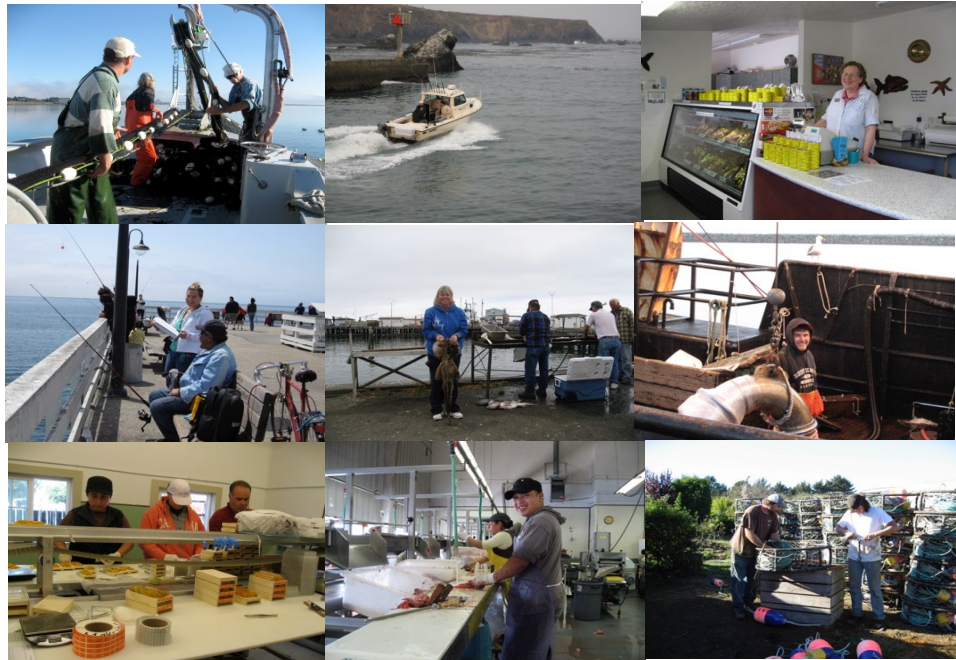# Socioeconomic Guidance for Implementing the California Marine Life Management Act

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SOCIOECONOMIC GUIDANCE

FOR IMPLEMENTING THE

CALIFORNIA MARINE LIFE MANAGEMENT ACT

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Fisheries are complex, dynamic integrated social-ecological systems. As such, consideration of the human systems associated with fisheries individually and as they interact with one another is essential for effective management. California's 1998 Marine Life Management Act (MLMA) specified socioeconomic as well as ecological goals and objectives for management of the state's fisheries using a proactive, coordinated, holistic approach. The 2001 MLMA Master Plan identified specific socioeconomic "essential fishery information" (EFI) needed to support MLMA-based management. While the MLMA and the Master Plan signaled the need to include socioeconomic information in the management of California fisheries, they provided insufficient guidance on the scope of information needed and how to identify and address relevant questions and information needs. This has limited managers' ability to effectively integrate socioeconomic information, evaluate management options, anticipate responses, achieve desired outcomes, and avoid unintended consequences.

This Guidance document seeks to assist the California Department of Fish and Wildlife (CDFW) in its efforts to identify, build, and incorporate socioeconomic information to support MLMA implementation and related fishery management. The Guidance is based on: an extensive review of state and federal fishery management policy; recent and ongoing socioeconomic research on various state- and federally-managed fisheries; targeted conversations with knowledgeable individuals within and outside CDFW; and observation of stakeholder meetings related to fishery management. The Guidance includes the following:

Part 1 provides conceptual background on the human dimensions of fisheries and associated information needs for MLMA-based fishery management. It describes an expanded set of socioeconomic EFI types that reflect those needs, and suggests questions about fisheries human systems that follow from the MLMA objectives. Four California fishery management examples highlight some of those questions and the types of socioeconomic EFI needed to address them.

Part 2 provides a stepwise, scientific process for iteratively developing and using socioeconomic EFI for MLMA-based fishery management, along with general approaches for building socioeconomic EFI, examples of relevant variables for each socioeconomic EFI type, and potential sources for that information. The stepwise process includes: 1) building a social baseline, 2) scoping to identify social research questions related to management, 3) selecting variables for data collection and analysis, and 4) synthesizing and analyzing those data to identify and assess management options and outcomes. Three California fishery examples illustrate the stepwise development and use of socioeconomic EFI.

Part 3 provides guidance for applying the stepwise process to develop a narrative that describes a fishery's human system, cross-referencing sections in Parts 1 and 2 and the Appendices. Narratives can be developed, refined, and expanded over time to meet baseline and emerging information needs. They can be used to prepare Enhanced Status Reports (ESRs) and Fishery Management Plans (FMPs), and to inform management processes such as Fish and Game Commission rulemakings.

Appendices provide supporting information including a glossary, detailed socioeconomic questions that follow from the MLMA objectives, data types and sources, examples from the literature that illustrate diverse approaches to developing and using socioeconomic EFI in fishery management, and selected methodological resources.

The Guidance concludes with **recommendations** for building and using socioeconomic EFI in state, and especially MLMA-based, fishery management. Recommendations to be pursued *concurrently* in the *near term* include:

- **Build an accessible inventory of available information sources and data**
  Considerable socioeconomic information is readily accessible to CDFW from its own and others' data collection efforts, databases, repositories, documents (e.g., refereed and grey literature, meeting notes), and knowledgeable people within and outside CDFW. An inventory of these sources along with a centralized repository of available resources that staff and others assisting CDFW can access and contribute to would enhance efforts to build and use socioeconomic EFI.

- **Draft socioeconomic narratives for each fishery**
  A historically grounded understanding of the human systems associated with the state's fisheries is essential for identifying and addressing socioeconomic considerations for management. Focused narratives that describe those human systems and their interactions with the ecological and management systems should be developed. Initial drafts can be based on existing information and expertise, highlighting as well as addressing socioeconomic information needs. Narratives should be reviewed by individuals with appropriate fishery and social science expertise. The narratives can be expanded and refined iteratively as fishery conditions change and new information needs are identified and addressed.

- **Identify and engage individuals with relevant social science expertise**
  New and continuing partnerships with social scientists from various agencies, academia, and the private sector can be used to leverage limited financial and human resources to guide the systematic development and use of socioeconomic EFI along with the identification and use of new approaches and tools. Social scientists with methodological and substantive knowledge and expertise can be engaged in various ways (individually and/or via an interdisciplinary social science advisory group) to assist, inform, and/or guide CDFW's efforts. They also can provide peer review to ensure the generation of valid, robust information and its appropriate application.

Recommendations for the *longer term* include:

- **Build regional and statewide social baselines**
  Extract, synthesize, and analyze the fishery-related data from CDFW and other sources to develop local, regional and statewide socioeconomic baselines. This includes identifying and characterizing: fishery participants (fishermen and buyers), their activities, and interactions *within and across fisheries and communities*; shoreside infrastructure and support; and associated communities. Fishery narratives developed in the near term can be linked to illustrate the connections among fisheries, participants, and communities. Additional information from various sources can be used to further characterize the larger system, identify gaps, and extend the scope of data collection and topics addressed over time (iteratively and cumulatively). Mapping and tracking connections and feedbacks within the human system can facilitate ongoing and future work to anticipate and assess changes to the human and fishery (social-ecological) systems at local, regional, and statewide scales.

- **Conduct scoping to identify human system information needs**
  Use scoping across fisheries and fishing communities — the process of identifying questions, challenges, opportunities and options — to identify and prioritize questions and associated

information needs not only for particular fisheries, but also interactions among fisheries and communities, locally, regionally and statewide.

- **Develop and implement a plan to systematically collect, analyze and apply data to meet information needs across fisheries and communities**
This plan should identify information needs that pertain to multiple fisheries, associated communities, and the interactions among them. It also should specify appropriate methods for collecting, analyzing and applying these data to address relevant management questions. Where data or opportunities to collect those data are limited, it will help to identify gaps and overlapping needs, and prioritize subsequent work.

- **Document lessons learned throughout**
Data collection, analysis and application afford not only new information about fisheries human systems (and their interactions with ecological systems), but also provide insights related to what worked, what did not, and how future efforts might be better directed.

INTRODUCTION

California's Marine Life Management Act (MLMA, 1998) specifies socioeconomic as well as ecological goals and objectives for management of the state's fisheries (MLMA 1998). Moreover, the MLMA requires that fisheries be managed using a proactive, coordinated, holistic approach, and cites the cultural as well as the economic importance of sustainable fisheries and the broader social, economic and historical value of the state's living marine resources (MLMA 1998; see discussion in (Pomeroy and Hunter 2008)). These ideas are variously articulated in the MLMA's management policy objectives (Fish and Game Code (FGC) §7055), fishery management system objectives (§7056), fishery management plan guidance (§7072) and elsewhere in the Act. The MLMA Master Plan, which provides guidance for implementing the MLMA, elaborates on these objectives and identifies socioeconomic "essential fishery information" (EFI) needed to support a management system and activities toward those objectives.

The MLMA explicitly highlights the human dimensions of fishery management and associated information needs with objectives including: observing the long-term interests of people dependent on fishing for food, livelihood, or recreation (§7056(i)); minimizing the adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies (§7056(j)); and being proactive and responding quickly to changing environmental conditions and market or other socioeconomic factors and to the concerns of fishery participants (§7056(l)).

The MLMA further requires that fishery management plans include: a summary of the economic and social factors related to the fishery (§7080(e)); and if additional conservation and management measures are included in the plan, a summary of the anticipated effects of those measures on relevant fish populations and habitats, *on fishery participants, and on coastal communities and businesses that rely on the fishery* (§7083(b); emphasis added). The Act also requires that the Fish and Game Commission (FGC) and the Department of Fish and Wildlife (CDFW) have available to them essential fishery information on which to base their fishery management decisions (§7056(g)).

While the MLMA and the 2001 MLMA Master Plan (CDFG Marine Region 2001) signal the need to include socioeconomic information in the management of California fisheries, guidance on the socioeconomic questions and information needs (including socioeconomic EFI) that are most important for fishery managers to address or a framework for building and integrating it into management is lacking. These gaps pose critical challenges for meeting MLMA objectives. Ultimately, the lack of guidance limits managers' ability to evaluate trade-offs, anticipate responses, and prevent unintended negative consequences for the marine and human environments. As an example, limited understanding about the human dimensions of the groundfish trawl fishery and the larger fishery system it is part of made it difficult to foresee impacts of the 2003 federal buyback on fishing communities and other fisheries (e.g., shifting effort into the crab fishery; substantial reductions in trawl fishery-related demand for goods and services, affecting those businesses and their ability to provide goods and services to others) (Pomeroy et al. 2010). Similarly, the marked shift in the distribution of market squid in 2014 led to shifts in fishing effort and related activity (Chavez et al. 2017) and the recent closures of Dungeness and rock crab fisheries due to persistent, elevated levels of domoic acid toxins highlight the need for socioeconomic information about how fishery participants, communities, and management can adapt to such changes, whether short- or long-term.

