendix 3). Notably, there was a gap in the state of California's agencies' EJ definitions from 1992 to 2018, spanning 26 years. These insights provide a practical view of agencies' interpretations of EJ, showcasing a dynamic landscape shaped by both shared principles and distinctive organizational values.

Strategies to Promote Equitable Ocean Access and MPA Design

The intersection of EEJ and MPAs brings to light critical questions surrounding equitable benefits in marine conservation efforts. While MPAs serve the primary purpose of preserving biodiversity and enhancing ecosystem health, their establishment and management may inadvertently perpetuate environmental injustices (Jones, 2009; De Santo, 2013; Mascia, 2010; Garcia, 2017). Indigenous and underrepresented communities have, in certain instances, faced marginalization during the decision-making processes related to MPAs (Bennett, 2023; De Santo, 2013; Garcia, 2018; Parsons, 2021). Historical injustices, such as land dispossession and colonization, have left Indigenous communities socio-economically disadvantaged, hindering their effective participation in MPA decision-making (Jones, 2009; Bennett, 2023; Parsons, 2021). Systemic racism within decision-making structures further exacerbates the marginalization of these communities, limiting their involvement and influence in MPA designations (Bennett, 2023; Crellin, 2022; Rowland-Shea, 2020; Mohai, 1992; Stokdasla, 2012; Garcia, 2017). The dominance of economic interests during MPA decision-making can exacerbate gendered impacts and diminish the rights and interests of Indigenous and underrepresented communities (Mascia, 2010; Parsons, 2021).

To address these issues and promote more equitable access to coastal spaces and marine conservation benefits, several strategies can be considered. First, efforts should be made to promote inclusive and equitable decision-making processes for MPA establishment and management. Indigenous and underrepresented communities must be provided with a voice in decision-making bodies to ensure that their interests are represented (Jones, 2009; Parsons, 2021). Engaging with these communities from the early stages of MPA planning is crucial to understanding their unique needs, perspectives, and traditional ecological knowledge (De Santo, 2013). This engagement can lead to more comprehensive MPA design and management, taking into account the specific circumstances and concerns of these communities.

Addressing historical injustices, such as land dispossession and colonization, should be a priority in MPA decision-making. Acknowledging and rectifying past wrongs through policies and actions that empower affected communities can help promote a sense of justice and

inclusivity (Jones, 2009). Moreover, efforts should be made to eliminate discriminatory practices related to systemic racism within decision-making structures. By raising awareness of these issues and working to eradicate such practices, decision-making bodies can become more inclusive and representative of diverse communities (Bennett, 2023; Parsons, 2021).

Gender equality should also be a central consideration in MPA decision-making. Ensuring that the concerns and needs of women and gender-diverse individuals in Indigenous and underrepresented communities are given equal consideration can help mitigate gendered impacts and promote a more just and inclusive approach (Parsons, 2021). Capacity-building initiatives should be established to empower Indigenous and underrepresented communities. This can involve providing training in environmental management, conservation, and MPA stewardship to enable active participation and benefit from conservation efforts (Jones, 2009; Mascia, 2010; Garcia, 2017; Bennett, 2023). These initiatives should focus on building the skills and knowledge necessary for effective engagement in MPA-related activities and decision-making. It is essential to ensure that data related to MPAs is transparent and includes information on the distribution of benefits and any disparities. This data can be used to inform decision-making and track progress in addressing issues of equity and justice.

Finally, promoting collaborative governance models that involve multiple stakeholders and decision-making bodies can address the complexities of MPA establishment and management. Engaging a diverse array of perspectives and interests can lead to more well-rounded and equitable outcomes (Jones, 2009; Mascia, 2010; Garcia, 2017; Bennett, 2023; Bennett, 2022; Bennett, 2018; Floyd, 1999; Scott, 2013).

In addition to these strategies, enhancing the accessibility of coastal spaces and MPAs is needed. This can be achieved by improving infrastructure, making beach parking, amenities, and overnight accommodations more affordable, and hosting community-specific events. Adding more lighting at beaches can enhance safety and encourage evening visits, making coastal spaces more accessible to all. Making amenities and accommodations more affordable can reduce financial barriers and increase access for underrepresented communities. Hosting community-specific events, such as surfing schools tailored to African American children, can promote inclusivity and provide opportunities for cultural and recreational engagement. For example, organizations like Brown Girl Surf and The Sea League have demonstrated the positive impact of hosting community-specific events (Brown Girl Surf, 2023; The Sea League, 2023).

By implementing these strategies and enhancing accessibility, marine conservation efforts can become more equitable, just, and inclusive, ensuring that the benefits of conservation are shared more broadly among all communities, particularly those that have historically been underrepresented.

Objective 2: Analyzing EJ Indicators for Ocean Access in California

Spatial Analysis of Public Access Points

We found the percentages of the environmental justice indicators (i.e. income, age, and race) among California zip codes using spatial environmental justice data collected by the State of California, called the CalEnviroScreen 4.0 data. Counties with the highest percentage of poverty include San Luis Obispo, Fresno, and Los Angeles. Counties with the highest percentage of elderly above 65 years of age include Orange, Sonoma, and Riverside. We assigned the "No majority" category to zip codes where no racial group accounts for at least 40% of the population, and thus there is no majority racial group.

Table 1. The 5 most poverty stricken zip codes

Zip Code	*County*	*Total Travel Time (minutes)*	*Poverty (%)*	*Racial demographic*
93405	*San Luis Obispo*	*14*	*89.6*	*White*
93702	*Fresno*	*153*	*87.2*	*Hispanic*
90007	*Los Angeles*	*23*	*85.4*	*No majority*
95351	*Stanislaus*	*111*	*80.1*	*Hispanic*
94704	*Alameda*	*39*	*80*	*Asian American*

Table 2. The 5 zip codes with the most elderly

Zip Code	*County*	*Total Travel Time (minutes)*	*Elderly over 65 years old (%)*	*Racial demographic*
92651	*Orange*	*3*	*54.9*	*White*
95421	*Sonoma*	*27*	*54.0*	*White*
90067	*Los Angeles*	*14*	*51.6*	*White*
92270	*Riverside*	*124*	*50.6*	*White*

92203	*Riverside*	*133*	*50.4*	*Hispanic*

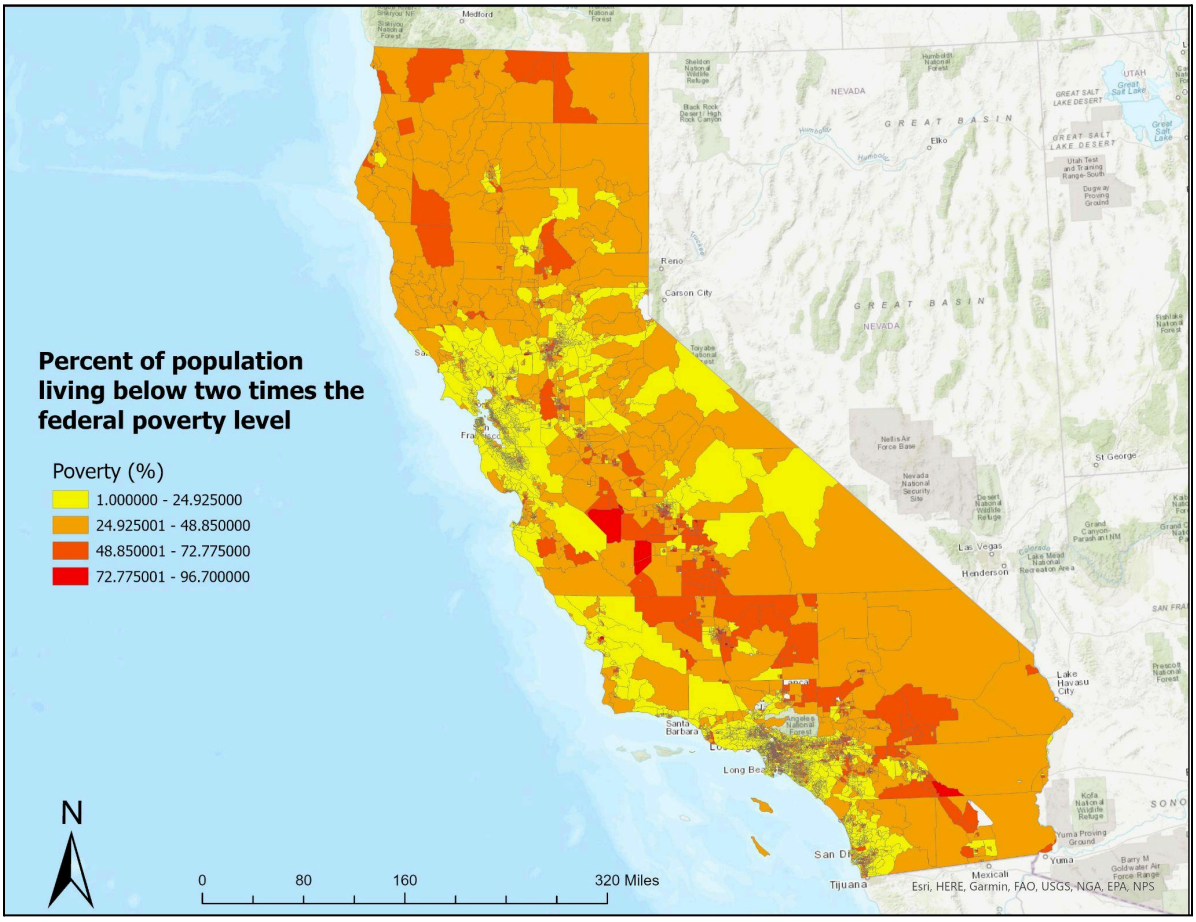

Figure 4. Percent of population living below two times the federal poverty level. In this graph poverty among California zip codes are denoted by percentages. With yellow showing the lowest percentage of poverty and red representing the highest percentage of poverty.

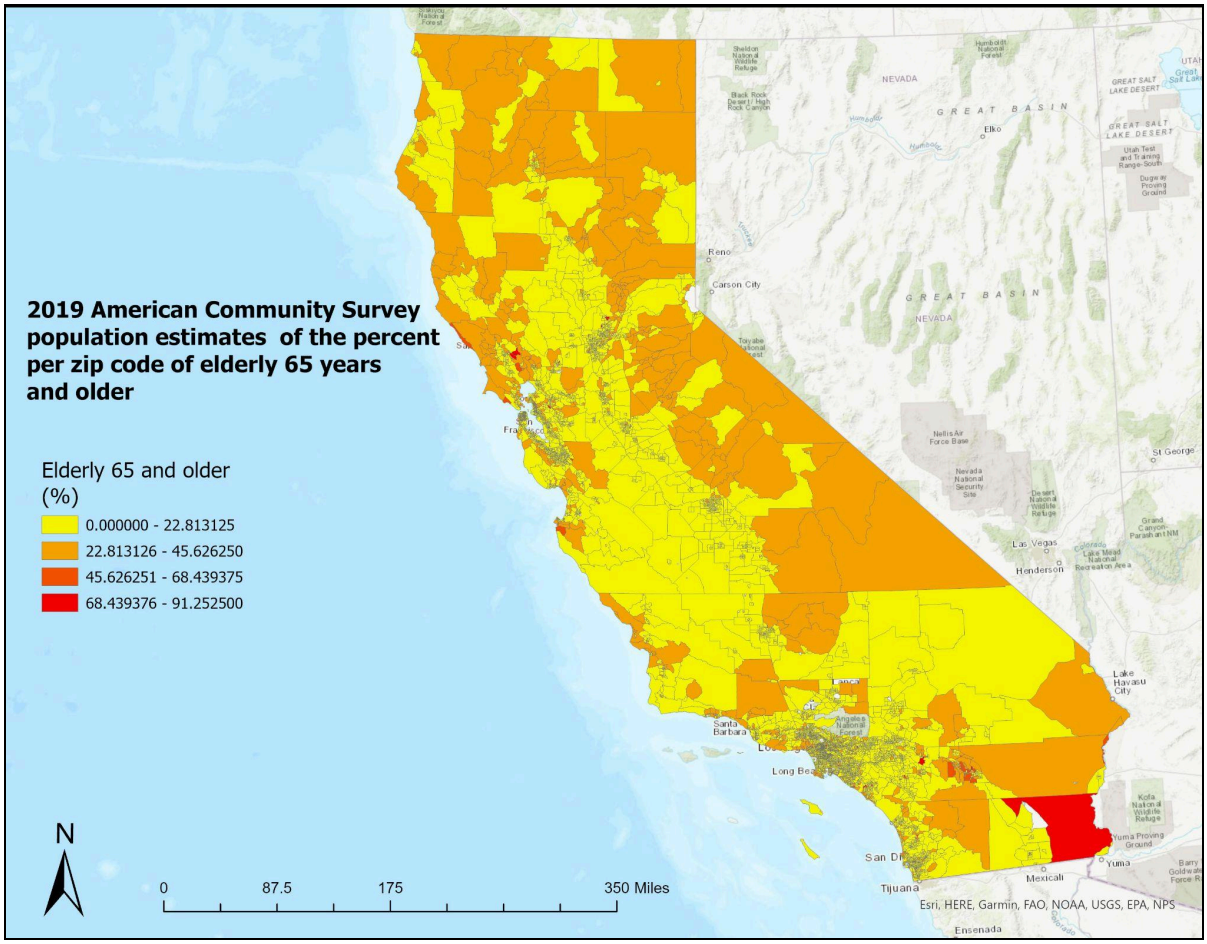

Figure 5. Percentage per zip code of elderly people 65 years and over. In this graph the percentage of elderly people 65 and older is shown by zip code. The yellow represents areas with the lowest percentage of elderly and the red represents areas with the highest percentage of elderly.