Federal as well as state guidance require that fishery management consider the entire ecosystem and the relationships between and among organisms through ecosystem-based management practices.[1] Considering the human systems associated with individual fisheries and with multiple, interacting fisheries (including federally- and state-managed fisheries) is essential for designing effective management, achieving desired outcomes, and avoiding negative unintended consequences. This Guidance document seeks to assist CDFW in its efforts to identify, build, and incorporate socioeconomic information to support MLMA implementation and related fishery management. The Guidance is based on extensive review of state and federal fishery management policy and recent and ongoing socioeconomic research on various state- and federally-managed fisheries, targeted conversations with knowledgeable individuals within and outside CDFW, and observation of fishery management-related meetings.

Part 1 of the Guidance provides conceptual background on the human dimensions of fisheries and associated information needs for MLMA-based fishery management, identifies and describes an expanded set of socioeconomic EFI types that reflect those needs, and identifies questions about fisheries human systems that follow from the MLMA objectives. Four California fishery management examples highlight some of the questions about the human system and the types and socioeconomic EFI needed to address them. Part 2 provides a stepwise process for developing and using socioeconomic EFI for MLMA-based fishery management, along with general approaches for building socioeconomic EFI, examples of relevant variables for each type of socioeconomic EFI, and potential sources for that information. Three California case study examples illustrate approaches for developing and using socioeconomic EFI relevant to each particular case. Part 3 provides guidance for applying the stepwise process to develop a narrative describing a fishery's human system that can be used to prepare MLMA-based fishery management documents and inform prioritization, assessment and other management functions. Appendices provide supporting information including a glossary, data types and sources, examples from the literature that illustrate diverse approaches to developing and using socioeconomic EFI in fishery management, and selected methodological resources. The Guidance concludes with a set of recommendations for building and using socioeconomic EFI in state, and especially MLMA-based, fishery management.

HOW TO USE THIS DOCUMENT
This document is intended to help guide CDFW staff through the process of identifying and addressing socioeconomic information needs relevant to MLMA-based fishery management and the particular fisheries they work on, whether through the extraction and synthesis of available data alone; the collection and analysis of new data; or the evaluation of data collected and analyzed by others. As such, it is best used by first reviewing the conceptual and practical background information in Part 1 to facilitate thinking about fisheries "human systems" as relevant to management, and then using the steps and resources outlined in Part 2 (and supplemented in the appendices) to build and apply socioeconomic information in management. To further support this process, CDFW staff can use Part 3 as a template for developing a narrative about a fishery's human system that explicitly addresses the

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[1] NOAA defines an ecosystem as "a community of organisms, including humans, in conjunction with their nonliving environment. Ecosystems involve complex interactions between organisms, their environment, and the processes that drive the system. Ecosystems are both complex and continuously changing. Humans and human institutions, beliefs and practices are integral parts of the ecosystem" (http://ecosystems.noaa.gov/EBM101/WhatareEcosystems.aspx, accessed 7/25/16). The Amended Master Plan addresses ecosystem-based fisheries management, defined as "An environmental management approach relying on credible science that recognizes the full array of interactions within an ecosystem, including humans, rather than considering single issues, species, or ecosystem services in isolation" {State of California, 2018 #3884}.

information needs for Enhanced Status Reports (ESRs), Fishery Management Plans (FMPs), and other management-related documents and processes.

PART 1: HUMAN DIMENSIONS INFORMATION NEEDS FOR MLMA-BASED FISHERY MANAGEMENT

CONCEPTUAL BACKGROUND

Fisheries are integrated social-ecological systems[2], consisting of dynamic ecological and social (or human) subsystems, with complex interdependencies and interactions within and between them (Figure 1) (Berkes et al. 2003). Likewise, the fishery management process is dynamic, with management actions and their outcomes as sources of feedback throughout the fisheries system. Fisheries' human systems affect, and are affected by, ecological conditions and management. Effective fisheries management requires attention to and integration of what Stephenson et al. (2017) refer to as the "four pillars of sustainability" — the social (including cultural), economic and institutional aspects (the 'human dimension') as well as the biological aspects of fisheries systems.
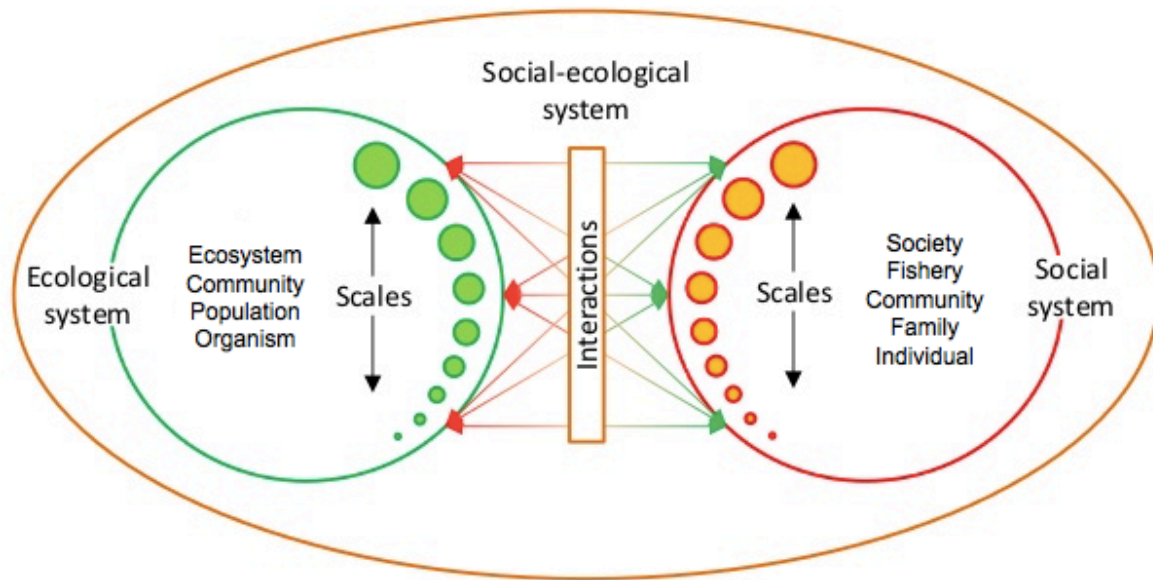
Figure 1. Fisheries social-ecological systems (adapted from Martin et al. (2015)).

Like fisheries ecological systems, fisheries social systems are complex, multi-faceted, and dynamic in space and time. Fisheries social systems consist of diverse components, relationships, and processes, which together constitute social structure and organization. They include the people, practices, institutions, and facilities involved, and their environmental, regulatory, economic, and social context (Pomeroy et al. 2016). Diverse values, preferences and needs contribute to peoples' attitudes, opinions and beliefs and, importantly, their behavior — how they interact with the marine ecosystem and associated social system. Whether people are involved in commercial, recreational or subsistence

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[2] http://ecosystems.noaa.gov/EBM101/WhatareEcosystems.aspx, accessed 7/25/16.

fisheries, they typically participate for a mix of reasons, which may include livelihood, recreation, sociocultural values and/or sustenance (Orbach 1980).

Despite the interconnectedness of fisheries social and ecological systems, the MLMA objectives often are separated into those that focus on the ecological system and those that focus on the human system. However, because of feedbacks in the larger fisheries system (and the understanding that healthy ecological systems are valued by society), management issues such as bycatch and depressed fisheries also affect the well-being of people dependent on fishing, with adverse impacts on small-scale fisheries, coastal communities, and local economies. Solutions to such ecological issues hinge on understanding the source of the problem and identifying practical, feasible options for addressing them that do not, in turn, cause negative consequences elsewhere in the fisheries system (Boonstra and Hentati-Sundberg 2014). Table 1 indicates the relevance of the human system, whether the fishery per se or its management, to each MLMA objective. For example, fishing and other human activities affect habitat (HS affects ES), management actions to protect or restore habitat affect fishing opportunities, behavior, and outcomes (MS affects HS), and habitat conditions affect fishing opportunities and outcomes (ES affects HS). In addition, information and understanding about fisheries human systems can be instrumental in identifying ecological change and emergent problems and opportunities (Hicks et al. 2016).

Table 1. Distilled MLMA objectives[3] as they affect and are affected by fisheries human systems. (ES = ecological system, HS = human system, MS = management system.)

MLMA Objectives	HS affects ES	MS affects HS	ES affects HS
Habitat protected/restored (§7056(b))	✓	✓	✓
Depressed fisheries rebuilt (§§56(c))	✓	✓	✓
Bycatch limited (§7056(d))	✓	✓	✓
Excess effort prevented/reduced (§7056(e))	✓	✓	
Long-term interests of fishing-dependent people considered (§7056(i))	✓	✓	
Adverse impacts on small-scale fisheries, coastal communities, local economies minimized (§7056(j))		✓	✓
Conflict resolved/addressed (§7056(k))[4]		✓	
Responsive to changing conditions and concerns (§7056(l))[5]	✓	✓	
Fair allocation among fishery sectors (§7056(m))		✓	
Commercial and recreational fishery management coordinated (§7056(f))	✓	✓	
Sustainable use (§7055(b), §7056(a))[6]	✓	✓	

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[3] These objectives are distilled from §7056 and related provisions in §7055, §7072, and elsewhere in the chapter.
[4] The MLMA Master Plan suggests developing a framework for conflict resolution and decision-making, and lists general types of information to be considered. How the information is weighted is a social choice, which can be informed, but not determined, by social science research.
[5] These include changes in climate, abundance and distribution of and access to fishery resources, working waterfronts (i.e., infrastructure, goods and services), domestic and international markets, and broader social and economic conditions, locally to globally.

USING SOCIOECONOMIC INFORMATION IN THE ADAPTIVE MANAGEMENT CYCLE

Information about fisheries' human systems, including individuals, communities and economies, is useful throughout the fishery management process: identifying problems and opportunities, identifying and evaluating options, monitoring and assessing their performance and impacts, and adjusting/adapting thereafter (Figure 2).[7]
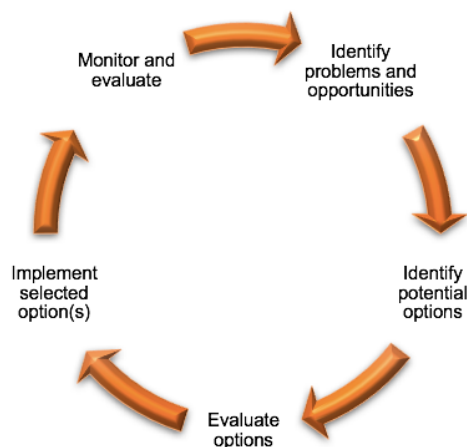
Figure 2. The adaptive management cycle.

The Channel Islands Marine Reserve Working Group (MRWG) process provides an example of the development and use of socioeconomic information at multiple stages in the management cycle. Through the 1990s, the commercial fishery for California market squid had grown considerably, leading some fishery participants and others to call for changes in management of the fishery. Based on the understanding that information about the social and economic organization of the fishery would be useful for identifying problems and opportunities, as well as evaluating proposed changes to the system, Pomeroy and FitzSimmons (1998) conducted semi-structured interviews, participant observation, literature review, and landings data analyses to characterize fishery participants, fishing and receiving operations, fishing practices and patterns, relationships and networks among participants and communities, and the key factors affecting them (*Monitor and Evaluate)*.

Meanwhile, in response to requests to establish marine reserves at the Northern Channel Islands (where the squid fishery was active), the Fish and Game Commission directed CDFW to work with the Channel Islands National Marine Sanctuary (CINMS) to consider establishing marine reserves within the Sanctuary boundaries (Helvey 2004) (*Identify Problems and Opportunities*). In 1999, MRWG was established to develop various marine reserve options (*Identify Potential Options*). NOAA's National

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[6] §7055 notes that fisheries management programs are to (a) assure (sic) the long-term economic, recreational, ecological, cultural, and social benefits of those fisheries and the marine habitats on which they depend; (b) prevent overfishing, rebuild depressed stocks, ensure conservation, facilitate long-term protection and, where feasible, restoration of marine fishery habitats, and achieve the sustainable use of the state's fishery resources; (c) support a reasonable sport use; and (d) encourage growth of commercial fisheries.

[7] Impacts may be positive and/or negative for particular groups or parts of the fishery system and overall.

Ocean Service (NOS), which led assessment of the potential socioeconomic impacts of these options, contracted with Pomeroy and colleagues to document on-the-water space use by squid and coastal pelagic species finfish ("wetfish") fishery participants and link it to socioeconomic features of the fishery for analysis. The NOS team incorporated the data collected into an input-output model to assess and compare the impacts of the marine reserve options developed by the MRWG *(Evaluate options)*. The model was based on the common assumption that impacts of change in activities in a given county and adjacent waters would be contained within that county. However, that assumption did not hold in the squid fishery. Documentation of the fishery's human system, particularly the socioeconomic relationships and mobility within the fishery, demonstrated that activities extended well beyond the two counties adjacent to the CINMS, north to the Monterey Bay area, and south to the San Pedro/Los Angeles area (Figure 3) (Pomeroy et al. 2005). This socioeconomic information led to adjustment of the model to more accurately reflect the socioeconomic impacts of each option on the fishery and associated communities. This in turn, improved the quantity and quality of information available to consider in the management process (*Evaluate Options/Implement Selected Option)*. This characterization of fishery patterns, updated input-output analyses, and other procedures can be used to re-assess and compare these and other patterns in the fishery to evaluate the individual and cumulative impacts of change on fishery participants, the fishery, and fishing communities, and to identify and address emerging management questions (*Monitor and Evaluate).*

Without this information, the analyses would have overestimated the negative impacts of closures on the two-county region and entirely missed the impacts on other communities and counties associated with the Channel Islands fishery. In addition, this socioeconomic research provided information and insight about demographic characteristics of fishery participants, their values, preferences and needs (overall and by subgroup based, e.g., on ethnicity, homeport, type of fishing/receiving operation), and the larger social, economic and regulatory context in which the options were being considered. This body of information enabled the assessment of the potential impacts of each marine reserve option alone and the cumulative effects of each option together with the impacts of other regulatory changes over time, and provides a baseline for subsequent work*.*
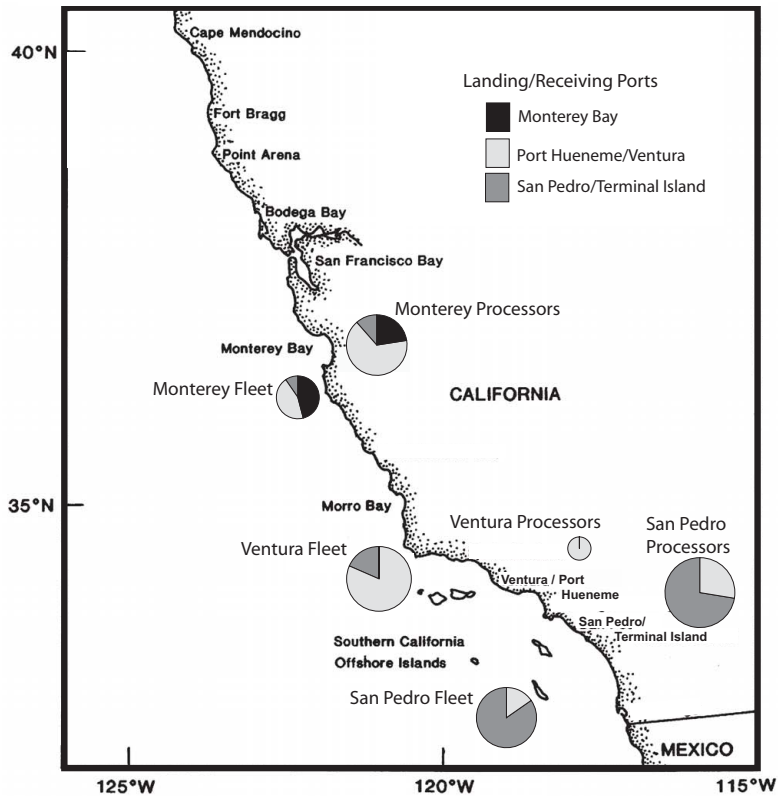
Figure 3. The initial spatial distribution of California squid revenues from ports of landing to regional processing centers for the FMP fleet and major receivers/processors, 2001 (PacFIN data; Pomeroy et al. (2005)).

SOCIOECONOMIC/HUMAN DIMENSIONS INFORMATION NEEDS

In a 2007 study evaluating the development and use of social science information pursuant to the MLMA (Pomeroy and Hunter 2008), state and federal fisheries scientists and managers that were interviewed identified a range of human dimensions information needs. Some identified one or more of the types of socioeconomic EFI identified in the Master Plan. However, they also reported a need for information on other topics including: social and economic relationships, individual behavior including strategies for adapting to environmental, regulatory and economic uncertainty, variability and change; and community structure and dynamics as they affect and are affected by fishery management.

It is important to understand these topics as they pertain to fishery participants, fishing communities and local economies, to address the full suite of MLMA objectives and fishery needs. A historically grounded baseline that synthesizes this information (as available and built over time) can afford a more thorough description of the fishery, enhance understanding of patterns and trends, enable the design of management solutions that avoid unintended negative consequences for ecological and human systems, and provide a foundation for predicting and evaluating management outcomes. For a given fishery or fishery management issue, some items will be especially relevant and/or higher priority than others, as illustrated by the examples provided later in the report.

Human dimensions information needs for addressing the MLMA "socioeconomic" objectives — and several other MLMA objectives (e.g., limiting bycatch, protecting/restoring habitat) — can be distilled

into a set of topics (Table 2), each with particular relevance to the entities variously identified in the MLMA and associated fishery management activities (Table 3) as well as the MLMA objectives.

Table 2. Human dimensions topics relevant to fishery management.

Demographics	Capital
Operations	Employment
Practices	Expenditures
Values, preferences, needs	Revenues
Attitudes, opinions, beliefs	Environmental factors
Institutions	Macroeconomic factors
Relationships and networks	

Table 3. Human system elements (foci/units of analysis) identified in the MLMA.

Individuals (fishery participants, people dependent on fishing, people affected by management)
Small-scale fisheries
Commercial, recreational and subsistence fisheries
Coastal communities
Local economies

The diverse types of socioeconomic EFI described below provide a more complete and meaningful understanding of the human dimensions of fisheries for informing MLMA-based management. Each type of socioeconomic EFI includes several variables, which can be operationalized and measured in particular ways to represent facets of the fisheries human system pertaining to individuals, social groups, place-based communities, and economies. For example, combining data on demographics, operations, and use patterns can be used to differentiate among groups of fishery participants, then combined with other types of socioeconomic EFI to evaluate the impacts of changes in management and the distribution of those impacts among groups. Moreover, certain variables can be used in together (and perhaps combined as an "index") to indicate and enable evaluation of key concepts such as vulnerability, well-being, resilience or fairness embodied in the MLMA.

Demographics
Demographic information typically consists of data relating to a population and particular groups that comprise it. Examples of demographic data include variables such as age, gender, ethnicity, race, education level, income level, residence location and type, and household size. Often, demographic characteristics are associated with particular values, preferences and needs, and thereby influence behavior. In a fisheries context, the population includes fishery participants (commercial, recreational and subsistence fishermen, and fish buyers), those who provide supporting goods and services, other members of the communities where they are based or operate, and consumers of the seafood that fishery participants produce. Demographic data and analyses may be used to characterize individuals, communities and other aggregates of people, including sociocultural groups, fisheries, and associated communities; to identify historic variability and change in populations and groups; and to measure change (impacts) resulting from management action or other factors. Demographic changes, in turn, can signal changes in motivations, values and practices.

Operations

Fishing operations include the vessels, equipment, gear, and crew involved in catching fish. Operations relevant to fisheries and their management also include shoreside operations (e.g., receiving, handling, processing, distribution), and the facilities, equipment, and personnel involved. Fishing and associated shoreside operations vary tremendously, but can be characterized based on key features. For fishing operations, these include items such as vessel length, hull material, fish holding capacity, engine type and horsepower; type of navigation, fish-finding and gear-handling equipment; gear types, configurations and number of units; and number of crew and their role(s). Shore-based fishing operations differ from ocean-going operations in terms of vessels and associated equipment. Shoreside operations for receiving fish may be mobile or fixed, and can range widely in size and function; handling, processing and distribution operations vary as well. Ports and other businesses provide infrastructure, goods and services that support fishery activities, often serving other users and community members as well. Shoreside operations are sensitive to and affected by changes in fishery activity, with implications for other coastal and marine users, communities and economies that depend on them. Understanding the types and characteristics of fishing and shoreside operations is necessary for determining how they affect and are affected by resource use and management.

Practices

Practices are the ways people do things (i.e., their behavior), and include where, when and how they participate in fisheries and fishery-related activities. More specifically, practices include how vessels, equipment and gear are configured and used, whether and how certain species are targeted, caught and handled, and how the catch is distributed, whether for commercial, recreational or subsistence purposes. Practices also include temporal and spatial use patterns of fishery resources and marine areas, ports and other launching/landing sites, and shoreside infrastructure, goods and services. Understanding fishery-related practices is key to identifying sources and solutions for ecological concerns (e.g., bycatch, habitat impacts) as well as human concerns (e.g., conflict, economic viability, social and economic impacts of environmental, regulatory, social or economic change).