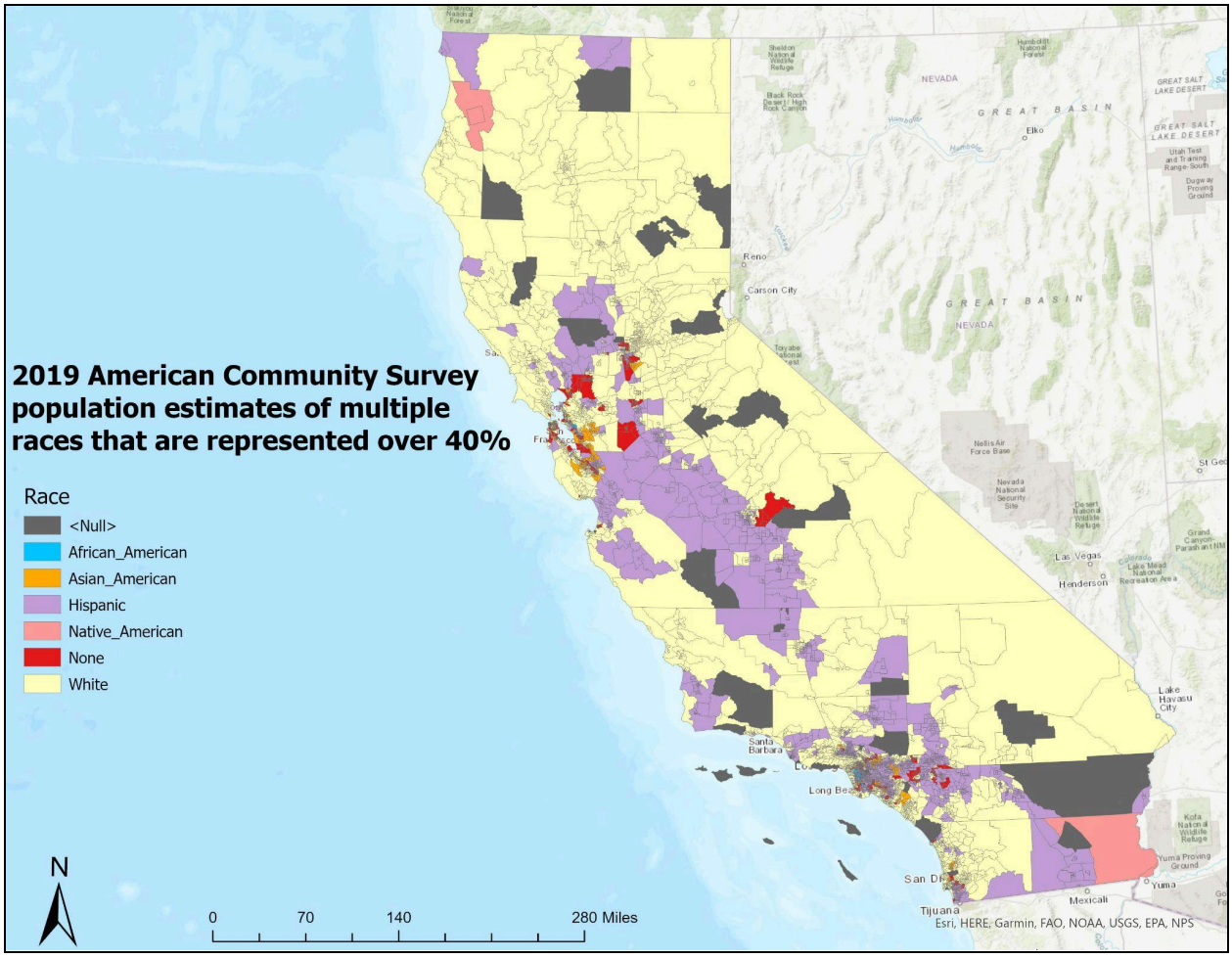

Figure 6. California zip codes by race. This graph shows the racial majority for each zip code represented by groups having over 40% of the population in a given zip code. This is important to note because Ocean Access among white people and people of color differ, and understanding this can help identify which counties need focused policy.

Network Analysis

From running the Network Analysis, a shapefile called “Routes” was created along with attribute tables that detailed the total travel time, the zip code/census tract/block group, and the mpa/nms/ferry/all access point names. This was conducted by NOAA intern, Lucas Lowe over the Summer 2023.

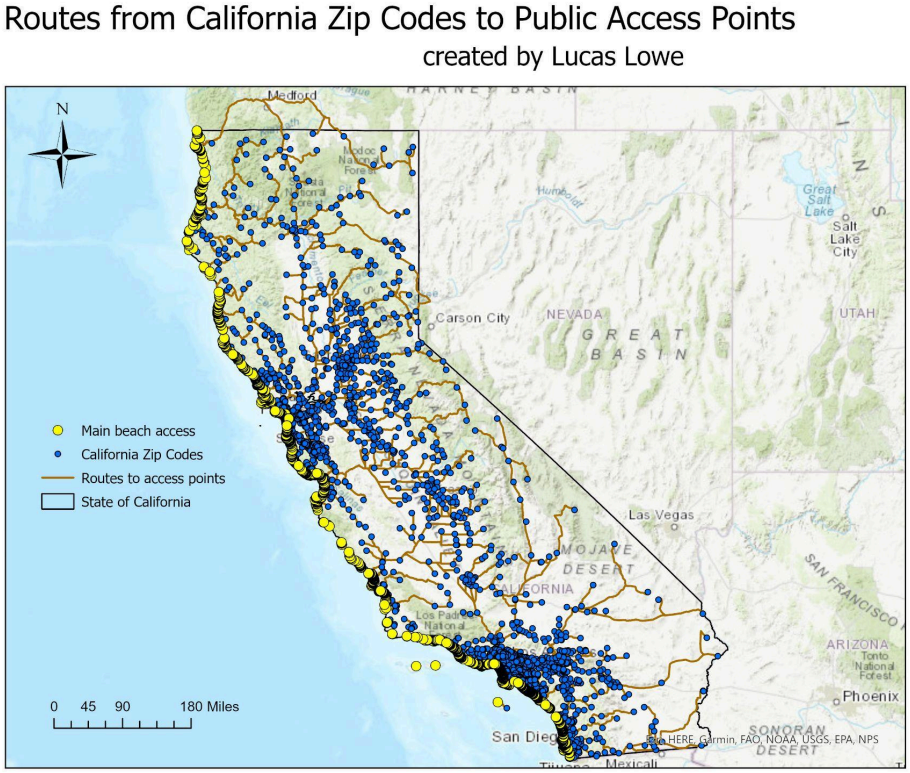

Figure 7. Network Analysis for MPA access points using zip codes. The blue squares indicate the “Incidents" or census tract data which represents the mean centers of population. The purple dots indicate “Facilities” or access points to MPAs along the west coast. The green lines indicate the fastest routes from origin to the destination point. Below the graph of California shows an attribute table labeled “Routes” with a column named “Name” which shows a linked origin and destination point.

Statistical Analysis

Initially, when considering all the data points together, the analysis showed that poverty had a significant effect on total travel time, as indicated by a p-value of less than 0.05. However, further analysis was conducted by dividing the data into two groups based on total travel time: under 70 minutes and over 70 minutes. In both scenarios, poverty did not have a significant effect on travel time. This means that when examining the data separately for shorter and longer travel times, poverty did not emerge as a significant factor influencing travel time. The significance of poverty on travel time only became apparent when considering the aggregate of all data points together. This finding suggests that the relationship between poverty and travel

time may not be straightforward and could be influenced by other factors. Further exploration is warranted to understand the nuances of this relationship and its implications for addressing barriers to access.

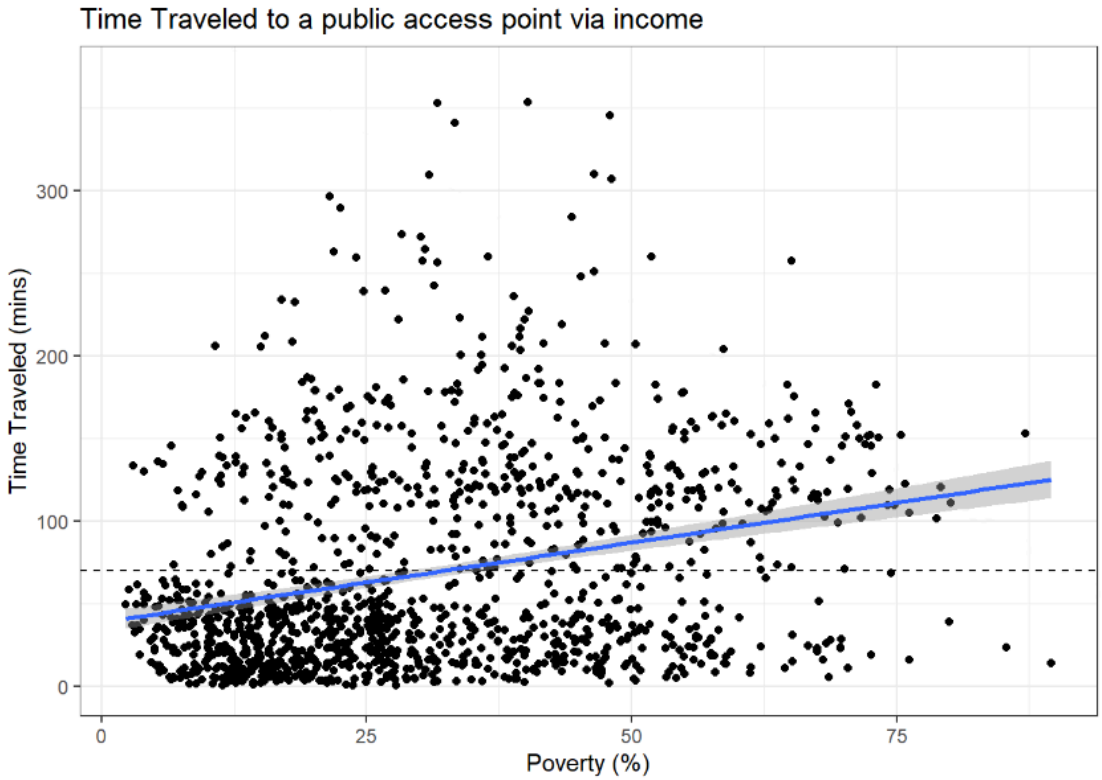

Figure 8. Time Traveled to a public access point via income. This graph shows a positive relationship between poverty and total travel time. The result shows there is a statistical significance (p-value: $< 2.2e^{-16}$) between poverty and total travel time .

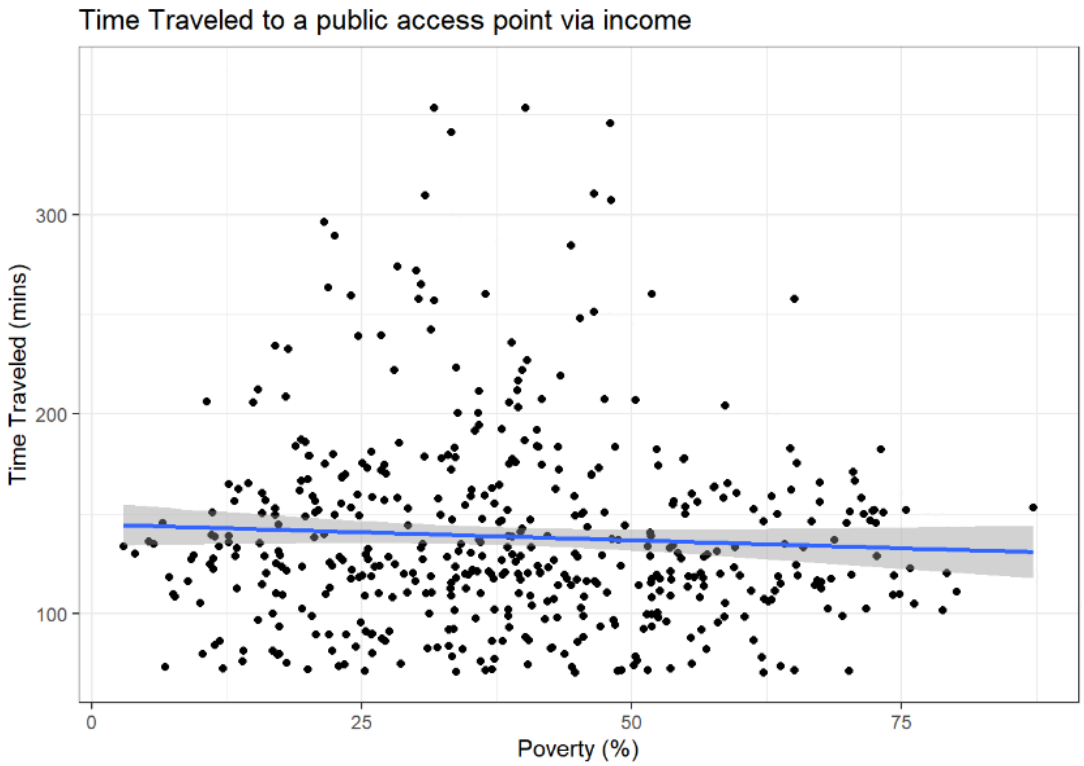

Figure 9. Time Traveled to a public access point via income for travel time of above 70 minutes. This graph shows the relationship between poverty and total travel time for zip codes that are 70 minutes or more away from a public access point. The result shows there is no statistical significance (p-value = 0.2) between poverty and total travel time only beyond 70 minutes of a public access point.

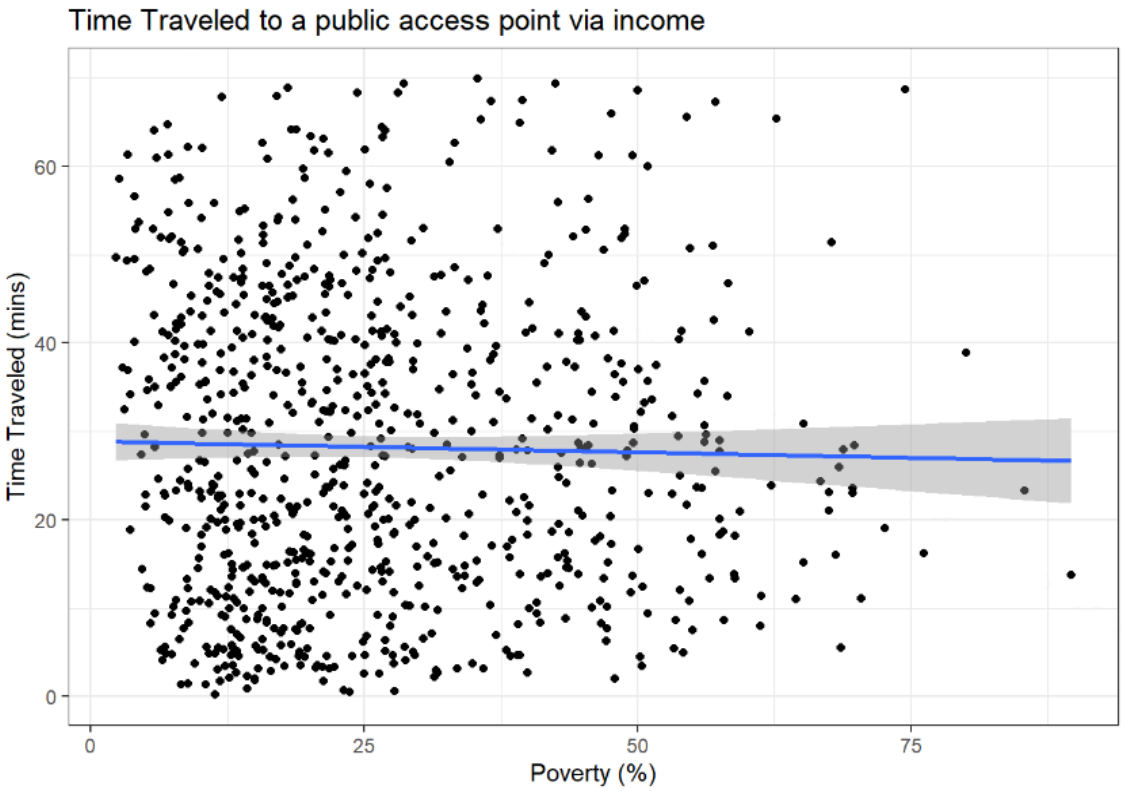

Figure 10. Time Traveled to a public access point via income for travel time below 70 minutes. This graph shows the relationship between poverty and total travel time for zip codes that are under 70 minutes away from a public access point. The result shows there is no statistical significance (p-value = 0.5) between poverty and total travel time only within 70 minutes of a public access point.

The results indicate that age does indeed play a significant role in how long it takes individuals to reach the coast, with older people being more prevalent in areas relatively closer to the coast. Figure 11 visually represents this trend, showing that a larger percentage of elderly individuals (above 65 years old) have shorter travel times. However, there is also a positive correlation between age and total travel time for distances greater than 70 minutes away from the coast. This suggests that a higher percentage of elderly individuals live farther from the coast, potentially facing barriers due to distance. Despite this, the focus on coastal access provides an accurate assessment of how age influences travel time to marine protected areas (MPAs).

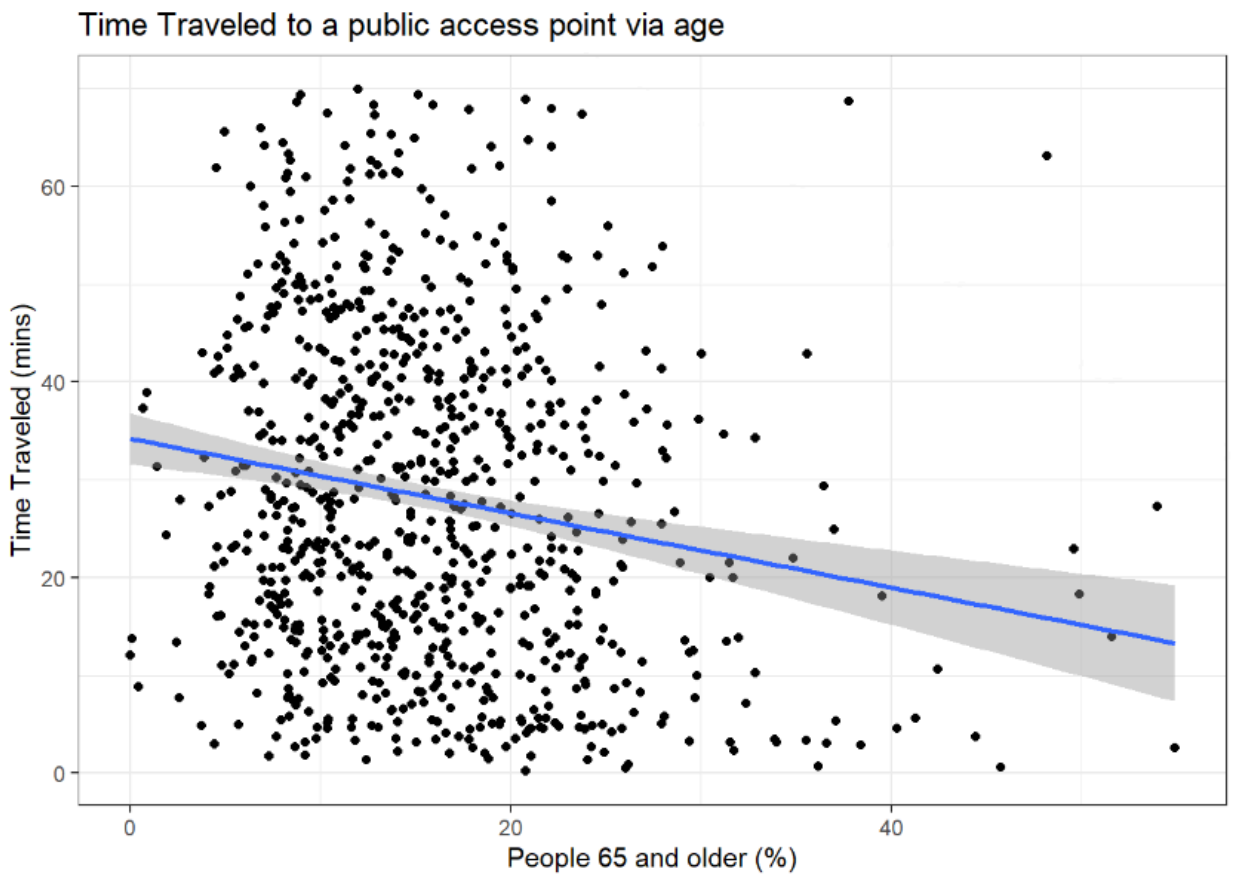

Figure 11. Time Traveled to a public access point via age for travel time below 70 minutes. This graph shows the relationship between elderly people 65 and older and total travel time for zip codes that are under 70 minutes away from a public access point. There is a negative relationship between elderly people 65 and older and total travel time. The result shows there is a statistical significance (p-value = $6.31e^{-}07$) between elderly people 65 and older and total travel time.

The findings regarding the relationship between race and total travel time to a Marine Protected Area (MPA) public access point are significant because they highlight disparities in access to natural resources based on racial demographics. The analysis conducted, using a two-way ANOVA, demonstrates that different racial groups experience varying travel times to reach these access points. The data indicates that, on average, African Americans have the shortest travel time, while White individuals have the longest. This suggests that despite living closer to the coast, African Americans face fewer barriers in accessing these areas compared to their White counterparts. The inclusion of the "No majority" category, representing areas without a dominant racial group, further emphasizes the complexity of racial dynamics in access to coastal resources.

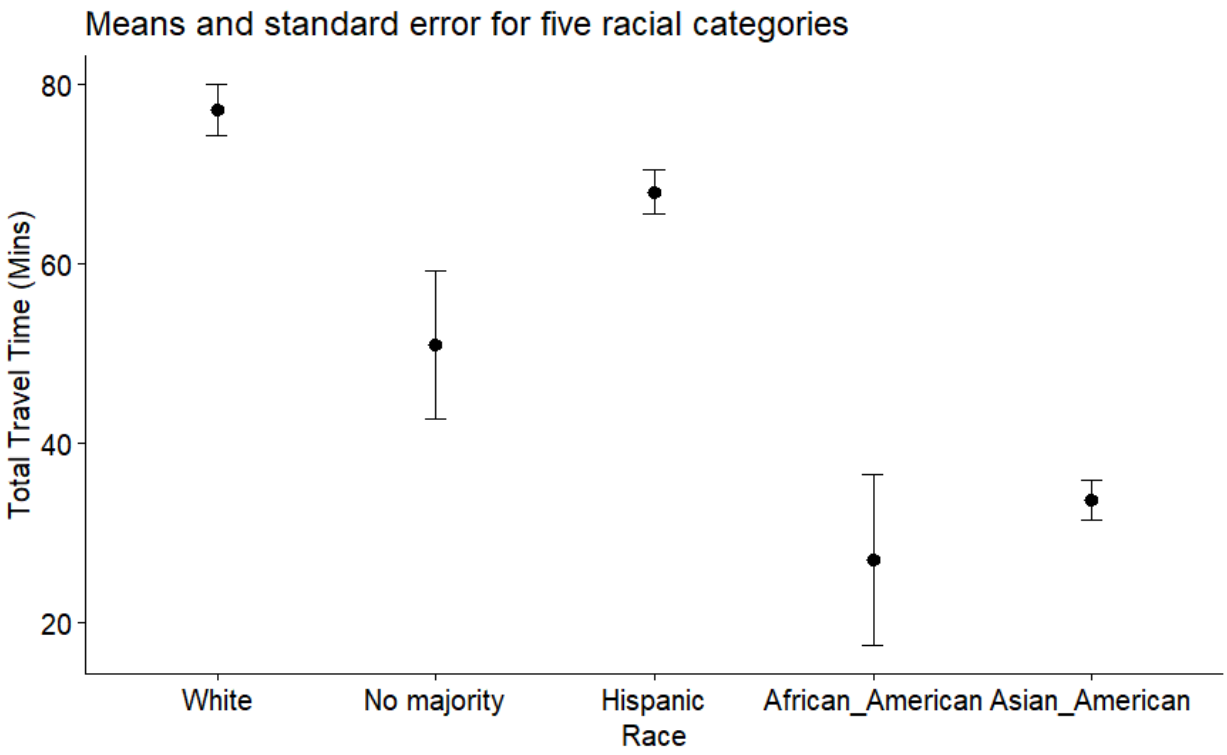

Figure 12. Means and standard error for five racial categories. This graph shows the total travel time in minutes on average for each racial group. The error bars indicate the standard error.

Table 3. Calculations of total time traveled by race

Race	mean	sd	median	IQR	se
African_American	27.014	30.185	15.437	3.365	9.545
Asian_American	33.685	18.617	38.338	26.447	2.225
Hispanic	67.983	49.074	51.585	85.376	2.433
No majority	50.931	42.103	44.328	49.255	8.257
White	77.125	73.458	45.022	109.618	2.821

Firstly, there's a clear relationship between income levels and total travel time to public access points, with zip codes experiencing higher poverty generally located farther away from Marine Protected Areas (MPAs). Secondly, there's a negative relationship between age and travel time, indicating that elderly populations, particularly those over 65, tend to have shorter travel times to the coast, suggesting a higher concentration of elderly individuals nearer to coastal areas. Lastly, the analysis reveals an unexpected result regarding race: contrary to expectations based on EEJ literature review, zip codes with a majority African-American population have the shortest average travel time to public access points. This unexpected finding challenges conventional assumptions and suggests a more complex relationship between race and access to coastal resources. Further research is warranted to better understand these dynamics, and their

implications for equitable access to coastal areas. Contrary to expectations from the environmental justice literature, majority African-American zip codes had the least amount of total travel time on average to public access points.

Objective 3: Subsistence Fishing Literature Review & Database

History of Subsistence Fishing and Inequities in California

Marine fisheries have been a significant part of California's history for thousands of years. There is evidence that humans have lived in coastal California for 10,000 years (Love, 2006). These early inhabitants, subsistence communities, utilized marine ecosystems for food and resources (Love, 2006). NOAA defines subsistence fisheries as "fishing for personal, family, and community consumption or sharing (NOAA Fisheries, 2022)." These communities relied on the richness of California's ecosystems. Fish were the most important source of protein. In Southern California, the Chumash fished in the Santa Barbara Channel and the nearshore waters of the California Channel Islands. They used a variety of methods; hooks and lines, harpoons, and nets, allowing them to fish a wide range of species (Love et al, 2006).

The long history of Spanish occupation and removal of Indigenous communities to missions led to the destruction of this civilization. There was a transition from traditional subsistence fishing practices by indigenous populations to the emergence of commercial fishing sectors. European settlers and the subsequent growth of commercial fishing industries had negative effects on the fishing practices of Indigenous communities through the displacement of these communities away from the coastal lands they inhabited. Around the time before and during the Gold Rush, California had a wave of immigrants who settled in the region. By the 1990s, MPAs were introduced, which combined recreational and commercial entities together (Love et al, 2006).

Management and regulatory frameworks put in place to govern California's marine fisheries were evolving. There were discussions around conservation efforts, resource sustainability, and the establishment of fishing regulations to prevent overfishing and protect vulnerable species. It is not to say that it was devoid of environmental injustices. Before 1940, different nationalities were concentrated in specific ports, with Scandinavians in northern California, Italians in San Francisco and Monterey, and Japanese in Long Beach and Monterey, and San Pedro. However, by 1948, significant changes had taken place due to World War II, which led to restrictions on Japanese fishing, naturalization requirements for other foreign nationals to obtain fishing licenses, and the drafting of young fishermen into the war effort. (Love et al, 2006).

Between 1850 and 1900, the only significant attempts to impose restrictions on marine fishery were focused on discriminatory laws targeting Chinese communities. In 1880, one such law prohibited Chinese immigrants from fishing in state waters, along with other anti-Chinese legislation. Although this law was later deemed unconstitutional by a federal court for violating

the equal protection clause, it exemplified the deep-seated hostility towards the Chinese community. After being forcibly expelled from the gold mining sector, similar efforts were frequently made to drive Chinese communities out of the fishing industry and other economic sectors in California (Love et al, 2006).

How Subsistence Fishers Interact with MPAs and Ocean Access in California

Greater diversity of stakeholder engagement in the process of implementing ecosystem-based management has led to higher success. In California, commercial fishers have participated in the implementation of MLPA. However, pier and shore anglers have not participated as much in this process. Although the California Department of Fish and Game is required to send official updates regarding regulations and policies to fishers with licenses, California does not require anglers to apply for this license to receive this information (Stevenson, 2012).

A study was conducted to address the gap in engagement with pier anglers and aimed to generate information on their understanding and sentiments towards MPAs. The researchers tried to educate anglers about the MLPA implementation process in southern California and provide opportunities for their involvement (Stevenson, 2012). The study surveyed a total of 3,030 pier anglers over a 12-month period. The findings showed that 78% of the surveyed anglers solely engaged in subsistence fishing from piers and shore without the use of boats (Stevenson, 2012). Furthermore, the majority of participants, approximately 84.6%, identified as non-White/Euro-American and spoke English as a second language. As noted by the author, "the majority (56%) of the anglers indicated they were unfamiliar with MPAs" (Stevenson, 2012).

This statistic is critical as it demonstrates a gap in the executive order that was passed in 1994. According to the 1994 executive order "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations":

> Sec. 5–5. Public Participation and Access to Information.
>
> (a) The public may submit recommendations to Federal agencies relating to the incorporation of environmental justice principles into Federal agency programs or policies. Each Federal agency shall convey such recommendations to the Working Group.
>
> (b) Each Federal agency may, whenever practicable and appropriate, translate crucial public documents, notices, and hearings relating to human health or the environment for limited English-speaking populations.
>
> (c) Each Federal agency shall work to ensure that public documents, notices, and hearings relating to human health or the environment are concise, understandable, and readily accessible to the public.

> (d) The Working Group shall hold public meetings, as appropriate, for the purpose of fact-finding, receiving public comments, and conducting inquiries concerning environmental justice. The Working Group shall prepare for public review, a summary of the comments and recommendations discussed at the public meetings.

Based on the literature, the above is rarely addressed, and this law from 1994 may be outdated. There appears to be a gap in this law that needs to be addressed. As mentioned earlier, since pier fishing does not require a license in California, there is no requirement for them to get information regarding policies. Therefore, these communities which, according to the survey, speak predominantly English as a second language, will not receive access to translated public documents as mentioned in sections 5-5 of the executive order.