Values, preferences and needs

Values are standards of behavior, shaped by one's background and experience, that capture the importance or worth of something — an experience, a way of doing things, an outcome. It is often assumed that individuals behave rationally, driven by economic motives to maximize individual utility (e.g, profit maximization in commercial enterprises). However, individuals are motivated by a complex and diverse mix of social, cultural and economic values. Preferences, which are a greater liking for one alternative over others, are also based on a mix of values such as satisfaction, enjoyment or utility based on one's own and often others' needs. Values and preferences are both personal (intrinsic) and shaped by external factors such as one's background and experience (extrinsic), and vary from one context to the next. Needs are those things that are required for individual survival and well-being, and for viable fisheries and fishing communities. For example, determining angler satisfaction ("satisfying sport use") depends on angler values and preferences. Whereas some anglers may value the opportunity to catch and keep a certain number of fish, others may value the opportunity to fish regardless of what may be kept. Similarly, some commercial fishery participants prefer to make day trips and return to the same port each day (e.g., to be close to family, work with a local buyer, or work known fishing grounds), others prefer (or are more willing) to make multi-day trips or "follow the fish," calling at multiple ports to deliver the catch and restock provisions. Benefits result from the fulfillment of values, preferences and needs; social, psychological, cultural and/or economic costs result when these are not fulfilled. Information about individuals' values, preferences, and needs can be used to develop management options that create appropriate and effective incentives for compliance and minimize adverse impacts

on fishery participants and communities, and to evaluate those options in terms of their acceptability, compliance, and socioeconomic outcomes.

Attitudes, beliefs, opinions

Attitudes, beliefs and opinions are influenced by one's social, cultural and economic background and context. Attitudes are individuals' ways of thinking or feeling, and are evident in a tendency to respond positively or negatively toward certain ideas, objects, people or situations. Attitudes are shaped by beliefs, the things that an individual assumes are true. Opinions, which are a function of attitudes and beliefs, are an expressed judgment about something. Fishery participants' attitudes, beliefs and opinions about fishery resources, the ecological system, and management legitimacy, efficacy and fairness, for example, influence their behavior. Broader public attitudes, opinions and beliefs about fishing practices, seafood consumption risks and benefits, and other facets of fisheries also affect the fisheries system. Understanding fishery participants', seafood consumers' and the broader public's attitudes, opinions and beliefs is useful, for example, for developing and evaluating allocation measures that are perceived to be fair, for gauging support or opposition for management measures, and for identifying misinformation and misunderstandings related to fisheries and their management.

Institutions

Institutions are the norms, rules and strategies that govern peoples' behavior (Ostrom 1990), whether formally (e.g., regulations) or informally (e.g., shared understandings of where and how gear is set, the distance between operations). For example, Eureka area Dungeness crab fishermen reported an informal rule or understanding (albeit not always adhered to) that one does not set one's gear perpendicular or within a certain distance parallel to another person's gear. Recreational fishermen and boaters often observe fishing "etiquette" such as maintaining a given distance from others in order to avoid disrupting their activities.[8] Institutions can create opportunities or barriers to avoiding or resolving conflict and other management challenges. The West Coast crabber-towboat agreement, for example, provides a framework for coordinating ocean space use by commercial fishermen and towboat operators to minimize conflict and safety issues (Industrial Economics Inc. 2012). Formal institutions include not only those specific to a given fishery, but those that pertain to (and affect practices and outcomes in) other fisheries, other/broader marine space use, coastal land use, environmental protection, food production and public health, among others. Understanding the mix of institutions that affect fishery participants and associated communities is useful for evaluating the potential efficacy and outcomes of fishery management actions.

Relationships and Networks

Relationships are the ongoing social and economic connections among people that are meaningful to those people. In fisheries, relationships include those among fishermen, buyers and providers of supporting goods and services, within and among fishing families and communities, and between fishery participants and managers. They reflect interdependencies among those connected for a range of tangibles (e.g., income, goods, services, practical support) and intangibles (e.g., information, shared identity, sense of belonging, social capital). Networks are the larger system of relationships among people, organizations and communities through which information and social and economic resources flow (e.g., enabling or inhibiting access to valuable information, fishing grounds and, for commercial fishermen, buyers). Networks include nodes, with some individuals connected with many others, making them useful for efficiently and effectively communicating with fishery participants and others in the fishery system. Taken together, relationships and networks, along with institutions make up the social

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[8] https://sdyc.org/assets/documents/other_docs/anglers_fishing_guide.pdf, accessed 8/1/17.

structure of a human system and guide patterns of behavior. Information about relationships and networks is useful for understanding how fisheries human systems function, and for assessing social and economic impacts of change on fishery participants, fisheries, and communities.

Capital
Capital consists of the tangible and intangible resources or assets held by an individual or group that can be used to achieve a given purpose. Fisheries-relevant capital includes the natural, human, social, physical, and financial resources needed and used by fishery participants and communities to sustain their activities and generate associated benefits (e.g., livelihood, recreation, sustenance). Natural capital consists of the ecological system including living resources and habitat. Human capital includes people and the skills and knowledge they possess, individually and collectively. Social (and cultural) capital includes trust, shared values and understandings generated and used via relationships and networks to enable individuals and groups to function effectively. Physical capital includes vessels, equipment, gear, ports and other landing sites and facilities, seafood processing facilities, and related technology. Financial capital includes the monetary resources used to purchase or provide physical capital and goods and services to enable human activities. Capital, in its various forms, may be shared through relationships and networks, and contributes to individuals' and communities' resilience groups; insufficient (or insufficiently diverse) capital can contribute to vulnerability to variability and change. Understanding the types of capital needed, available to, and used by fishery participants and communities is useful for evaluating fishery-related behavior, social and economic impacts, and opportunities and challenges to effective adaptation to environmental and regulatory change.

Employment
Employment relevant to fisheries and their management includes not only part- and full-time, seasonal and year-round jobs in fishing and seafood production, but also those associated with the provision of supporting infrastructure, goods and services, including related research and management activities. Changes in fishing opportunities and activities can have direct, indirect and induced effects on employment of fishery participants, goods and service providers, and others in the associated communities and economies. Jobs gained or lost in one part of the human system affect those in other parts of the system (which are connected via social and economic relationships). Employment information is useful for understanding how a fishery works, and for evaluating the impacts of management (and other sources of) change on fishery participants, communities and economies.

Expenditures
Expenditures are payments made by fishery participants for goods and services used directly in fishing or indirectly to enable fishery-related activities to occur. Expenditures related directly to fishing include those for durable (and re-usable) goods such as a vessel, equipment and gear, licenses and permits, and expendable (and operational, trip-specific) items such fuel, bait and ice. Indirect expenditures include items that are ancillary to fishing per se such as vessel taxes, medical insurance, worker's compensation, accessories and clothing (Lovell and Hilger 2011). Expenditures also include those by fish receivers and others engaged in seafood production (which affect prices paid to fishermen) and other fishery-related activities. Information on these types of expenditures, where they are made, and by whom is used to help estimate the economic value of fisheries, and the impacts of changes in resource availability and management on those fisheries and associated communities. For example, changes in expenditures related to fisheries affect the viability and well-being of associated businesses and communities.

Revenue
Revenue consists of payments received by fishery participants and businesses for fish landed (commercially), handled, processed and sold, and for fishery-related goods and services, ranging from charter fishing trips to vessel, equipment and gear sales, maintenance and repair, boat rentals, fuel, bait and ice. Revenues may originate and circulate primarily within a community, although they typically come from and/or circulate outside a community, as noted in the squid fishery example above. Information about fishery-related revenues, including sources, amounts and how they move through the economy, is useful for assessing the impacts of changing resource availability and management on fishery participants, fisheries, fishing communities and the overall economy. Moreover, changes in revenues, such as the ex-vessel (dockside) price for commercially caught species can signal a change in fishing practices.

Environmental factors
Diverse factors within and outside fisheries per se affect fishery participants, fisheries and communities, influencing their behavior, with ecological and social feedbacks, and social and economic outcomes. Environmental factors such as changing ocean conditions, resource abundance and distribution can affect access to fishery resources and the temporal and spatial distribution of fishery activity and resulting catches, with associated social and economic impacts to fishery participants and communities (see, e.g., Chavez et al. (2017)). Information about environmental factors and how fishery participants are affected by and respond to them is useful for interpreting fishery trends, distinguishing between natural and anthropogenic sources of change, and designing management that enables effective adaptation by fishery participants and communities while protecting the ecological system.

Macroeconomic factors
Macroeconomic factors such as inflation, recession, interest rates, and the general state of the regional, state and global economies affect employment, income to individuals and revenue to businesses. These, in turn, affect fishing activity and spending on goods and services, and seafood. For example, a recession can dampen demand for seafood, tourism and recreation, including sport fishing, with attendant social and economic impacts on participants, providers of goods and services, and communities that depend on these activities. An economic upturn can stimulate increases in these activities, enhancing social and economic well-being. Such increases also can pose challenges including space-use conflict on and off the water and increased pressure on fishery resources. Understanding these factors as they affect fishery participation and related activity is useful for anticipating and interpreting change in fishery patterns, developing management options that work within that context, and evaluating outcomes.

Integrating Types of Socioeconomic EFI
Integrating the various types of socioeconomic EFI described above provides a more complete and meaningful understanding of the human dimensions of fisheries for informing MLMA-based management. Each type of socioeconomic EFI includes several variables, which can be operationalized and measured in particular ways to represent facets of the fisheries human system pertaining to individuals, social groups, place-based communities, and economies. For example, combining data on demographics, operations, and use patterns can be used to differentiate among groups of fishery participants, then combined with other types of socioeconomic EFI to evaluate the impacts of changes in management and the distribution of those impacts among groups. Moreover, certain variables can be used in together (and perhaps combined as an "index") to indicate and enable evaluation of key concepts such as vulnerability, well-being, resilience or fairness embodied in the MLMA. Table 4 suggests the types of socioeconomic EFI that are particularly useful for addressing general questions associated with the socioeconomic, management system and ecological objectives of the MLMA. (See

Appendix B for more detailed questions related to each objective and a table indicating the types of socioeconomic EFI relevant to the questions in Table 4.

Table 4. Examples of questions about the fisheries human system relevant to MLMA socioeconomic, management system, and ecological objectives.

Socioeconomic Objectives
Sustainable use
How do people use the state's fishery resources?
What social, cultural, and economic benefits do fishery participants derive from fishing?
What is necessary (and sufficient) to sustain resource use?
Is the fishery's human system sustainable, i.e., viable ecologically and socioeconomically?
How does fishery management affect the viability of the fishery's human system?
Long-term well-being of fishing-dependent people observed
How are people dependent on fishing for food, livelihood, or recreation?
How does fishing contribute to the well-being of fishing-dependent people, communities and economies?
What conditions/factors affect people's fishing for food, livelihood or recreation?
How do changes in management, individually and cumulatively, affect their long-term well-being?
Adverse impacts on small-scale fisheries, coastal communities and local economies minimized
What are the impacts of management on the function and well-being of small-scale fisheries, communities and economies?
What are the *cumulative* impacts of management (and other factors) on their function and well-being?
Catches allocated fairly
What are the criteria for allocating resources among fishery participants (e.g., equal shares, need, fishing history)?
How is fairness defined and perceived by fishery participants?
Do allocation options meet criteria for fairness?
What are the social and economic impacts and implications of allocation options for the fishery's human system?
How do human system responses, in turn, affect achievement of MLMA objectives?
Prevent/reduce excess effort
What constitutes excess effort in the fishery?
What factors contribute to excess effort in the fishery?
How does excess effort affect the fishery's human (as well as ecological) system?
What are the impacts and implications of measures to reduce excess effort for the fishery's human system?
How do human system responses, in turn, affect achievement of MLMA objectives?
Management system objectives
Proactive/responsive to changing environmental, market or other socioeconomic factors and concerns
What *environmental* factors or concerns affect the fishery?
What *social* and *market* (and broader *economic*) factors or concerns affect the fishery?
Are there new/emerging opportunities in the fishery?
Are there new/emerging challenges in the fishery?
What are the impacts and implications of changing circumstances for the fishery's human system?

What are the impacts and implications of management to address changing circumstances for the fishery's human system?
How do human system responses, in turn, affect achievement of MLMA objectives?

Conflict resolution
Are there actual or potential conflicts related to gear, access to the resource, or other aspects of the fishery?
What are the impacts and implications of conflict for the fishery's human (as well as the ecological) system?
What are the options for avoiding, mitigating or eliminating conflict?
What are the impacts and implications of measures to avoid, resolve or mitigate conflict for the human system?
How do human system responses, in turn, affect achievement of MLMA objectives?

Ecological objectives
Sustainable resource
How do fishing practices affect the long-term health of the resource?
What are the options for modifying or eliminating fishing practices that negatively affect the long-term health of the resource?
What are the impacts and implications of measures to avoid, resolve or mitigate conflict for the human system?
How do human system responses, in turn, affect achievement of MLMA objectives?
Healthy habitat
What are the impacts of fishing practices (gear and equipment use) on habitat?
What are the impacts and implications of measures to maintain, restore and/or enhance habitat for the fishery's human system?
How do human system responses, in turn, affect achievement of MLMA objectives?
Restore/rebuild depressed fisheries
What factors contribute to the depressed fishery?
What are the impacts and implications of the depressed fishery for the human system?
What are the impacts and implications of measures to rebuild the depressed fishery for the human system?
How do human system responses, in turn, affect achievement of MLMA objectives?
Bycatch limited
What fishing practices contribute to unacceptable types and amounts of bycatch?
What are the impacts and implications of measures to limit bycatch for the human system?
How do human system responses, in turn, affect achievement of MLMA objectives?

EXAMPLES OF HUMAN DIMENSIONS INFORMATION NEEDS AND APPLICATIONS IN CALIFORNIA FISHERIES

The following are brief examples of management issues that have arisen in the state's fisheries. These issues have become evident through structured monitoring of fishery activity (e.g., ongoing or episodic data collection), observation by CDFW staff, and/or informal or structured communication with fishery participants and others knowledgeable of the fishery. For each example, we identify some of the SE/HD questions and information needs for identifying or defining issues, evaluating options, monitoring implementation, and evaluating results. Many of the questions identified can be framed as hypotheses for testing as part of monitoring and evaluating management.

Changing environmental conditions negatively affecting abalone populations in state waters. *Note: In late 2017, the California Fish and Game Commission voted to close the northern California recreational abalone fishery, effective April 1, 2018, due to ongoing environmental conditions that have had significant negative impacts on abalone.*

Although commercial fishing for abalone has been closed statewide and recreational fisheries for abalone have been closed south of San Francisco since 1997 due to declines in stocks, the recreational fishery in northern California has continued to play an important social and economic role in the region (Reid et al. 2016; NOAA 1997; Pomeroy et al. 2010). However, recent events including an abalone die-off following harmful algal blooms (HABs) in 2011 and marked decreases in kelp growth in recent years have led, in turn, to declines in abalone populations (along with increases in purple sea urchins, which also feed on the limited kelp). These conditions prompted the state to restrict access to certain areas. Noting the social, cultural, and economic importance of the recreational abalone fishery to fisherman and associated North Coast fishing communities, Reid et al. (2016) used a combination of abalone report card (recreational catch) data and a survey of fishery participants to estimate the economic value of the fishery. They also identified variables most likely to influence divers' (shore-based) site selection based on expert opinion of CDFW staff and analysis of use patterns derived from the existing fishery data.[9] This work is useful for prioritizing limited fishery management resources, for evaluating options for restricting access to sites (including minimizing negative impacts on fishery participants), and understanding how effort might shift under such options. Changing environmental conditions in the fishery and their implications for resource use also point to questions related to the larger human system associated with the fishery.

Examples of questions and information needs
- How did participation and practices in the abalone fishery change in response to
  - the decline in the abalone resource?
  - the HAB event per se?
  - management actions taken (i.e., area closures) to conserve the resource?

- How did changes in participation and practices interact with and affect other fisheries?

- What are the near- and long-term impacts of these events on individuals, coastal communities and local economies that
  - depend on the fishery for livelihood, recreation and sustenance?
  - provide supporting goods and services?

- How will they adapt to these changes and impacts in terms of their operations and practices
  - in the abalone fishery?
  - in other fisheries?
  - in associated shoreside context?

THE COMMERCIAL FISHERY FOR CALIFORNIA MARKET SQUID
Shifting resource availability related to variable and changing oceanographic conditions, coupled with changes in other parts of the larger fisheries' human system

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[9] The authors also identified additional information needs to be met through modification of CDFW's data collection procedures for the fishery.

In 2014, squid became abundant north of the fishery's typical range. A small number of permittees and associated buyers briefly shifted effort into this area, with squid trucked south to processing facilities (Chavez et al. 2017). This short-term adaptation enabled fishery participants to take advantage of the emergent fishing opportunity in another location, mitigating the negative impacts of limited resource availability in parts of the fishery's historic range and restricted fishing opportunities in the associated fishery for coastal pelagic species (CPS) finfish (managed under the federal CPS FMP). It also generated economic benefits for fishery-support businesses in Eureka, where activity in the commercial recreational fisheries for salmon and groundfish has diminished due to changes in resource availability and management measures to conserve those resources {Pomeroy, 2010 #1382}.

This example highlights some of the challenges associated with dynamic ecological and human systems, and the feedbacks they have on one another. It also raises some questions about the flexibility of the current permitting system to enable effective adaptation by fishery participants, fishing communities and the fishing economy. Information about the human systems associated with the squid fishery and with fishing communities both within and beyond its historic range can help CDFW assess fishery management outcomes under these dynamic circumstances, and identify and evaluate options for addressing some of the challenges and opportunities that such changes in resource distribution pose.

Examples of questions and information needs
- What were the characteristics of established squid fishery participants (fishermen and buyers) who participated in the fishery off Eureka compared those who didn't?

- What social, economic and environmental factors did squid fishery participants consider in deciding whether or not to travel to the Eureka area to fish?

- What factors affected Eureka area fishery participants' ability to participate in the squid fishery locally?

- What were the social and economic impacts of participating/not participating in the Eureka area fishery on fishery participants, coastal communities and local economies for
  - established squid fishery participants?
  - historic squid fishing communities (including providers of infrastructure, goods and services, families)?
  - Eureka area fishery participants (i.e., involved in other fisheries)?
  - Eureka providers of infrastructure, goods and services?
  - Eureka area communities?

THE COMMERCIAL FISHERY FOR DUNGENESS CRAB
Excess capacity contributing to gear conflict and undesired interactions with marine mammals

Although access to the commercial fishery for Dungeness crab has been restricted since 1995, participation and productivity in the fishery have increased in response to market opportunities in the fishery, and reduced opportunities in a number of other associated fisheries since the early 2000s. As some fishery participants and fishing communities have become increasingly dependent on Dungeness crab for livelihood and well-being (Pomeroy et al. 2010), an apparent increase in gear use led to concerns about conflict within and among fisheries and the potential for interactions with marine mammals. These ecological and social factors led to the establishment of the Dungeness Crab Task Force

in 2009. Composed of fishermen representing the fishery's major ports, buyers, sport fishing representatives, and (non-voting) members from CDFW, California Sea Grant (as science advisor), and an environmental NGO, the Task Force was convened to make recommendations to the Legislature for addressing these and other issues relevant to the MLMA objectives including sustainable use, limiting bycatch (species interactions), reducing excess effort (with participant input), and being responsive to changing conditions and participant concerns. Following the recommendation of the Task Force, the Legislature passed SB 369, which established a Dungeness Crab Trap Limit Program. The Trap Limit Program capped the amount of gear used in the fishery, with each permittee assigned to one of seven tiers (allowing between 175 and 500 traps) based on landings history. A preliminary evaluation of the Program (Juhasz and Pomeroy 2016) addressed a number of questions generated by fishery participants and managers and identified others for future work related to: 1) access to the fishery, 2) fishing capacity, 3) fishing activity, 4) direct and indirect economic impacts, and 5) program operation and effectiveness.

Even as the Trap Limit Program capped the amount of gear used in the fishery, a wide ranging and persistent harmful algal bloom in 2015 significantly disrupted the fishery. The fishery opened several months later than usual, with substantial social and economic impacts on fishery participants, communities and economies. The shift in the timing of the fishery, together with warmer ocean conditions that compressed prey species and attracted whales closer to shore, increased the risk of entanglement with fishing gear (Chavez et al. 2017). Efforts are under way to better understand and address the impacts of HABs on fisheries and interactions with protected species.

Examples of questions and information needs
- What are the temporal and spatial patterns of participation in the fishery within and across tiers, ports and types of operation?

- How do changes in species abundance and distribution, environmental conditions, regulations, markets, and other factors (including other fisheries) affect participation and production in the fishery?

- How do these patterns — and variability in them — affect coastal communities and local economies?

- How did the recent HABS and associated closures affect fishery participants, operations, and practices?
    - in the Dungeness crab fishery?
    - in other, related fisheries?

- How did the changes in fishing activity affect coastal communities and local economies?

THE COMMERCIAL FISHERY FOR NEARSHORE ROCKFISH
Concerns about negative impacts on fish stocks due to a rapid increase in effort directed toward slow-growing, relatively sessile species.

Changes in fishing opportunities and the emergence of the market for live rockfish and related groundfish species through the 1990s led to a rapid increase in effort in the open access fishery in California. At the height of the fishery in the late 1990s, more than 1,000 vessels landed the species using traps or line gear. These changes and activity together with ecological evidence of the vulnerability

of the target species and impacts from fishing led the state to develop a regional restricted access program for 19 nearshore species. A Nearshore Fishery permit first was required (following the 1998 passage of the Nearshore Fishery Management Act) in 1999. The number of permits issued dropped from 1,127 in that year to 508 by 2002. That year, the Fish and Game Commission adopted the Nearshore FMP, which included a regional restricted access program that capped the number of permits at between 29 and 76 permits in each of four fishery management regions.[10] In doing so, the Nearshore FMP sought to meet MLMA and fishery-specific objectives including the reduction of excess effort (with substantial input from fishery participants) and ensuring sustainable use of the resource. Between 2003 in 2013 the number of Nearshore Fishery permits issued dropped by 29% from about 220 to about 157 (Wilson-Vandenberg et al. 2014); as of May 2016, CDFW had issued 121 permits for the year, reflecting nearly 40% attrition since the program was implemented.[11]

Recently, CDFW and the Commission have sought to address issues related to transferability of Nearshore Fishery and the Deeper Nearshore Species permits.[12] Given the relatively small number of Nearshore Fishery permittees, it has become difficult to obtain the required two permits in the same region in order to enter the fishery, with adverse impacts on those seeking to leave the fishery and those seeking to enter it. The prohibition on the transfer of a Deeper Nearshore Species Fishery Permits is likewise problematic. And, because nearshore and deeper nearshore species are frequently caught together, fishermen with only one permit must discard the species they are not permitted to keep. In response to ongoing dialogue with fishery participants, a survey of needs and preferences of permit holders, and analysis of fishery landings data, CDFW and the Commission are considering changing the regulations to address these socioeconomic and ecological challenges in the fishery, consistent with several MLMA objectives.