The article highlights this study as an example of an alternative and customized outreach approach specifically designed to engage a unique stakeholder group that had been previously engaged. Subsistence anglers, who would potentially be affected by the implementation of the MLPA, were targeted for their input and participation (Stevenson, 2012). By understanding their perspectives and gaining their support, the study contributes to ensuring the inclusivity and effectiveness of MPA planning processes in southern CA (Stevenson, 2012).

Based on the 2022 Equity plan, the Ocean Protection Council found that one-fifth of California residents engaged in some type of marine fishing. Over 50% of people in Southern California visit the coast for recreational purposes. 52% of pier fishers stated that this was “an important source of food” for them. Highlighting the importance of having these fishers be represented in the decision-making process to ensure food security.

Although the California Coastal Act ensures access for all, numerous studies show that many low-income households and communities of color do not visit the coast as frequently as their counterparts in California. The region closest to the coast with the best access points for all recreational activities is overwhelmingly white and wealthy (Reineman, Wedding, Hartge, McEnery, & Reiblich, 2016). Due to time constraints, more data is needed to determine the recreational uses of the California coast. This includes the quality of the data, characteristics of the activity, information about the populations of users, methods of data collection, and systems for data management.

Objective 4: Social Implications of Targeted Species Threats

Social Equity Analysis

Based on the CalEnviroScreen cumulative impact score, we determined which zip codes in all of California are considered disadvantaged and to what extent (Figure 13). We also

determined which zipcodes subsistence fishers are coming from and which disadvantaged communities they are from (Figure 14a). The number of subsistence fishers from each zip code was also calculated (Figure 14b.) We also calculated the number of subsistence fishers fishing at each county in coastal California and found there is the greatest number of fishers in Los Angeles County (Figure 15).

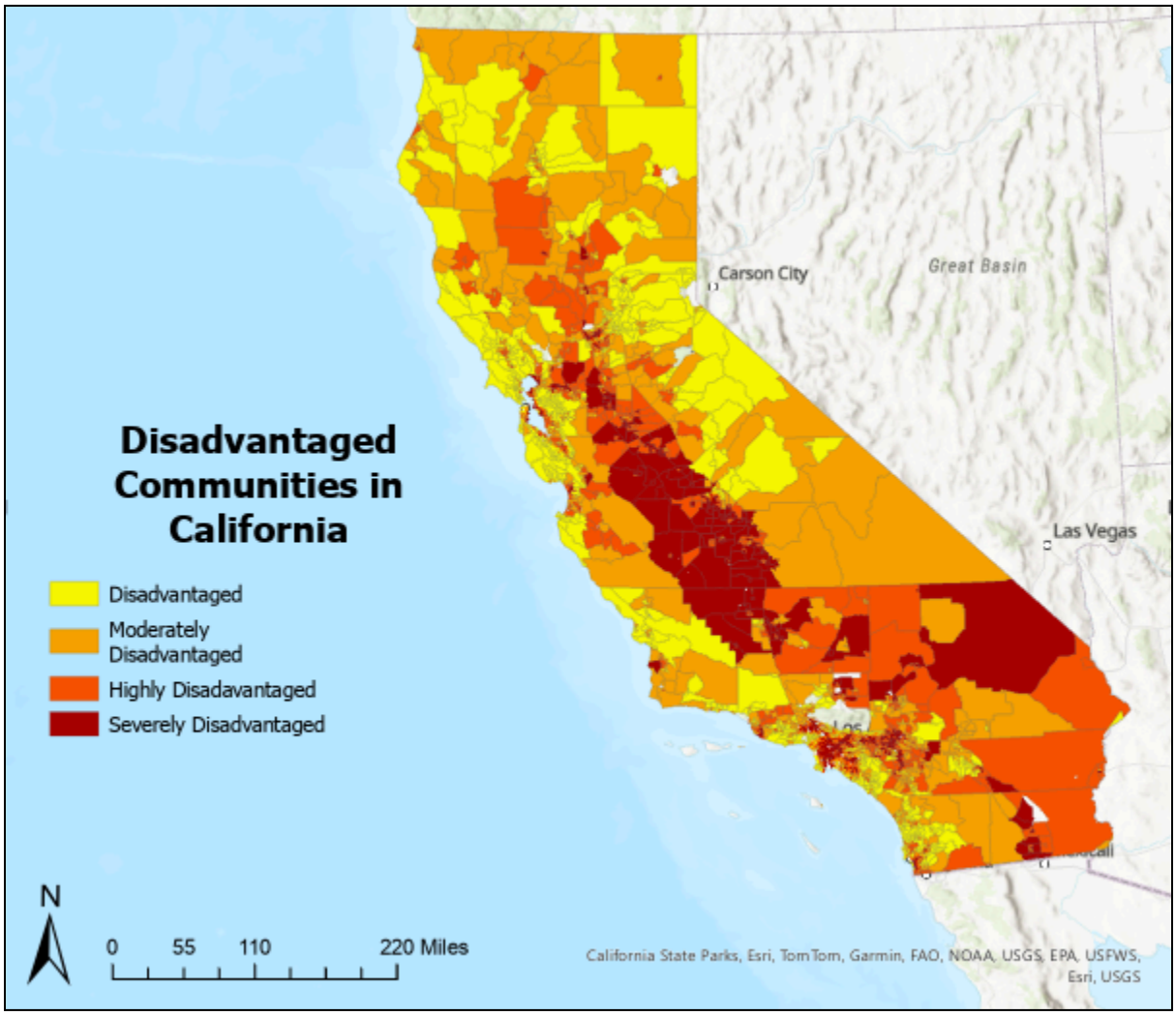

Figure 13. Disadvantaged Communities in California. Different levels of how disadvantaged a community is, based on zip codes, in California. Yellow indicates disadvantaged communities; Orange indicates moderately disadvantaged communities, darker orange indicates highly disadvantaged communities, and darker red indicates severely disadvantaged communities.

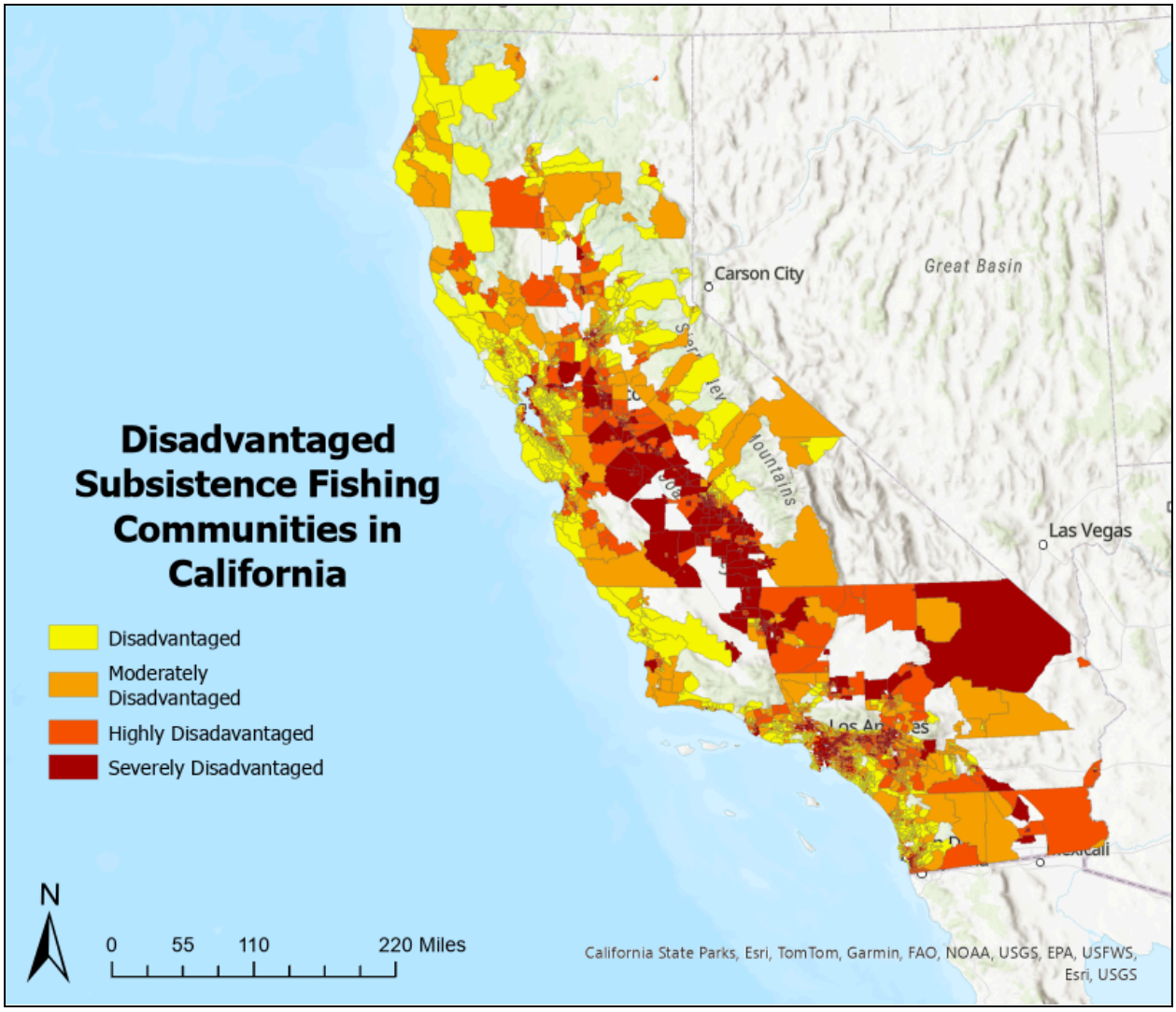

Figure 14a. Disadvantaged Subsistence Fishing Communities in California. Different levels of how disadvantaged a subsistence fishing community is, based on zip codes, in California. Yellow indicates disadvantaged communities; Orange indicates moderately disadvantaged communities, darker orange indicates highly disadvantaged communities, and darker red indicates severely disadvantaged communities.

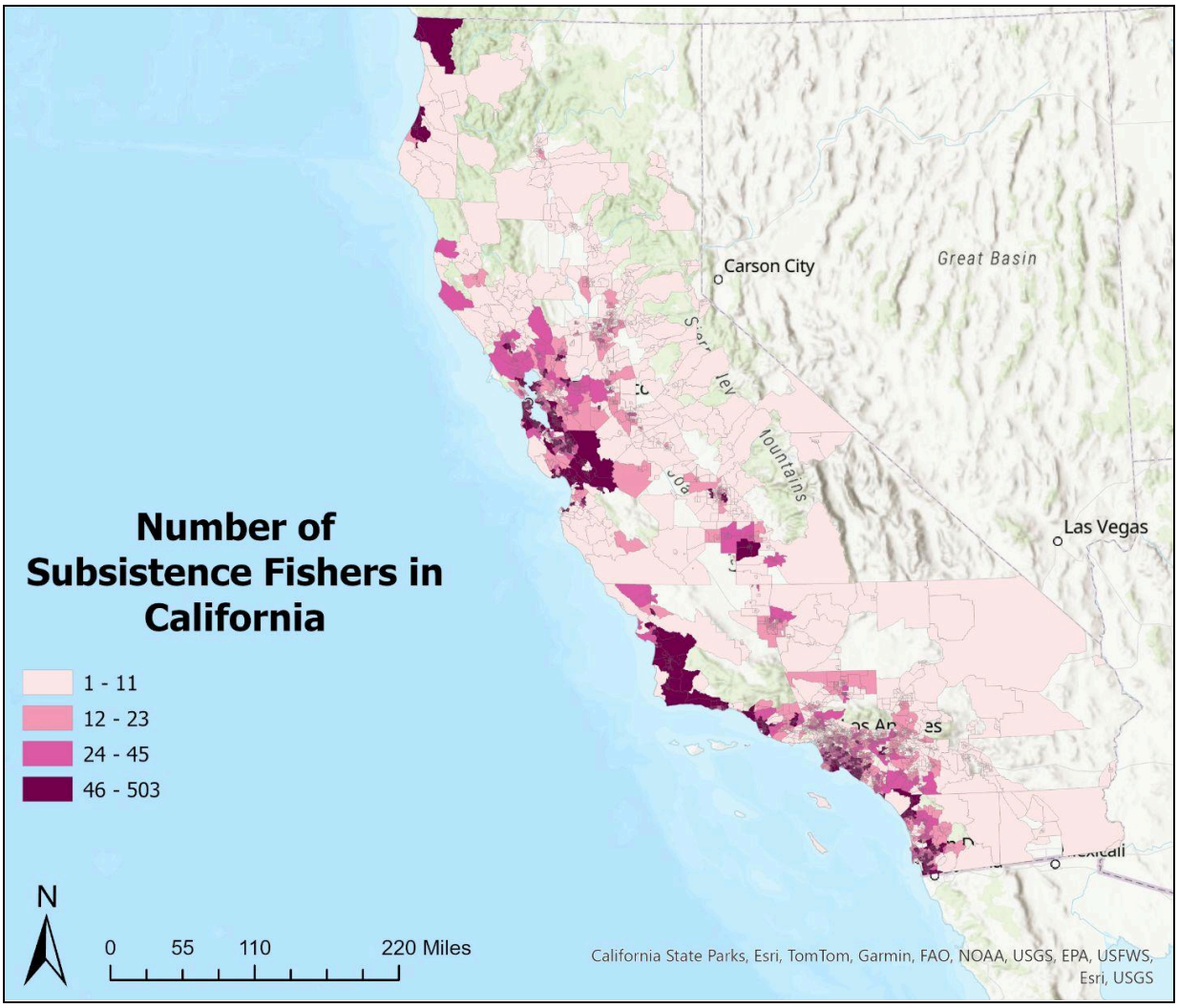

Figure 14b. Number of Subsistence Fishers for Each Zip Code in California. Darker shades of pink indicate a greater number of fishers.