Examples of questions and information needs
- How have fishing and receiving patterns for nearshore and deeper nearshore species changed since the initial implementation of restricted access for the two fisheries?
    - What have been the social and economic impacts and implications of those changes?

- How do proposed changes in permit transfer provisions affect
    - the costs of entry into the nearshore fisheries?
    - participation, including entry and exit, in the fishery?
    - participation in other fisheries?

- What are the impacts and implications of changes in fishery participation on associated coastal communities and local economies?

As the foregoing examples illustrate, there is a need to expand the scope of socioeconomic EFI and guidance for its development and use to support and enhance state fishery management consistent with the MLMA. Building and using information about the human system throughout the management process (cycle) is useful for achieving both socioeconomic and ecological objectives. The view of fisheries from the human perspective complements the view from the ecological perspective, affording a more complete understanding of fisheries systems, which can enable more effective management.

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[10] The fishery also is managed using gear specifications, quotas, and temporal and spatial closures.
[11] https://www.wildlife.ca.gov/Licensing/Commercial-Fish-Business/Nearshore-Provisions, accessed 7/21/17.
[12] http://www.fgc.ca.gov/regulations/2017/#150, accessed 8/16/17.

PART 2: DEVELOPING AND USING SOCIOECONOMIC EFI FOR FISHERY MANAGEMENT

Developing and using socioeconomic essential fishery information (EFI) in management is an iterative process, much like fishery management itself. It entails the use of diverse information sources, methods, and tools to meet particular information needs at each stage in the management cycle: ongoing monitoring, evaluation and scoping to identify problems, opportunities, and information needs; building and using new information to help meet those needs; and monitoring and evaluating conditions and outcomes, thus enabling the identification of emergent problems and opportunities.[13]

A STEPWISE PROCESS FOR BUILDING AND USING SOCIOECONOMIC INFORMATION FOR FISHERY MANAGEMENT
Federal and state authorities variously mandate and/or provide guidance for building and applying socioeconomic information for fishery management (NMFS 2007, 2007; Pomeroy and Hunter 2008). NMFS' *Guidelines for Social Impact Assessment* (SIA) (NMFS 2007) in particular provide a useful starting point for such efforts in California consistent with the MLMA.[14] The NMFS guidelines note that although social and economic impact assessments are related, "they differ considerably in focus, underlying questions, methods, and approaches" (NMFS 2007). Economic analyses focus on resource supply and demand, prices, and jobs, and determining whether the economic benefits of an action or policy outweigh the costs to society. Social analyses focus on the fuller range of social, cultural and economic features and dynamics of the human system, and how social, cultural and economic impacts manifest and are distributed within and among various groups or interests (see Table 3):

> For example, an economic analysis of a proposed fishery allocation might suggest an increase in jobs, local trade, and tax bases. The same data subjected to a social factors analysis might indicate community changes and losses due to a shift from year-round to seasonal employment. The social factors analysis might also show decreased opportunities for crew members to become vessel owner/operators, loss of cultural values, and a rise in cultural costs to families and communities as they deal with the social effects of under-employment (NMFS 2007).

The present guidance is designed to enable both social and economic analysis (singly and in combination).[15] Borrowing from the NMFS SIA Guidance, the following iterative process entails four major steps, each of which may inform the others throughout the management process:

- ***Building the social baseline:*** Characterizing the human dimensions of fisheries and associated communities.
- ***Scoping***: Identifying the questions pertaining to the fishery management issue.
- ***Selecting relevant social variables for investigation:*** Identifying the key concepts and associated variables suggested by the management questions.

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[13] Note that while social science research can provide guidance on scientifically appropriate use of the resulting information (i.e., informing policy considerations) and their likely outcomes, it cannot determine the policy choice per se. That choice depends on the particular management objectives and priorities, which in turn are a product of the political (policy-making) process rather than the scientific process and, therefore, are outside the scope of this work.

[14] The order suggested here differs from the NMFS SIA Guidance, where scoping precedes building the social baseline. However, because building socioeconomic EFI is an iterative and cumulative process and can inform scoping, it is suggested as a first and foundational step.

[15] The Economic Guidance Document developed by Conservation Strategy Fund (2015) specifically addresses economic impact analysis and economic valuation methods, and complements the present guidance.

- ***Synthesizing and analyzing data to address management questions***: Using the appropriate analytical approach to evaluate the data to illuminate problems and opportunities and compare impacts and outcomes of management options among individuals, groups, and communities.

The first three steps — building the social baseline, scoping, and selection of variables for investigation — constitute social factor analysis, a data collection and analysis process that characterizes the fishery or fisheries and associated communities, identifies problems and opportunities, and identifies those parts of the fishery system that are most relevant to the management context. The last step, synthesis and analysis for application to management, entails further analysis to address specific management question(s) and evaluate management options and outcomes.

Whether within a specific fishery management process or in the aggregate (across multiple processes and/or over time), addressing some management questions and information needs provides a necessary foundation for other work, thereby enabling the development of cumulative knowledge. Furthermore, it enables the identification of data gaps and can reveal emergent questions, new sources of information, and ways of thinking about and approaching management challenges and opportunities.

SCOPE OF DATA COLLECTION

Building socioeconomic information to address management questions and evaluate progress toward meeting MLMA objectives involves gathering, processing, organizing, and structuring data *in context* to make it useful, useable information.[16] This process may include:

- using data and knowledge that CDFW collects or possesses;
- extracting and analyzing data from other available sources; and
- conducting new research to collect and analyze new data.

Whereas some information needs can be met by primarily using data and knowledge CDFW possesses, it often is preferable to use a mix of in-house and other sources. Not only does this help ensure that the information produced is valid and reliable; it also affords a more complete and nuanced understanding based on diverse experiences and perspectives. Using all three approaches is useful for generating robust information to meet the needs for the issue at hand and for building a broader foundation consistent with the MLMA objective to be proactive and responsive to change (§7056(l)). The particular analytical approach — the methods and techniques — used to synthesize and analyze social data depends on the particulars of the fishery, the issues at hand, and the data needed as well as the availability of time, funding, personnel and expertise.[17]

BUILDING THE SOCIAL BASELINE

- *What are the key components and characteristics — based on the socioeconomic EFI types — of the fishery, shoreside support system, and associated communities?*
- *How are these components connected to one another?*
- *How have these varied and changed over time — and why?*

The social baseline provides a foundation for understanding how management change and other types of perturbations (e.g., those associated with climate change) may affect fishery operations and

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[16] https://www.diffen.com/difference/Data_vs_Information, accessed 1/17/18.

[17] As the NMFS SIA Guidance notes, the skillful use of available data can minimize the expense of new data collection; however, "the nature of readily available data should not drive the analysis" (NMFS 2007).

practices. These, in turn, have implications for the ecological and social subsystems, and for identifying management options to mitigate negative impacts, maximize positive impacts, and support emergent opportunities as they arise.

A social baseline consists of a characterization or description of the current features of the system of interest, as identified for the socioeconomic EFI types, in historical context. The scale and scope of the social baseline should be sufficiently broad to capture the relevant people, places, and connections among them. For example, in characterizing participants in a fishery, the baseline should capture not only individuals' participation in the fishery of interest, but their participation in other fisheries as well, and how and why participation in those fisheries has varied or changed over time. Similarly, the baseline identification and characterization of the communities associated with a given fishery should account for different types of association with place (e.g., residence, homeport, fishing port/launch site, place where goods and services are obtained).

Over the past two decades, considerable work has been done by state and federal fishery management personnel, academic researchers, and others to build social baselines — that is, characterize fisheries and communities and, to a lesser extent, broader multi-fishery, multi-community systems — to inform fishery management (see Appendix C). Because much of this work has been done opportunistically, contingent on interest, need, and funding, and often without clear coordination, there are notable gaps and inconsistencies. However, the information generated can be — and has been — used as part of the iterative social assessment process outlined above. For example, the West Coast fishing community profiles developed by Norman et al. (2007) provided selected social baseline information to inform and motivate Pomeroy and colleagues' North Coast Fishing Communities Project, which used a mix of data sources, methods and techniques to substantially expand that social baseline and identify trends, problems and opportunities facing the region, its commercial and recreational fisheries, and coastal communities (Pomeroy et al. 2010).

As often occurs, this work began with examination of data and knowledge directly available to the research teams, supplemented by quantitative and qualitative data from other sources (i.e., data collection efforts and repositories, archives of historical materials, and literature based on previous research), then expanded to include the collection of new data through observation, interviews and group meetings. The resulting information is depicted using a mix of narrative description coupled with figures and tables representing the key features of the fishery, community and/or fishery system and connections within and among these; patterns and trends in fishery-related activity; and summary statistics related to fishery participation and production, community demographics, and other relevant features.

SCOPING
- *What is the management question, problem or opportunity?*
- *What options might be considered?*
- *Who among fishery participants and which communities may be involved in or affected by the issue and/or resulting management action?*

Whereas the social baseline provides the initial conditions independent of the management issue or question, scoping orients the investigation within and beyond that baseline. For social assessment purposes, scoping is used to identify not only management issues and options, but also the user groups and communities that may be affected, key social and resource availability issues, and social and

environmental benefits and values associated with the fishery (NMFS 2007). Altogether, this enables the identification of key questions; examples of these questions are identified in (Pomeroy et al. 2017).

Scoping engages fishery managers, fishery participants, other stakeholders, and those tasked with ecological and social assessment of management options, through formal processes (e.g., public comment[18], advisory group meetings) and informal discussions with knowledgeable individuals. The information and knowledge they provide may be qualitative or quantitative, and is useful for informing subsequent data collection and analysis.

SELECTING RELEVANT SOCIAL VARIABLES FOR INVESTIGATION

- *Based on the questions and options identified through scoping and relevant MLMA objectives, what concepts or topics warrant investigation?*
- *What parts of the fishery's human system are most relevant to the management issue?*
- *What variables can be used to represent and measure the relevant concepts in each context?*

The social baseline and results of scoping provide a critical foundation for selecting relevant variables for investigation to meet the particular information needs for management. Social concepts identified in the MLMA include dependence on fishing, livelihood, satisfaction, well-being, conflict, fairness, adverse impacts, and sustainable use. Other social concepts such as vulnerability, resilience, and adaptive capacity also are relevant to fishery management, not only in the context of climate change but more broadly. The issues identified in the scoping process highlight these and other key social concepts that can be operationalized and measured qualitatively or quantitatively to enable analysis. These concepts may be represented by the same or different variables for the relevant parts of the fishery's human system. Those parts include the operational contexts: fishing, shoreside infrastructure and support systems, communities, and the entities identified by the MLMA: individuals (fishery participants, people dependent on fishing, people affected by management); small-scale fisheries; commercial, recreational and subsistence fisheries; coastal communities; and local economies.