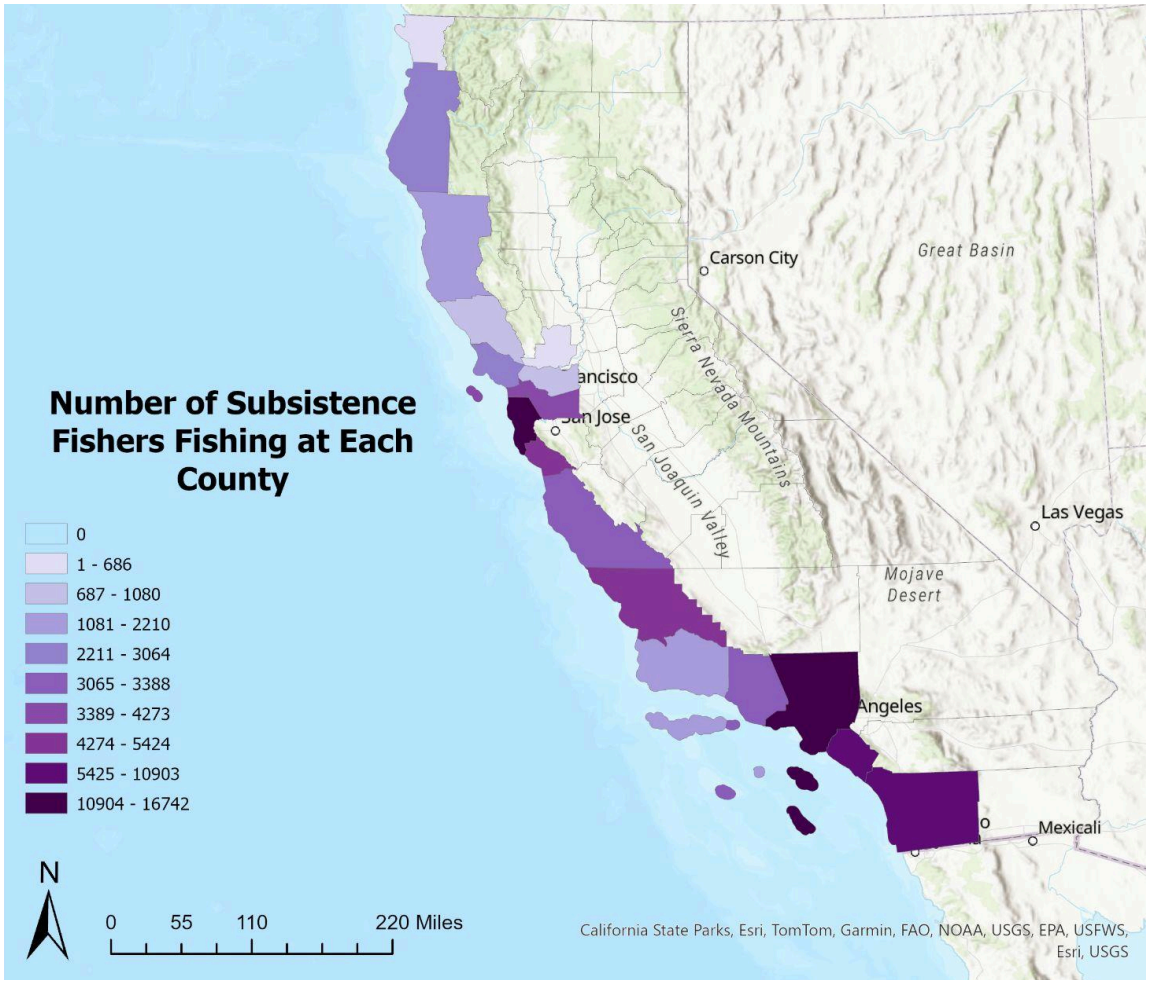

Figure 15. Distribution of Subsistence Fishers Across California Counties. Depicts the number of subsistence fishers engaged in fishing at each county, with darker shades of purple indicating higher concentrations of individuals.

Hotspot Analysis of Threats to Target Species

Based on the R analysis, we determined the top five most targeted species, including their common name, scientific name, and the number of each species that were caught (Table 4). The Pacific chub mackerel was the most harvested species by subsistence fishers, with 79,925 total caught. The top 5 species were the Pacific chub mackerel, dungeness crab, red rock crab, jacksmelt, and northern anchovy. For our hotspot analysis, we created maps where species richness is overlaid with areas of highest impact of ocean-based pollution for each of the top 5 species caught (Figures 16-20). The areas of high to severe pollution impact for the dungeness crab are distributed along the entirety of the California coast with a large concentration found off the coast of Los Angeles (Figure 16). The northern anchovy has a similar pollution impact distribution along the entire coast, however, with more areas of severe impact (Figure 17). The pollution impact for the Pacific chub mackerel is distributed along the entire coast with areas of severe impact found further offshore (Figure 18). Ocean-based pollution impact is concentrated along the San Francisco Bay and coast of Los Angeles for the red rock crab (Figure 19). Greater

impact levels are observed in the San Francisco Bay, while low to high impact levels are observed in Los Angeles (Figure 19). There is high variability in the ocean-based pollution impact levels for the jacksmelt, with a greater concentration found along the coast of Los Angeles (Figure 20).

Table 4. Top 5 Marine Species. Count of the top five targeted species caught by subsistence fishers in California.

Common Name	**Scientific Name**	**Number Caught**
mackerel, chub (Pacific)	*Scomber japonicus*	79925
crab, dungeness	*Metacarcinus magister*	38944
crab, red rock	*Cancer productus*	28363
smelt, (jacksmelt)	*Atherinopsis californiensis*	24649
anchovy, northern	*Engraulis mordax*	21182

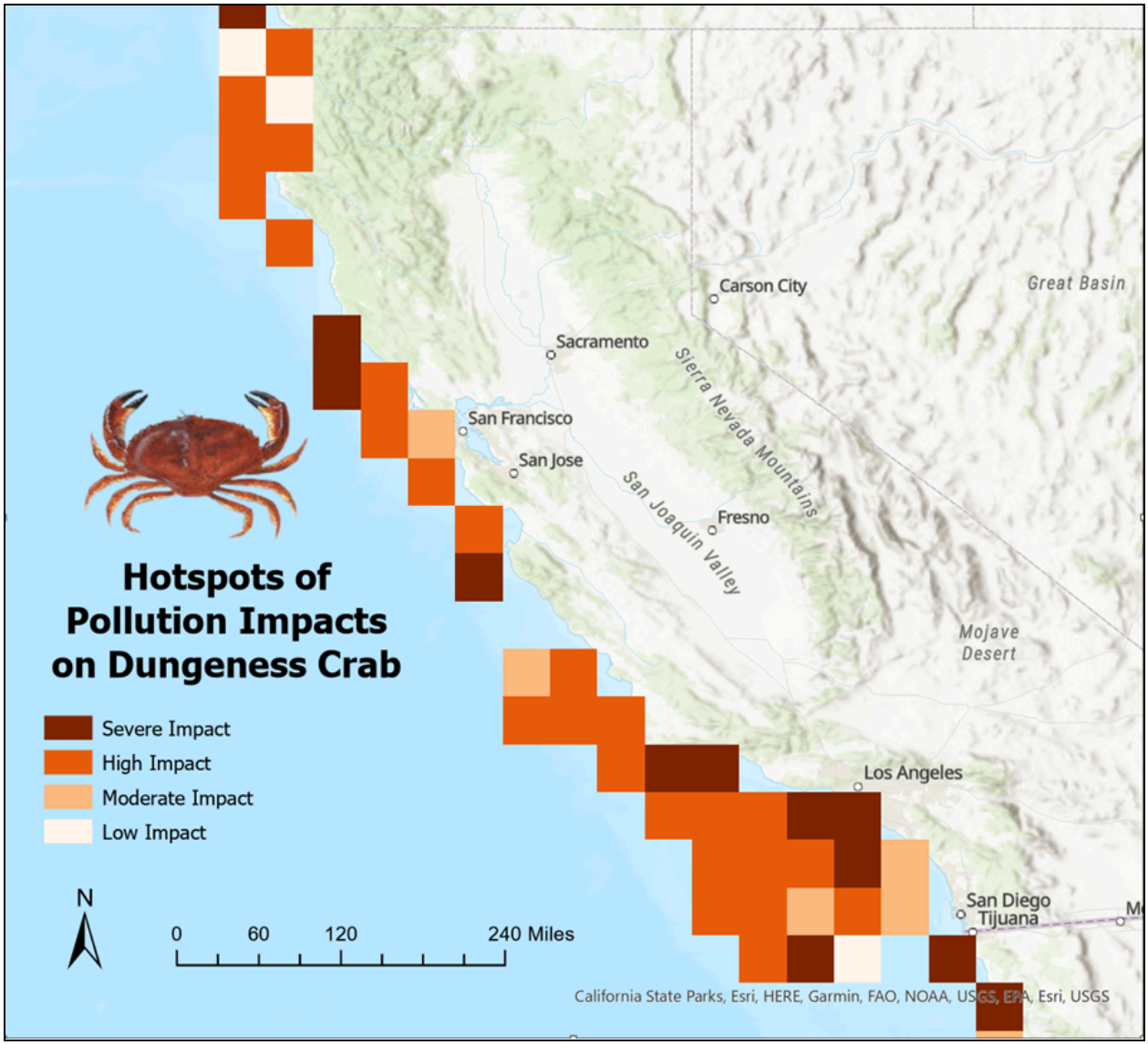

Figure 16. Hotspots of Pollution Levels Impacting Dungeness Crab (*Metacarcinus magister*) Along the California Coast. Colored areas represent the extent of influence pollution exerts on dungeness crab. Regions in darker red indicate areas experiencing greater impacts from ocean-based pollution. The impact level is determined based on the numerical value of each hotspot location.

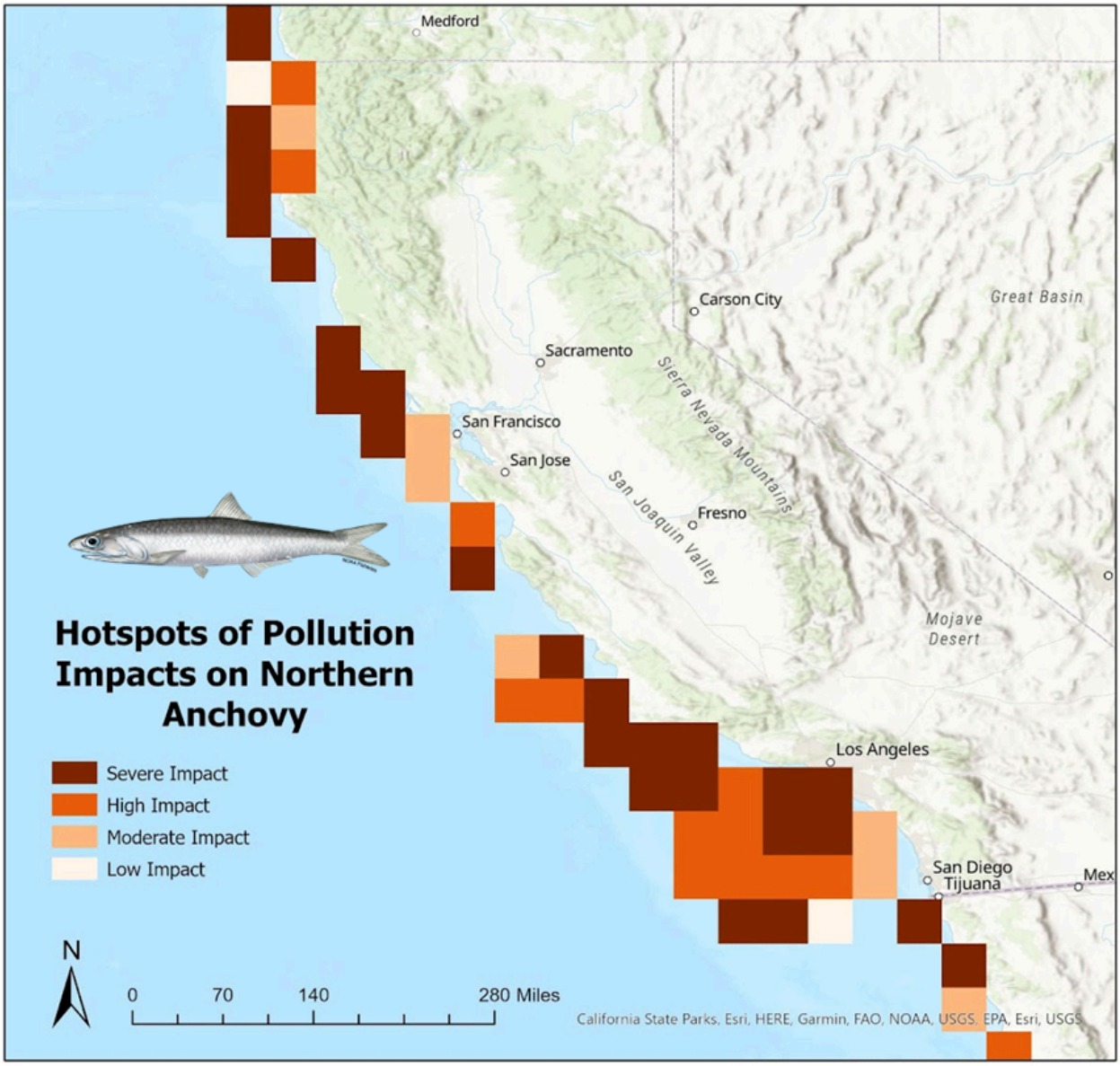

Figure 17. Hotspots of Pollution Levels Impacting Northern Anchovy (*Engraulis mordax*) Along the California Coast. Colored areas represent the extent of influence pollution exerts on northern anchovy. Regions in darker red indicate areas experiencing greater impacts from ocean-based pollution. The impact level is determined based on the numerical value of each hotspot location.

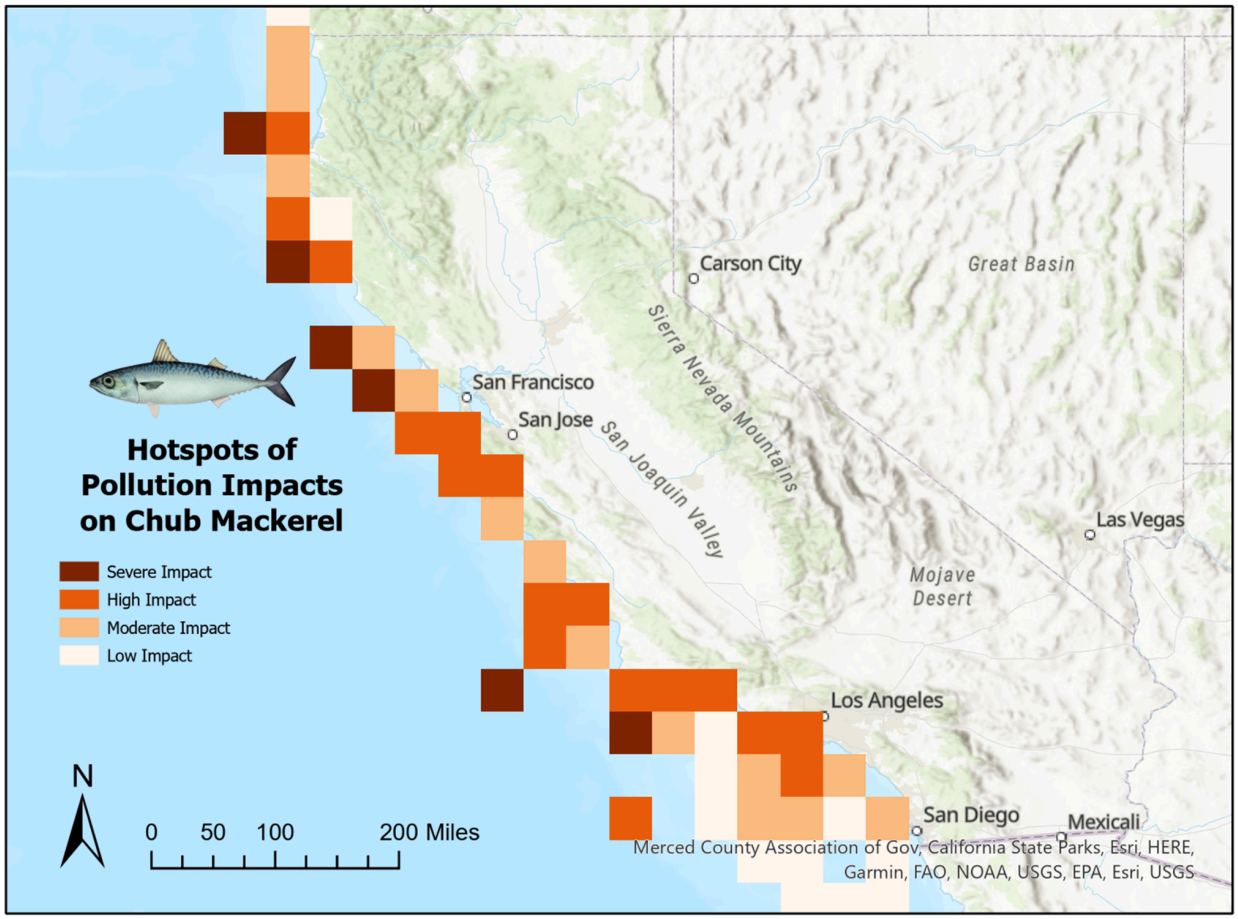

Figure 18. Hotspots of Pollution Levels Impacting Pacific Chub Mackerel (*Scomber japonicus*) Along the California Coast. Colored areas represent the extent of influence pollution exerts on Pacific chub mackerel. Regions in darker red indicate areas experiencing greater impacts from ocean-based pollution. The impact level is determined based on the numerical value of each hotspot location.