Identifying the relevant social concepts and the corresponding social variables for investigation is guided by practical as well as methodological considerations. Consistent with guidance provided for social and environmental analyses in general, variables selected for analysis should be contextually appropriate and valid, clearly and accurately representing the key concept in the management context. They also must be amenable to reliable measurement, and sufficiently sensitive to enable the detection of change. Other considerations include the availability of data to measure the variable and the feasibility of data collection where data are not already in hand.

Building and Using Socioeconomic EFI
The NMFS SIA Guidance identifies five categories of social factors or social variables for social impact assessment (SIA). The socioeconomic EFI types provide a finer-scale set of social factors consistent with these five categories and the broader range of economic as well as social considerations for MLMA-based fishery management.

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[18] However, because public comment is not systematically sought and gathered from a random sample of the population of fishery participants (or stakeholders more broadly), it is biased toward those who participate, and should not be treated as representative of that population or the population of stakeholders for a given issue (NMFS 2007).

For each type of socioeconomic EFI, a mix of variables can be identified, operationalized and measured singly or in combination with others to characterize aspects of the fishery system, answer management-related questions, and/or evaluate fishery management outcomes related to the MLMA objectives. The particular questions and information needs for the fishery typically follow from an emergent problem or opportunity which, while context-specific, also relates to one or more MLMA objectives, as illustrated in the California case study examples provided in Part 1. The variables suggested by the questions may be simple, single items such as fishermen's age or community population size, whereas others may be more complex. Concepts such as "dependence on fishing," "identity," "vulnerability," and "well-being" may be measured by combining multiple variables into an index that captures diverse aspects of such concepts (see, for example, (Breslow et al. 2017; Clay and Olson 2008; Colburn et al. 2016; Himes-Cornell and Kasperski 2016; Kelty and Kelty 2010)). Table 5 identifies a sampling of variables for each type of socioeconomic EFI that are particularly relevant to understanding fisheries human systems for MLMA-based fishery management. These variables can pertain to multiple contexts: commercial, recreational and/or subsistence fishing per se, shoreside support, and coastal communities[19], with narrower or wider scope: a fishery sector, all sectors of a fishery, all fisheries, and to multiple scales: individual, family, fishery, community, region, the state.

Table 5. Examples of variables for each type of socioeconomic EFI.

EFI Type	EFI Variables
Demographics	age, gender, race, ethnicity, occupation, employment, income level, education level/attainment, housing status, residence location, household/family size
Operations	vessels, gear, equipment, crew and other personnel, permits and licenses, infrastructure
Practices	fishing, shoreside provisioning and use, receiving, handling, processing, distribution
Values, preferences, needs	what matters to people what motivates their behavior (e.g., financial gain, power, desire or need for food, livelihood, independence) what people prefer (ordering of priority) what people/fisheries/communities need in order to fish, to sustain livelihood, community
Attitudes, opinions, beliefs	how people think or feel, and what they perceive and believe, about fisheries, fishery status, management options, etc.
Institutions	formal: codified rules, regulations, government, non-governmental organizations (not limited to fisheries management) informal: shared norms, rules, strategies of/for behavior
Relationships and networks	among people (fishery participants, families, social groups), businesses (owned, operated, or used) and formal institutions, within and among places

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[19] This includes management, associated institutions, and people who develop, implement, and enforce them.

EFI Type	EFI Variables
Capital	natural: e.g., fishery resources, habitat, harbor, shoreline human: people, skills, knowledge social and cultural: e.g., trust, shared values and understandings physical: vessels, equipment, gear, ports/other landing sites, infrastructure, seafood receiving and processing facilities, related technology financial: monetary resources
Employment	by industry, community, and overall
Expenditures	durable/re-usable goods: e.g., vessels, equipment, gear, licenses, permits operational/expendable goods: e.g., fuel, bait, ice indirect: e.g., vessel taxes, medical insurance, worker's compensation, accessories, clothing
Revenues	to fishery participants (commercial, recreational-for-hire) to seafood businesses to goods and services providers to local, state, and federal government (taxes, fees)
Environmental factors	ocean conditions (including climate change), resource abundance and distribution, weather and associated shoreside impacts
Macroeconomic factors	inflation, recession, interest rates, state of the economy (regional, state, global), global markets (supply, demand)

There are many potential sources of data on these variables (whether they are single or composite measures). Those sources provide data on multiple variables for a given type of socioeconomic EFI and/or for one or more of four fishery-management related social contexts: **commercial fishing**, **recreational fishing** (both focusing on the fishing or on-the-water aspects of fisheries), **shoreside infrastructure and support**, and (place-based, typically coastal) **communities**. The sources are assigned to one of four general groups. **Datasets/data collection efforts** include data collected by agencies and others that can be obtained from the data collecting entity and analyzed. **Information repositories/clearinghouses** typically serve as a portal for access to data from multiple sources that address a common subject. These sources may provide data in various forms, for example, raw, filtered (e.g., excluding identifying information to ensure confidentiality of certain individuals' or businesses' information), aggregated and/or summarized for a particular purpose. **Documents and other media** include materials that provide results of work done (e.g., research reports, refereed articles, documentaries) or information assembled for various purposes. **People** include individuals and groups that may have direct knowledge or experience related to the management question or information need.

Appendix D includes tables that identify sources and types of data for building socioeconomic EFI by social context (Table D1) and the types of socioeconomic EFI each source can provide in general (Table D2), and followed by a list of those sources with web links where available and brief descriptions that highlight items that may be of particular interest (Table D3).

Especially in the case of documents and other media and people, the items identified may serve as primary or secondary sources of data, depending on the context. "Primary sources are the original materials or evidence to be analyzed, evaluated, contextualized, or synthesized in the research process....

Secondary sources analyze, evaluate, contextualize, or synthesize evidence. They often give second-hand accounts based on engagement with primary sources."[20]

Developing socioeconomic EFI requires the collection of *data* — qualitative and quantitative values of variables — and analysis of variables individually and/or in combination with one another to generate *information,* which in turn can be interpreted and applied to management questions as part of the adaptive management cycle. For example, commercial fishing license applications provide a source of *data* on licensees' date of birth, which can be synthesized and analyzed to generate *information* about fishery participant demographics. This information can be used, for example, in fishery profiles, assessments of the impacts of potential management change on the make-up of a fishery and specific groups of fishery participants, and evaluations of fisheries relative to management objectives. Age and other demographic data have been used to characterize trends in fishery participation in Alaska and other places, where the apparent "graying of the fleet" following regulatory, social, and economic changes poses challenges to the long-term viability of fisheries and fishery-dependent communities.

Table 6 provides a short, generalized list of methods for collecting socioeconomic EFI. Each of these methods is appropriate in some contexts and for collecting some types of data but not others. For example, semi-structured interviews of purposefully selected individuals are particularly appropriate for exploring topics not well understood, both to provide in-depth and nuanced understanding and to inform the design and administration of structured surveys to collect data from a sample of a population. Most efforts to build and use socioeconomic EFI employ a combination of such methods, as each renders some types of information and not others. Moreover, approaches that use multiple methods, data types, and data sources are forms of triangulation, useful for evaluating and ensuring the accuracy, validity and replicability of the research and its results.[21]

Table 6. General methods for collecting socioeconomic EFI (adapted from Given (2008)).

Data collection method	Definition
Literature review	Systematic identification and consultation of secondary sources (i.e., products of previous research) to extract or distill information related to the topic of interest, typically as part of a meta-analysis.
Archival research	Systematic search for and extraction of evidence from original source materials such as databases, newspapers, public records, meeting minutes, and other items typically collected and/or maintained by an institution, government body, business, family, or other entity. Also includes artifacts, things that societies and cultures make for their own use, which provide historical, demographic, and personal information about a culture, society, or group of people including insights into values, beliefs, and knowledge.
Observation	The systematic and purposeful collection of impressions of the world (e.g., human behavior) through looking and listening to learn about a phenomenon of interest using a pre-defined schedule and strategy to collect information on specific variables (structured observation) or guided by a general idea of what is salient to the research question (naturalistic, nonstructured, and/or participant observation).
Interviews	The collection of data from individuals via direct verbal interaction (in person or by phone/internet communication) using an unstructured (narrative or conversational),

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[20] https://www.uvic.ca/library/research/tips/primvsec/index.php, accessed 2/4/18. See also https://guides.library.ucsc.edu/primarysecondary, accessed 2/6/18.
[21] Research methods in the social sciences, whether qualitative, quantitative or mixed, are guided by standards of practice for ensuring validity and reliability.

Data collection method	Definition
	semi-structured, or structured format. The ability to clarify questions and responses and use probes and follow-up questions to explore topics in depth enhance the validity and reliability of the resulting data.
Focus groups	A form of qualitative interviewing that uses researcher-led group discussion to generate data useful for a range of purposes from exploration (scoping) and evaluation.
Surveys	The use of structured questionnaires administered via mail, online, in person or by telephone to systematically collect data from individuals, organizations, or other units of interest. Typically used to collect the same types of data from a sample or population of subjects of interest to enable quantitative and/or qualitative analysis.

As data are collected, they should be organized to enable synthesis and analysis. Quantitative data can be organized in tabular form, mapped and/or plotted to provide snapshots and depict trends in space and time, and summarized using descriptive statistics. For instance, geographic information systems (GIS) and other tools can be used to organize data on and depict social structures, networks (connections among parts of the systems), and characteristics based, for example, on landings and permit data (for fisheries) and demographic data (for communities) (NMFS 2007). Qualitative data can be organized in a variety of ways for synthesis and analysis (Miles et al. 2014; Silverman 2013) to describe the structure and function of fisheries, communities, and fisheries systems, and explain causes and consequences of events, patterns and trends.

SYNTHESIZING AND ANALYZING DATA TO ADDRESS MANAGEMENT QUESTIONS

- *How would each management alternative change the variables of interest and the fishery's human (social) system?*
- *How do these expected changes affect achievement of MLMA objectives related to a) the fishery's human system, b) the fishery's ecological system, and c) the management system?*

Synthesis and analysis to address management questions follows the previous three steps' work of building the social baseline, scoping, and selecting relevant variables for investigation. This step provides the opportunity (and the imperative) to determine whether the social and economic information collected is sufficient to 1) understand the social (human) aspects of the management problem, opportunity, or question, 2) identify and evaluate the (feasible) options (including the status quo), 3) implement the selected option, and 4) monitor and evaluate impacts and outcomes relative to the fishery and the MLMA objectives. If the information is not sufficient to support these processes, further work to augment the social baseline, scope, and select and measure relevant variables for investigation may be necessary.[22]

Synthesis and analysis of social data to address management questions occurs on multiple scales, with assessment focusing on social concepts and units of analysis identified by management policy.[23] (See *Selecting Relevant Social Variables for Investigation.*) A primary objective of this step is to enable comparison of impacts and outcomes of the management options (including the status quo) relative to

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[22] The feasibility of such further work may be limited by the urgency of an issue and/or the limited availability of resources necessary for conducting it. However, as CDFW inventories and continues to build socioeconomic information — and capacity for its use — the cost of this work should diminish.