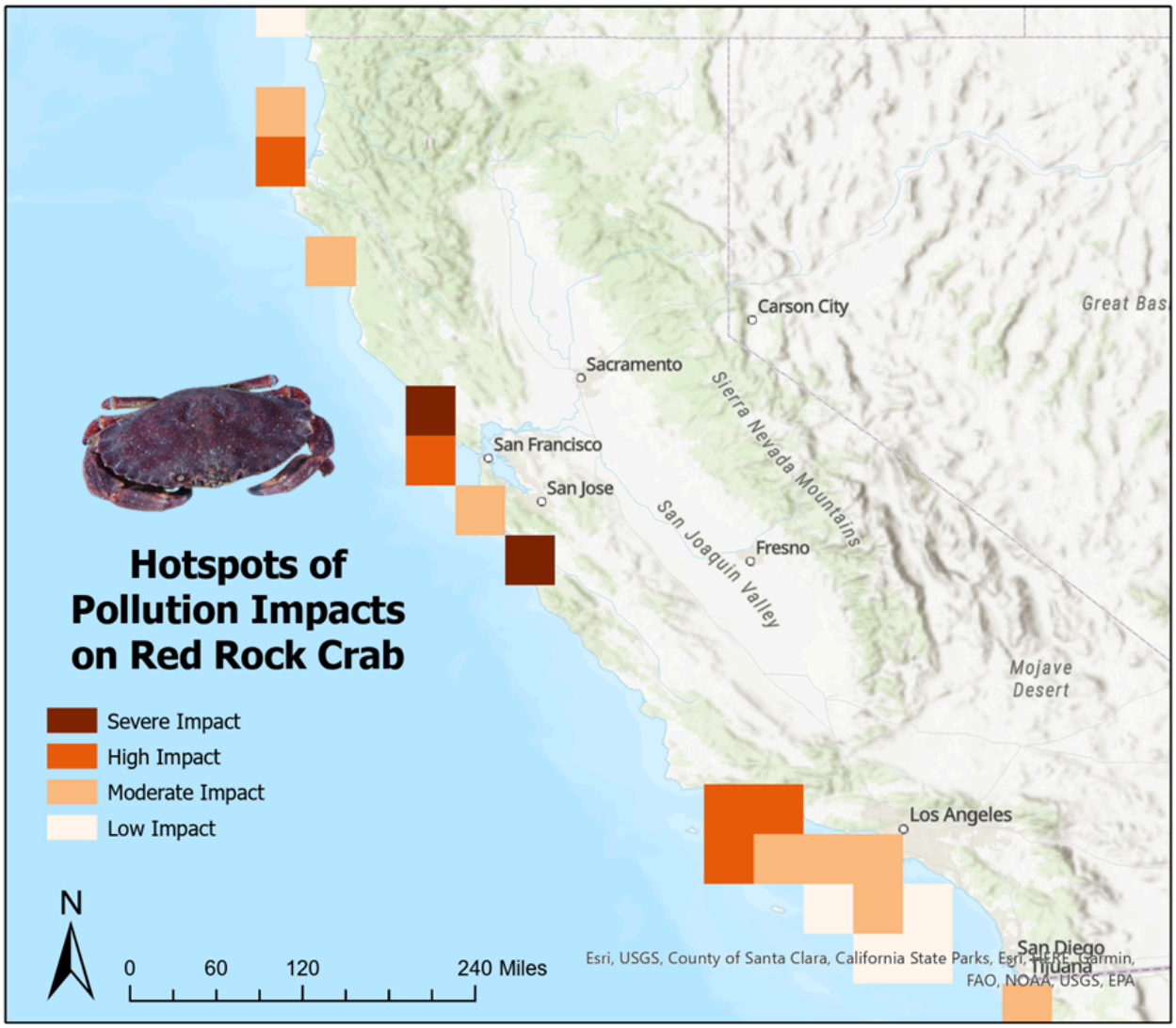

Figure 19. Hotspots of Pollution Levels Impacts Red Rock Crab (*Cancer productus*) Along the California Coast. Colored areas represent the extent of influence pollution exerts on red rock crab. Regions in darker red indicate areas experiencing greater impacts from ocean-based pollution. The impact level is determined based on the numerical value of each hotspot location.

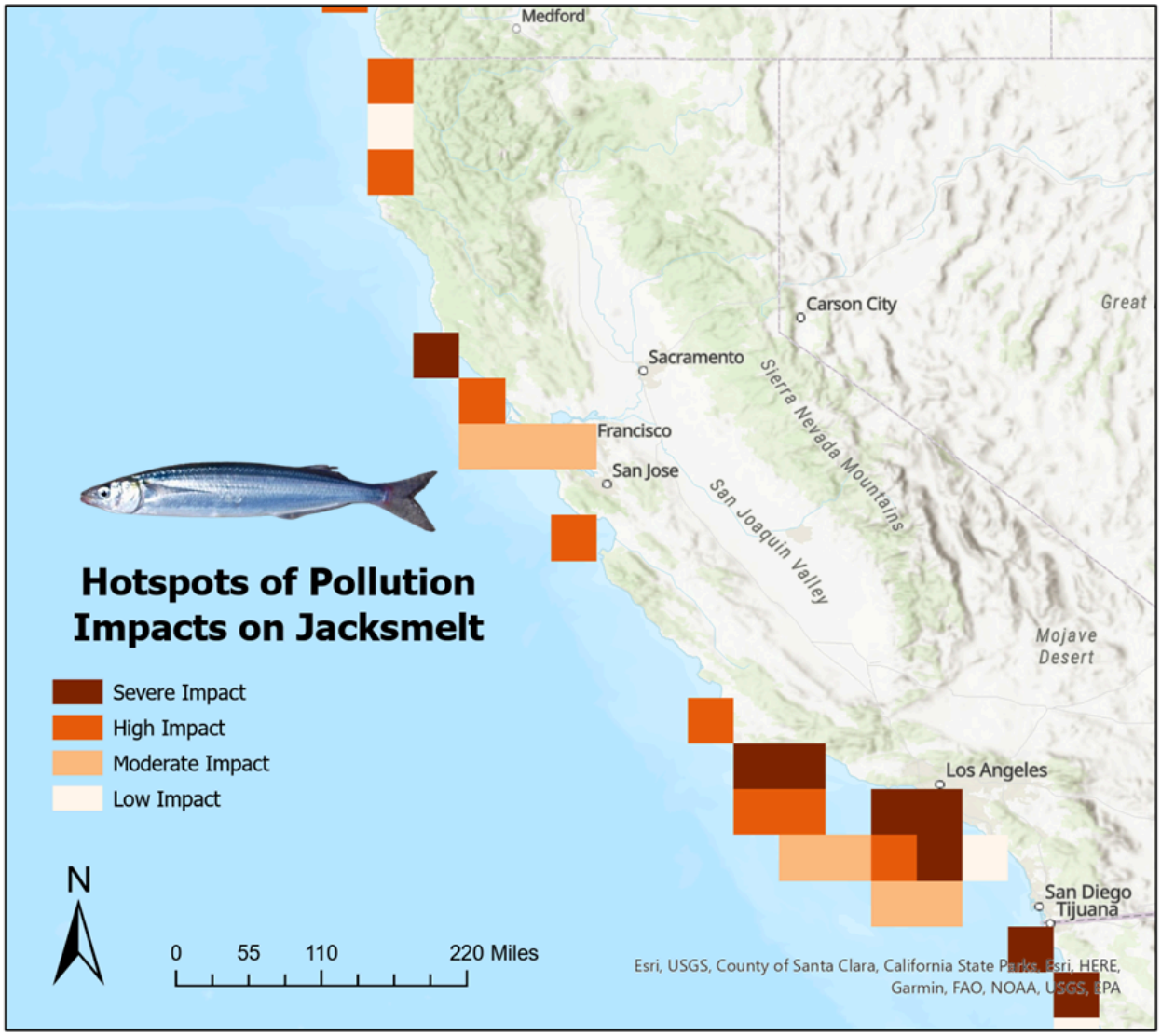

Figure 20. Hotspots of Pollution Levels Impacting Jacksmelt (*Atherinopsis californiensis*) Along the California Coast. Colored areas represent the extent of influence pollution exerts on jacksmelt. Regions in darker red indicate areas experiencing greater impacts from ocean-based pollution. The impact level is determined based on the numerical value of each hotspot location.

Discussion

Objective 1: EEJ Literature Review & Database

The exploration of EEJ has unveiled a multifaceted landscape shaped by principles, challenges, and shifting policies aimed at ensuring equitable access to resources and safeguarding communities from environmental hazards. Our overview has examined the core dimensions of EEJ, including distributive justice, procedural justice, and recognitional justice, which form the bedrock for addressing environmental health disparities (Bullard, 2001; Bennett, 2018; Gauna & Foster, 2003). These principles revolve around fair resource distribution, inclusive decision-making processes, and acknowledging the intrinsic worth of all communities.

In the context of our extensive oceans, a recurring theme emerges—Blue Justice (Parsons, 2021; Bennett, 2023; Dawson, 2018). This often-overlooked facet of EEJ emphasizes the significance of ensuring historically marginalized coastal communities can access marine opportunities while being shielded from environmental harm. With oceans covering over 70% of Earth's surface, disparities in access and benefits emphasize the importance of incorporating Blue Justice into the EEJ discourse in the 21st century.

Our examination of governance and policymaking has revealed policy shifts over time through various Federal and State Executive Orders (Appendix 1). These orders have embraced a broader interpretation of EEJ, incorporating climate justice principles rather than equitable access to nature and its resources, including oceans. A notable 21-year policy gap from 2000 to 2021 beckons further exploration into the factors that contributed to this hiatus (Appendix 1). The resurgence of EEJ policies since 2021 offers an opportunity for a deeper dive into the reasons behind this renewed emphasis.

It is imperative for the policy language to consider the diverse needs and interests of minority communities in the design of outdoor recreation and park access initiatives. By enhancing safety measures, promoting community engagement, and offering affordable coastal accommodations, we can work toward ensuring that individuals from all backgrounds have equitable access to these resources. Easing the economic disparities that limit access to publicly funded park and recreation resources is pivotal. It highlights the need to address these inequalities to provide better opportunities for economically disadvantaged Americans.

Federal and state agencies governing natural resources and oceans have also emphasized EEJ principles, prioritizing inclusivity, equitable protection, and meaningful community involvement (Appendix 2). These agencies, with varying missions, share a common commitment to equitable protection against environmental hazards and access to a healthy environment. However, their definitions differ in scope and community interpretations, reflecting their unique roles and responsibilities within EEJ (Appendix 2). The release of Equity plans by certain state-level agencies demonstrates a commitment to addressing environmental injustices

(Appendix 2). Extensive research on EEJ commitments across state agencies could provide valuable insights into state-level EEJ landscapes (Appendix 3).

The future of EEJ is marked by both challenges and opportunities. The expansion of EEJ to encompass blue justice and equitable access to nature reflects a growing awareness of the interplay between environmental disparities and climate change. Comprehensive state-level analysis and the development of Equity plans can further EEJ goals. Environmental education, with a focus on intersectionality, promoting inclusivity through community engagement, and making coastal accommodations more affordable, can empower communities to engage in EEJ initiatives. The pursuit of EEJ represents a collective endeavor aimed at fostering a world where the distribution of environmental benefits is equitable and environmental burdens are shared justly while acknowledging the intrinsic worth of all individuals and the interconnectedness of our planet. This vision is a call to continued diligence and exploration by communities, scholars, policymakers, and advocates in the years ahead.

EEJ & Equal Coastal Access Recommendations

To address the challenges and harness the opportunities in EEJ, several recommendations should be considered:

1. **Enhancing Coastal Safety Measures and Accessibility:** To address concerns about safety and the fear of crime in coastal areas, it is essential to implement strategies that enhance safety and comfort for all beachgoers (Bennett, 2023). This includes increasing lighting along coastal areas, especially in the evenings, to provide well-lit and safe environments. A couple of ideas include installing an alarm system along coastal areas, building charging stations for phones, and having lifeguards become a requirement at beaches. It is highly recommended that there are more signs in coastal areas that are translated into other languages, including but not limited to Spanish, Chinese, Braille, Vietnamese, and so on. It is recommended to prioritize a comprehensive examination and a steadfast commitment to dismantling systemic barriers, with the aim of fostering a more inclusive and equitable environment[24] for all beachgoers and surfers, regardless of their racial background. This involves implementing policies, initiatives, and educational programs that actively address the existing disparities in coastal access and recreational opportunities, ensuring that all individuals can enjoy these natural spaces without facing systemic obstacles based on their race, ethnicity, sexual preference, or disability.
2. **Promoting Inclusivity Through Community Engagement**: Hosting more events and programs aimed at encouraging participation from minority communities is the right step in promoting equitable access to coastal resources. These events should be designed to be inclusive and representative. Collaboration with local community leaders and

[24] **Inclusive and Equitable Environment:** The establishment of a fair and welcoming space that accommodates the needs and perspectives of all stakeholders, irrespective of their background or identity. As informed by Executive Order 14008**.**

organizations can help plan events that cater to the unique needs and preferences of different demographic groups, fostering a sense of belonging and involvement (Bennett, 2022; Stodoskla, 2018; Garcia, 2013; Garcia, 2017). Organizations like Outdoor Afro (Outdoorafro.org), and Brown Girl Surf (browngirlsurf.com), which celebrate and inspire Black and Brown connections and leadership in nature, offer valuable models for engaging minority communities with outdoor education, recreation, and conservation. Similarly, GreenLatinos (GreenLatinos.org), with an active community of Latino/a/x, draws strength from cultural power to demand equity, dismantle racism, and achieve victories in climate justice. Initiatives like Outdoor Afro, Brown Girl Surf, and Green Latinos contribute to the broader mission of fostering diverse and inclusive outdoor experiences. In addition to these highlighted organizations, countless others share a commitment to fostering diverse and inclusive outdoor experiences. Recognizing the wealth of expertise and perspectives within these groups is a step forward in amplifying their voices and providing platforms that empower them to contribute meaningfully to the ongoing dialogue on equitable access to coastal resources.

3. **Affordable Coastal Accommodations:** Making parking and hotel accommodations more affordable for economically disadvantaged people in coastal regions, especially in states like California with high tourist demand, can significantly contribute to equitable access. By implementing pricing policies that consider the financial constraints of various income groups, it is possible to ensure that all individuals and families have the opportunity to enjoy the coast without being burdened by high costs. Strategies like affordable parking rates and subsidized accommodations can help make coastal visits more accessible while meeting the preferences of visitors who, on average, are willing to pay under $10 a day for parking (Christensen & King, 2017; Bennett, 2023; Floyd, 1998; Stodolska, 2012). It is worth noting that such user fees, including parking and day-use fees, can serve as a vital part of the revenue stream that supports parks in California (Christensen & King, 2017). These fees contribute to the enhancement of amenities that enrich visitors' experiences along the coast, making them an integral part of ensuring long-term access and sustainability.
4. **Comprehensive State-Level Analysis**: A thorough examination of EEJ policies and definitions across all U.S. states is essential to understand variations and commonalities. As part of this broader examination, the 'Equity in California Ocean Access and Management Project' (www.californiaoceanaccessandmpas.com) serves as a noteworthy initiative. This project seeks to illuminate the dynamics of how California individuals from disadvantaged and severely disadvantaged communities, as defined by the U.S. Census, as well as Tribal communities, access, use, relate to, and value the ocean. A key aspect of the investigation involves assessing the role of Marine Protected Areas (MPAs) in either amplifying or diminishing these benefits for people across diverse demographics, locations, and user groups as climate change unfolds. The research collective behind this project (https://www.californiaoceanaccessandmpas.com/) intends

to conduct interviews, administer surveys, and hold focus group discussions in central and southern California between 2023-2025. The ultimate goal of this concerted effort is the co-development of local strategies aimed at enhancing equity in ocean access and MPA management, particularly in the context of a changing climate. By examining and learning from such projects, one can glean valuable insights into effective strategies for promoting environmental justice at both local and state levels.

5. **Equity Plans and Community Engagement**: Encouraging more federal and state agencies to develop Equity Plans and emphasizing community engagement in EEJ policy and decision-making processes is vital. These plans can serve as models for integrating environmental justice into various agency missions and actions.
6. **Environmental Education and Awareness**: Promoting environmental education and awareness, particularly among marginalized communities, is critical to empower individuals to participate actively in EEJ initiatives. This includes educating communities about their rights, the environmental issues they face, and how to engage in decision-making processes (Garcia, 2018; Rowland-Shea, 2020). And to have translations of other languages at the events too.
7. **Intersectionality and Inclusivity**: EEJ efforts should emphasize intersectionality by considering how various aspects of a person's identity, such as race, gender, disability, income, and location, intersect to influence their exposure to environmental hazards and access to resources. It is essential that EEJ definitions and principles evolve to encompass equitable access to nature and resources. Inclusivity should remain a core principle in EEJ to ensure all voices are heard and respected (Bullard, 2001; Bennett, 2023; Bennett, 2018; Scott, 2013; Gauna & Foster, 2003; Garcia, 2013). Addressing the barriers to equitable access to nature and resources should be embedded within the very definition of EEJ, highlighting the importance of removing socio-economic and systemic obstacles that limit the enjoyment of coastal regions, natural environments, and marine resources. (Bullard, 2001; Bennett, 2023; Bennett, 2018; Scott, 2013; Gauna & Foster, 2003; Garcia, 2013).
8. **Research on 21-Year Gap**: Future research should investigate the reasons for the 21-year gap in federal EEJ policy, examining the political, economic, and social factors that influenced policy priorities during that period. This understanding will help prepare for future policy interruptions and advocate for continuous attention to EEJ.

These recommendations provide a comprehensive roadmap for advancing EEJ in coastal areas and marine environments. By focusing on enhancing safety measures, promoting inclusivity through community engagement and accessibility, and making coastal accommodations more affordable, we can encourage individuals from all backgrounds to have equitable access to these natural resources. Conducting comprehensive state-level analyses, emphasizing environmental education and awareness, and incorporating the principles of intersectionality and inclusivity into EEJ definitions are crucial steps in the journey toward

greater environmental justice. Exploring the reasons behind the 21-year gap in federal EEJ policy allows us to understand better and address policy interruptions. Through these actions, we can collectively work towards more accessible, safe, and equitable coastal regions and marine resources, promoting a more sustainable and just future for all.

Objective 2: Analyzing EJ Indicators for Ocean Access in California

Spatial Analysis of Public Access Points

From the EEJ Literature review, "The Nature Gap", 70% of low-income communities across the country live in "nature-deprived" areas and communities of color are three times more likely than white communities to live in an area that is "nature deprived." Also stating that, discrimination and racism in the United States have had profound effects on human settlement patterns and on the patterns of protections for the nation's remaining natural areas (Center for American Progress, 2020). From this project we learned that poverty has an adverse effect on ocean access however to what extent needs to be looked deeper into by environmental justice agencies and local governments for more context.

In terms of communities of color, African Americans were found to have the least amount of total travel time to a public access point, meaning that the black community on average live relatively close to the coast (Figure 12). This however does not theoretically represent ocean access, as there has been a history of African American exclusion to public spaces. A recent example of this is the Bruce Family and the historical landmark of Bruce's beach – a former African-American beach resort at Manhattan Beach in Los Angeles County, California – that was seized by the government in 1924 through eminent domain, and new laws constructing resort-type business in the area were passed to deter other Black families from purchasing any additional beachfront property for a resort (County of Los Angeles, 2024). The land sat barren for decades. A century later, the county of Los Angeles and City of Manhattan Beach gave back the property to the descendants, however the land now had unwanted complexes such as the Los Angeles County Lifeguard Administration Building that currently sits at the site where the Bruce's resort business once stood a century ago, and to the left and right of the Lifeguard facilities rows of private residences (County of Los Angeles, 2024). On Jan. 20, 2023, the Bruce Family sold the beach back to the county for $20 million–an offer that was less than market value– due to their inability to pay the property taxes (Los Angeles Sentinel, 2023). This highlights the longstanding discrimination dealt by the black community in ocean access.

Certain programs have been created such as the Outdoor Access for All initiative from the California Natural Resources Agency, championed by Governor Gavin Newsom, which looks to create open access to outdoor spaces for all Californians. In 2021, Governor Newsom made a historic $1 billion-plus investment to expand access to parks and open space, creating a once-in-a-generation opportunity to improve outdoor access for all Californians (State of California, 2024). Working in partnership with the legislature and local leaders and communities

across the state, these investments ensure more Californians can experience the benefits that nature provides. With their plans for a statewide park revitalization program certain communities will also be included. For instance, educational materials are being handed out of Tribal land acknowledgements for all 280 state parks. Also, a partnership with the California African American Museum and State Parks will help research, interpret, and communicate the stories of Black Californians. As a result of this project, we infer that most of these plans are broad, and do not directly affect the specific needs certain communities have as it relates to creating ocean access. For example, due to the historical exclusion of African Americans like redlining, many black communities reside in areas with high pollution. Certain redress could require state agencies to conduct impact assessments on the cumulative health impacts prior to citing industrial facilities and hazardous waste sites (i.e. superfund sites) near Black communities.

Ultimately, With an adoption of the proposed solution detailed above, the impact of this can refigure the behavior of underrepresented groups' as it pertains to the ocean. The potential to increase participation allows for a stronger bond between disadvantaged populations and their relationship with the ocean. Building this relationship is a positive step towards not only conservation, but also, can improve the quality of life of communities deprived from the amenity value of the ocean.

Objective 3: Subsistence Fishing Literature Review & Database

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Moving Forward: Centering Subsistence Fishers Voices in California's Marine Protected Area Decisions

Traditionally, fishery and marine conservation management have tended to consider the biophysical aspects of any management decision first and the socioeconomic impacts second (Stewart, 2005). The controversy about the immediate costs of implementing MPAs intends to impact consumptive users of the area, including recreational and commercial fishermen. In the case of benefits, they tend to be delayed & geared towards non-consumptive users. MPAs can have negative effects on the incomes of fishers and charter-boat operators due to fishing restrictions, but they can also bring positive changes to the regional economy by attracting tourism (Mizrahi et al, 2020). These marine management measures can also lead to social changes, affecting the participation profile and distribution of recreational and commercial activities in an area. Socioeconomic impacts, whether positive or negative, play a crucial role in policy-making, and disregarding the concerns of affected user groups may widen the divide between fishery managers and fishing communities, which is already evident in the face of recent fishery declines, particularly in the West Coast (Scholz, 2004).

Incorporating local ecological knowledge (LEK) in policy processes can serve various purposes by complementing scientific information and addressing data gaps through corroboration and validation. Integrating local knowledge into decision-making and establishing

community-based resource management systems offer multiple benefits, as observed in the success of marine reserves involving resource users in the design and implementation stages. Involving stakeholders early on and utilizing local knowledge can enhance participation and empower them in governing marine resources (Scholz, 2004). Lessons from other countries highlight the potential applicability of local knowledge and participation in California to address growing conflicts between user groups and managers in fishery and marine resources (Scholz, 2004).

Overall, this pilot study highlights the importance of integrating local knowledge from underrepresented communities into the planning and decision-making processes of MPAs. By utilizing geospatial analysis tools and participatory methods, the study demonstrates the potential of incorporating socioeconomic and biodiversity information from underrepresented communities, including subsistence fishers, to inform MPA planning, resolve conflicts, and identify areas of consensus. The developed tools and databases provide the foundation for future research and decision-making in California's MPA planning processes (Scholz, 2004).

Objective 4: Social Implications of Targeted Species Threats

Social Equity Analysis

The results from our social equity analysis provide more information toward filling the gap about the demographics of subsistence fishers in California. Severely disadvantaged communities are observed mostly in the Central Valley and areas of Los Angeles (Figure 13). Based on our analysis of the subsistence fishers, many are from severely disadvantaged communities in the Central Valley and Los Angeles (Figures 14a and 14b). Many subsistence fishers are also from zip codes in the San Francisco Bay which are disadvantaged and moderately disadvantaged (Figure 14a and 14b). Los Angeles and San Francisco are areas where there is a greater number of subsistence fishing taking place (Figure 15). Determining whether subsistence fishers are from disadvantaged communities provides insights into the risks their communities face and the demographic groups with which they identify. Some of these subsistence fishers are already facing disproportionate environmental impacts within the areas they come from, so we want to ensure they are not also facing disproportionate environmental impacts in the areas they fish. Incorporating this social dimension into policymaking would enable state agencies to make better-informed decisions regarding subsistence fishers and broader environmental issues. Subsistence fishers from DAC rely on the ocean for their livelihoods, therefore, it is critical they are part of the decision-making processes to protect and manage the ocean.

There are also limitations with the EJ indicator we chose for this analysis. Although we can determine which areas are disadvantaged based on the CIScore, this analysis is broad. A more in-depth study can be done using more specific indicators that a cumulative impact score might not completely capture. For example, some communities in Los Angeles have greater

populations that are more likely to be exposed to air pollution, while other communities in the Central Valley may face other burdens such as pesticides from agriculture more disproportionately. Therefore, future studies may choose a specific indicator to get more insight into why a community is considered disadvantaged. Another limitation arose with our subsistence fishers dataset. This data was recreational fisheries data collected for pier fishers, therefore, we used this as a proxy for stating that they are subsistence fishers. This decision is backed by Ocean Protection's Council study that found that 52% of pier fishers stated that their harvest was "an important source of food" (Ocean Protection Council, 2022).

Hotspot Analysis of Threats to Target Species

Identifying the top 5 most harvested marine species allowed us to determine which species are critical to subsistence fishers and should therefore be prioritized by managers for conservation plans (Table 4). This list of marine species can allow managers to make more informed decisions about which species to focus on in conservation work because it provides the social dimension of why these are important species to consider. Our hotspot analysis offers intricate insights into the spatial distribution of where target marine species are found and where the highest areas of pollution impacts are along the California coast. The health of subsistence fishers catching these species in polluted regions may be at risk, therefore, these maps provide subsistence fishers with information about where these risks are greater for the species they catch (Figure 16-20). Based on the 5 hotspot analyses, the regions of highest pollution impact for all species were found along the coast of Los Angeles and San Francisco Bay (Figures 16-20). This suggests that policymakers might consider focusing on these two regions when forming regulations aimed at mitigating pollution stemming from both ports and commercial ships. Based on our findings, signage (available in many languages) stating these areas have high pollution from the ports and ships may be one way to educate subsistence fishers about the potential health risks (Figures 16-20).

Managers can strategically target these regions containing elevated pollution levels when devising conservation plans for the protection of these species. Although these regions exhibit the highest levels of pollution impacts, it is important to note that such impacts are not representative of each species. For example, the Pacific chub mackerel, based on its distribution, experiences more significant impacts farther from the coastline (Figure 18). Consequently, while managers may be focused on efforts to mitigate impacts on species along coastal areas, it is imperative to formulate management strategies to reduce pollution impacts in deeper coastal regions. For species displaying a wider spatial distribution of high to severe pollution impacts, such as the dungeness crab and northern anchovy, a more comprehensive plan to reduce pollution across the entire coastline would need to be developed (Figure 16 & Figure 17). Ultimately, these findings offer valuable insights to managers regarding where the pollution can be mitigated to safeguard marine species and ensure the continued livelihood of the subsistence fishers who depend on these species.

The analysis presented in our study is limited to only the observed effects of ocean-based pollution. Therefore, these results only represent a limited scope when considering the 24 other threats that may greatly affect the targeted fish populations and the overall well-being of subsistence fishers along the California coast. In addition, we only looked at 5 species that subsistence fishers targeted. A more comprehensive analysis of all the species may provide more insights into how each of these species is affected by their associated threats. An analysis can also provide a cumulative threat impact analysis to determine how each species is affected overall.

Intersecting Social Equity Disparities & Species' Vulnerabilities

Our analyses show a correlation between the marine species hotspots and social equity analysis maps. Specifically, our maps identify the greatest numbers of subsistence fishers are fishing in Los Angeles and San Francisco counties, which are severely disadvantaged regions (Figures 14a, 14b, 15). These regions also coincide with high pollution levels impacting targeted species along the coast (Figures 16-20). Our findings underscore the need to prioritize pollution mitigation strategies and implement educational outreach initiatives tailored to subsistence fishers from DAC in these areas along the coast.

Conclusions

Our EEJ literature review underscores the need for comprehensive recommendations to enhance equitable ocean access. By highlighting gaps in federal and state EEJ policies, we emphasize the importance of developing Equity Plans and engaging communities in policy-making. While there is a wealth of literature about the lack of access to land-based areas for underserved communities, there remains a significant gap in understanding access to coastal areas and oceans. The spatial analysis of ocean access contributed to the understanding of coastal access. The analysis found that areas further from the coast tend to have higher poverty rates, particularly notable in diverse Los Angeles. Coastal regions tend to have more elderly residents, predominantly in areas with a majority White population. Despite living closer to public access points, African Americans still encounter barriers to accessing the ocean. This highlights the importance of addressing socioeconomic disparities and removing barriers to ensure fair access to coastal areas for all communities.

One particular community of interest that faces these barriers are subsistence fishers, which our second literature review and analysis focused on. The subsistence fishing literature review highlights that traditionally there has been a focus on biophysical aspects over socioeconomic impacts in fishery and marine conservation management. Currently, MPAs can have infeasible impacts on fishers' income, participation, and distribution of recreational activities. However, if socioeconomic impacts are considered during the MPA decision making process, then MPAs can reduce the divide between managers and underserved communities. As shown in our findings, subsistence fishers are one of the severely underrepresented populations

in ocean management and there has been a lack of studies characterizing who these subsistence fishers are and which species they fish.

Our results from the social equity and target species analysis, aimed to contribute to this gap in knowledge about subsistence fishers. Many subsistence fishers come from DAC and are fishing in areas with high coastal pollution. Additionally, they reside in zip codes from Los Angeles and the San Francisco bay area, and based on the EJ spatial analysis, these zipcodes are mostly Hispanic and Asian-American. These areas also had high coastal pollution for target marine species. We recommend these findings be shared directly with subsistence fishers so they are aware of where the species they catch are being impacted by pollution to lower their health risks. Providing subsistence fishers with this knowledge can help them voice their concerns at public meetings or other avenues so decision-makers can develop fishing regulations that take these concerns into account. It is also critical to ensure continued engagement with subsistence fishers through education and public outreach, increasing equitable access to fishing.

Future studies should prioritize understanding diverse community needs and preferences. Practical measures like multilingual signage and affordable accommodations can improve accessibility, alongside targeted community engagement initiatives. These steps can foster environmental education and address systemic barriers, advancing a more inclusive approach to ocean access. State and federal agencies can utilize our results to develop effective future management strategies that take into perspective the concerns of subsistence fishers from DAC to ensure they are being represented in the decision-making process. Policymakers can devise plans to mitigate ocean-based pollution in high pollution regions to protect marine species targeted by subsistence fishers and support their livelihoods. The methodology of our project serves as a valuable framework that can be replicated for future studies to investigate other climate or environmental threats marine species may be impacted by to inform conservation plans**.**

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APPENDIX 1

Table 1. Federal and State of California Executive Orders containing Environmental Justice Definitions

Level of Governance	Executive Order	Executive Order Name	Year	Definition
Federal	Executive Order 12898	“Address Environmental Justice in Minority Populations and Low-income Populations”	1994	"Each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands."
Federal	Executive Order 13175	Consultation and Coordination with Indian Tribal Governments	2000	"To reaffirm the fundamental principles of the United States Government-to-Government relationship with Indian tribes, to provide for meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications, and to strengthen the United States Government's accountability to Indian tribes.
Federal	Executive Order 13985	“Advancing Racial Equity and Support for Underserved Communities Through Federal Government”	2021	"It is the policy of my Administration to advance equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality."
Federal	Executive Order 14008	“Tackling the Climate Crisis at Home and Abroad”	2021	"Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related, and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.".

State (California)	Executive Order N-16-22	“California for all”	2022	“agencies and departments within my Administration can and should take additional actions to embed explicit analysis of equity considerations in policies and practices, including by analyzing demographic and geographic gaps in outcomes and access to funding and services, developing and consistently utilizing data analysis tools and practices to understand gaps in access to services and programs or outcomes from state programs, and reviewing community engagement strategies with a focus on Californians who reside in communities that have historically been underserved and marginalized;”
Federal	Executive Order 14091	“Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government”	2023	“The equitable treatment of all individuals and communities, particularly those who have historically been underserved or disadvantaged, in matters related to environmental policies, programs, and the fair distribution of environmental benefits and burdens. Environmental justice aims to rectify and prevent the disproportionate impact of environmental hazards, pollution, and resource allocation on marginalized and vulnerable populations. It seeks to ensure that everyone, regardless of their race, socioeconomic status, or geographic location, has the same level of protection from environmental harm and the opportunity to participate in decisions affecting their environment.”
Federal	Executive Order 14096	“Revitalizing Our Nation's Commitment to Environmental Justice for All”	2023	"Environmental justice means the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment so that people are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers, and have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices."

APPENDIX 2

Table 2. Federal Agencies' Environmental Justice Definitions, Focusing on agencies that deal with pollution, oceans, and natural resources.

Level of Governance	Agency	Year	Definition	Source
Federal	Department of Interior (DOI)	2023	"To provide outstanding management of the natural and cultural resources entrusted to us in a manner that is sustainable, equitable, accessible, and inclusive of all populations."	Environmental Justice | U.S. Department of the Interior (doi.gov)
Federal	Department of Commerce (DOC)	2021	"The Department has a longstanding role in the creation of jobs that will sustain economic growth, the stewardship of environmental data, the protection of life and property from environmental hazards and in predicting changes in climate, weather, oceans, and coasts, and conserving and managing coastal and marine ecosystems and resources. This traditional role is now augmented by a whole-of-government approach focused on providing communities and businesses with the information, products, and services they need to prepare for, adapt, and prosper in a changing environment."	Strategic Plan | U.S. Department of Commerce
Federal	Department of Agriculture (USDA)	1997	"ENVIRONMENTAL JUSTICE means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by,	USDA Departmental Regulation 5600-002

			government programs and activities affecting human health or the environment. “	
Federal Agency	Environmental Protection Agency (EPA)	1992	"The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies."	Environmental Justice | US EPA
Federal Agency within U.S. Department of Interior	U.S. Fish & Wildlife Service (USFWS)	2021	"To ensure fair treatment and meaningful involvement of all in the environmental arena. Environmental Justice communities define the environment as 'where we live, work, play, learn, and pray.'"	Environmental Justice | About Us | U.S. Fish & Wildlife Service (fws.gov)
Federal agency within the U.S. Department of Commerce	National Oceanic and Atmospheric Administration (NOAA)	2023	"The fair treatment and meaningful involvement of all people, regardless of race, color, gender, sexual orientation, national origin, tribal affiliation, religion, disability, or income during the development, implementation, and enforcement of environmental laws, regulations, and policies, including but not limited to: 1) Equitable protection from environmental and health hazards; 2) Equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices; and 3) Equitable opportunity and access to decision-making processes for underserved communities."	NOAA Fisheries, Equity and Environmental Justice Strategy
Federal Agency within the U.S.	Bureau of Land	2022	"EJ is about more than addressing the harmful effects on humans from air pollution, toxic chemicals, groundwater pollution, or herbicides. EJ is	RGFO_Scoping_Handout_-_Env_Justice_formatted.pdf (blm.gov)

Department of Interior	Management (BLM)		also about ecological, economic, cultural, and social impacts—for instance, recreation opportunities of low-income and minority populations or communities, and their access to vital natural resources."	
Federal Agency within the U.S. Department of Interior	National Park Service (NPS)	2023	“To provide outstanding management of the natural and cultural resources entrusted to us in a manner that is sustainable, equitable, accessible, and inclusive of all populations.”	NPS Groundwork Partnership Report
Federal Agency within the U.S. Department of Agriculture	U.S. Forest Service (USFS)	1997	“the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. It will be achieved when everyone enjoys the same degree of protection and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.”	USDA Deputy Under Secretary promotes environmental justice goals | US Forest Service
Federal Branch of Agency under NOAA	National Marine Fisheries Service (NMFS)	2021	"Environmental justice is measured at the community level, where a community is either a group of individuals living in geographic proximity to one another or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."	NOAA Fisheries, Equity and Environmental Justice Strategy

Branch of Agency Under NOAA	Office of National Marine Sanctuaries (ONMS)	2023	"The fair treatment and meaningful involvement of all people, regardless of race, color, gender, sexual orientation, national origin, tribal affiliation, religion, disability, or income during the development, implementation, and enforcement of environmental laws, regulations, and policies, including but not limited to: 1) Equitable protection from environmental and health hazards; 2) Equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices; and 3) Equitable opportunity and access to decision-making processes for underserved communities."	NOAA Fisheries, Equity and Environmental Justice Strategy
Federal Branch of Agency under NOAA	Channel Islands National Marine Sanctuary	2023	"The fair treatment and meaningful involvement of all people, regardless of race, color, gender, sexual orientation, national origin, tribal affiliation, religion, disability, or income during the development, implementation, and enforcement of environmental laws, regulations, and policies, including but not limited to: 1) Equitable protection from environmental and health hazards; 2) Equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices; and 3) Equitable opportunity and access to decision-making processes for underserved communities."	NOAA Fisheries, Equity and Environmental Justice Strategy

Federal Agency within U.S. Department of Interior	Bureau of Ocean Energy Management (BOEM)	2021	"BOEM defines environmental justice as the fair treatment and meaningful involvement of all people—regardless of race, color, national origin, or income—with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."	Environmental Justice | Bureau of Ocean Energy Management (boem.gov)
Federal level committee with a mandate to coordinate and integrate federal actions related to ocean policy and science	White House's Ocean Policy Committee (OPC)	2023	"Based on Executive Order 14096's definition of "environmental justice," "ocean justice" refers to the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in Federal Agency decision-making and other Federal activities related to the ocean. Advancing ocean justice will enable people to have protection from disproportionate and adverse human health and ocean environmental risks and hazards, as well as equitable access to the benefits of a healthy, sustainable, and resilient ocean environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices. "	Ocean Justice Strategy and Ocean Climate Action Plan

APPENDIX 3

Table 3. California Natural Resource Agencies' Environmental Justice Definitions

Agency	Year	Definition	Source
California Natural Resources Agency	2018	"California law defines Environmental Justice as "the fair treatment of people of all races, cultures and income with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (Government Code Section 65040.12 and Public Resources Code Section 72000)."	Environmental Justice Policy California Resources Agency
California State Lands Commission	2018	"Ensure that all voices are heard, all communities are treated fairly and equitably, and everyone is given equal opportunity to participate in the Commission's decision-making process, with an emphasis on ensuring that traditionally disadvantaged groups are not left behind"	Environmental Justice Policy (ca.gov)
California Department of Conservation	2018	"California law defines Environmental Justice as "the fair treatment of people of all races, cultures and income with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (Government Code Section 65040.12 and Public Resources Code Section 72000)."	Environmental Justice Policy California Resources Agency
California Fish and Wildlife of Commission	2021	"Environmental Justice looks to change that grim reality: to ensure fair treatment and meaningful involvement of all in the environmental arena. "	Striving for Environmental Justice | U.S. Fish & Wildlife Service (fws.gov)
California Ocean Protection Council (OPC)	2022	"The fair treatment and meaningful involvement of people of all races, cultures, incomes, and national origins, with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies."	Equity Plan - Ocean Protection Council (ca.gov)

California Department of Fish & Wildlife (CDFW)	2022	"The fair treatment and meaningful involvement of all people, regardless of their identity or circumstance, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no population bears a disproportionate share of negative environmental consequences resulting from industrial, municipal, and commercial operations or from the execution of federal, state, and local laws; regulations, and policies. Meaningful involvement requires effective access to decision-makers for all, and the ability in all communities to make informed decisions and take positive actions to produce environmental justice for themselves."	CDFW: Justice, Equity, Diversity and Inclusion: Definitions for Key terms
California Coastal Commission	2022	"Environmental justice" means the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.	Environmental Justice (ca.gov)
California Environmental Protection Agency	2023	"The principles of environmental justice call for fairness, regardless of race, color, national origin or income, and the meaningful involvement of community in the development of laws and regulations that affect every community's natural surroundings, and the places people live, work, play and learn."	Environmental Justice Program | CalEPA
California Department of Water Resources (DWR)	2023	"Environmental Justice principles call for the fair treatment and meaningful involvement of all people regardless of race, color, national origin or income, in the development, adoption, implementation, and enforcement of all environmental laws, regulations, and policies that affect every community's natural surroundings, and the places people live, work, play, and learn."	Environmental Justice (ca.gov)
California State Parks	2023	"One of the core values at California State Parks is cultural diversity and accessibility. We believe in the right of all Californians, including persons with disabilities, to have access to recreational opportunities, and enjoy the cultural, historic, and natural resources found in our state parks."	Accessible Parks for All (ca.gov)

Table 5. Environmental justice indicators.

Summary of variables	
zip	California zip codes

Total_TravelTime	Time traveled by minutes
Poverty	Income
Youth_65	Age range below 65 years old
Elderly_65	Age range above 65 years old
White	Population of White people
Hispanic	Population of Hispanics
African_American	Population of African Americans
Asian_American	Population of Asian Americans
No majority	Zip codes denoting no racial population above 40%

Table 6. Marine environmental threats indicators.

Summary of threats	
acid	Ocean Acidification
beach	Beach Access
coastal	Coastal Engineering
dep_ocean	Ocean Deposition
inorganic	Inorganic Pollution
invasives	Invasive Species
light_pol	Light Pollution
nutrient	Nutrient Runoff
oil	Ocean Engineering
organic	Organic Pollution
pens	Fish Farming
pollution	Ocean Based Pollution
pplants	Power Plants
sed_increases	Sediment runoff increase
sed_decreases	Sediment runoff decrease

shipping	Shipping
sst	Sea Surface Temperature Change
trash	Coastal Waste
uv	Ultraviolet Radiation Change
dem_d	Fishing: Demersal Destructive
dem_nd_hb	Fishing: Demersal Non-Destructive High-Bycatch
dem_nd_lb	Fishing: Non-Destructive Low-Bycatch
pel_hb	Fishing: Pelagic High-Bycatch
pel_lb	Fishing: Low-Bycatch
rec_fish	Fishing: Recreational