[23] The NMFS SIA Guidance identifies three levels of assessment: impacts on participants, on fishing communities, and on participation, dependence, and the cultural/social framework of the fishery and any affected fishing communities (NMFS 2007).

the baseline and the relevant management objective(s) within and across these scales and over time. Results may be presented quantitatively or qualitatively, as data, analysis, and subject matter warrant.

Research to address socioeconomic (human dimensions) information needs for fishery and broader ocean management is conducted — and informed — by multiple social science disciplines including economics, sociology, anthropology, geography, and psychology (ODFW Marine Reserves Program 2016). Each of these has established approaches and tools for collecting and analyzing qualitative and quantitative data to answer questions. As such, a wide range — and often a mix — of approaches can be used to collect, synthesize and analyze qualitative and quantitative data to address fishery management questions and information needs, with particular procedures and processes contingent on the context.

Appendix C provides examples from the literature of efforts to systematically build information to meet fishery management needs. The items presented focus primarily on California and US West Coast fisheries and communities, where considerable work to build socioeconomic information for fishery management has occurred or is under way. Additional examples from other US (primarily federal) fishery management contexts are provided, as they afford some further grounding, insight and ideas for meeting information needs in California. The examples variously address one or elements of the stepwise process outlined in this report for different contexts (i.e., fishing, shoreside infrastructure and support, communities). Each synopsis summarizes data sources and methods used, topics addressed, and findings. In addition, the MLMA objectives that the source addresses (explicitly or implicitly), whether specific to California or another context, are indicated. (See also Appendix E, Resources for Further Information about Research Methods and Tools.)

CASE STUDY EXAMPLES
Case study examples from California fisheries help illustrate how socioeconomic information has been and/or can be developed in context to inform fishery management consistent with the MLMA. Note that the following examples, like most cases in the "real world," do not precisely follow the stepwise process, as information needs and efforts to identify and address them are part of the dynamic and iterative information and management processes.

THE COMMERCIAL FISHERY FOR DUNGENESS CRAB
The case of the California commercial fishery for Dungeness crab highlights the relevance of variable and changing climate conditions, which can disrupt the fishery system, creating new management challenges and attendant information needs.

Although access to the commercial fishery for Dungeness crab has been restricted since 1995, participation and productivity in the fishery continued to increase in response to market opportunities in the fishery and reduced opportunities in a number of other fisheries. In the early 2000s, amid growing concerns about excess capacity, a derby fishery, and a consolidated processing sector, Dewees and colleagues (2004) conducted a study to systematically characterize the problem, identify potential management options, and assess fishery participants' opinions and preferences related to those options. They used diverse methods and data sources to collect and analyze data in a stepwise process that included building a social baseline, scoping, selecting relevant variables for investigation, and synthesizing and analyzing data to evaluate management options (Table 7). Results indicated that the majority of

fishermen favored 2 of the 12 management options posed: uniform trap limit for vessels and a daylight-only fishery, with opinions varying by vessel-size group.[24]

Table 7. Approach used to explore problems and solutions related to capacity and its use in the commercial fishery for Dungeness crab.

Methods	Data Sources	Management Cycle	Social Assessment Steps	SE EFI Types
Informal conversations, interviews	Fishery participants and managers	Identifying problems and opportunities	Scoping, building social baseline, selecting social variables to investigate	Operations; Practices; Attitudes, opinions, and beliefs; Institutions
Literature review	Gray and refereed literature on capacity reduction strategies	Identifying potential options	Scoping, selecting variables to investigate	
Archival research	CFIS fish ticket data	Scoping, identifying problems and opportunities	Scoping, building social baseline	Operations; Practices; Capital
Mail survey	Permittees	Evaluating options	Building social baseline, comparing alternatives	Demographics; Operations; Practices; Opinions; Preferences; Capital
Semi-structured interviews	First receivers, processors	Evaluating options	Building social baseline, comparing alternatives	Operations; Practices; Capital; Expenditures; Revenues; Macroeconomic factors

Although management action did not immediately follow the team's work, their results provided a better understanding of structure and function of the fishery, the issues and factors that contribute to them, as well as fishery participants' attitudes toward and preferences for management options, and laid a foundation for future decision-making and social research related to the fishery.

As these issues persisted, the California Dungeness Crab Task Force (DCTF) was created pursuant to SB 1690 (2009), with the directive to make recommendations to the Legislature for addressing these and other issues relevant to the MLMA objectives including sustainable use, limiting bycatch (species interactions), reducing excess effort (with participant input), and being responsive to changing conditions and participant concerns.[25] The DCTF subsequently proposed a seven-tier trap limit program, which ultimately was established via the Legislature (SB 369, 2011). As this process of management change unfolded, Juhasz (CDFW) and Pomeroy (CA Sea Grant) cataloged questions posed by the DCTF and

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[24] The team's literature review, however, indicated that these options typically do not significantly decrease total traps fished or slow derby fishing, indicating a divergence between fishery participants' preferences and the likely utility of the various management options.

[25] The Task Force is composed of fishermen representing the fishery's major ports, buyers, sport fishing representatives, and (non-voting) members from CDFW, California Sea Grant (as science advisor), and an environmental NGO.

identified management-related information needs for addressing those questions and evaluating the trap limit program *(scoping)*, as required by the Legislature (Juhasz and Pomeroy 2016). The topics identified included: 1) access to the fishery, 2) fishing capacity, 3) fishing activity, 4) direct and indirect economic impacts, and 5) program operation and effectiveness. Lacking resources for primary data collection,[26] Juhasz and Pomeroy used readily available information to characterize aspects of the fishery *(building the social baseline)* and explore associated questions *(selecting social variables to investigate, synthesizing and analyzing data to address management questions)*. They thereby addressed a subset of these information needs while noting the limitations of the work[27], and laid the foundation for future efforts *(building the social baseline)* (Juhasz and Pomeroy 2016, 2017) (Table 8).

Table 8. Approach used to assess conditions and trends associated with the implementation of the Dungeness crab trap limit program and other events in the fishery.

Methods	Data sources	Management Cycle	Social Assessment	SE EFI-Building
Observation	DCTF meetings	Scoping	Scoping, building social baseline, selecting social variables to investigate, evaluating outcomes	Operations; Practices; Attitudes, opinions, and beliefs; Institutions
Informal conversations	Fishery participants and managers	Scoping	Scoping, building social baseline, selecting social variables to investigate	Operations; Practices; Attitudes, opinions, and beliefs; Institutions; Capital; Environ-mental factors; Macroeconomic factors
Archival research	CFIS fish ticket and permit data	Scoping, evaluating outcomes	Scoping, building social baseline, selecting variables for investigation, evaluating outcomes	Operations; Practices; Relationships and networks; Capital; Revenue

A key factor affecting this preliminary evaluation of the trap limit program was the wide-ranging and persistent harmful algal bloom in 2015, which significantly disrupted the fishery. The fishery opened several months later than usual, with apparent substantial social and economic impacts on fishery participants, communities and economies. The shift in the timing of the fishery, together with warmer ocean conditions that compressed prey species and attracted whales closer to shore, increased the risk of entanglement with fishing gear (Chavez et al. 2017). As efforts to reduce such risk proceed,

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[26] Specifically, resources to support the evaluation of the program would have enabled the collection of primary data from fishery participants on fishing capacity and its use prior to program implementation along with demographic and other relevant socioeconomic EFI to update and assess change in the fishery's human system since Dewees and colleagues' work.

[27] Key limitations included: the lack of baseline (pre-implementation) trap use data, the lack of systematically collected primary descriptive and explanatory data on fishery participants and their practices specific to their pre- and post-trap limit activities and experiences, the short time period since implementation, and the delayed season opener due to elevated domoic acid toxins in the crab.

information about the fishery's human system can provide a foundation for identifying options that are consistent with the diverse socioeconomic, ecological and management objectives of the MLMA and other relevant policy and evaluating impacts and outcomes of policies implemented.

This disruption to the fishery highlights the relevance of environmental factors in affecting the fishery's human system, with further feedbacks to the ecological system, altogether relevant to several MLMA objectives. Baseline information on the fishery's human system is useful for anticipating fishery participants' responses to changing resource availability or access and for assessing socioeconomic impacts on the fishery. The resulting information is useful for developing appropriate management options consistent with the MLMA and for informing mitigation efforts for the affected human and the ecological subsystem.

THE COMMERCIAL FISHERY FOR CALIFORNIA HALIBUT[28]
In 2004, the California Legislature passed SB 1459, which closed state waters to bottom trawling, except in the previously designated California Halibut Trawl Grounds (CHTG), which cover about 200 square nautical miles in the Santa Barbara Channel region.[29] In September 2006, pursuant to the implementation of SB 1459, state officials notified fishermen that Monterey Bay's designation as state waters (determined by case law in the 1950s {Welles, 2005 #719}, but not enforced) would be enforced beginning October 1 of that year. The enforcement of the Monterey Bay closure caught fishery participants by surprise, and led to debate between some sectors of the commercial fishing and some environmental NGOs over the impacts of the fishery on the resource and habitat, the impacts of the closure on the fishing community, and ways to mitigate both of these. These issues are most relevant to the MLMA objectives related to managing for sustainable use (in social and ecological terms; §7055(b), §7056(a)) and minimizing adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies (§7056(j)).[30]

In an effort to resolve this conflict, California State Assembly Member Monning's office helped establish the Halibut Research Design Project as a mechanism for bringing diverse interests together to discuss questions and concerns raised by the closure and options for mitigating its effects or finding an alternative that would allow fishing while protecting the resource and habitat *(scoping)*. Although the group did not arrive at a long-term solution, the discussions led to research questions and information needs related to the human dimensions of the fishery (among other topics). In addition, the MLMA Master Plan had identified the fishery for California halibut as a top priority for development of a FMP fishery management plan (CDFG Marine Region 2001). As such, an approach that considered the commercial fishery more holistically, including all gear groups and the full geographic range, was needed.

To help meet the human dimensions information needs related to the commercial fishery for California halibut, Pomeroy and colleagues (including CDFW Senior Environmental Scientist Paul Reilly as co-PI) conducted a collaborative fisheries research project that engaged selected, knowledgeable fishery participants, scientists, and managers to: 1) identify and map the key features of the commercial California halibut fishery social system *(building the social baseline)*; 2) characterize recent fishery

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[28] Adapted from Pomeroy et al. (2016).
[29] In 2009, the California Fish and Game Commission further restricted the fishery, adopting requirements for "light touch" trawl gear for use in the CHTG (Fish and Game Code Section 124 (b)(1) through (b)(5)).
[30] Other MLMA objectives including those related to limiting bycatch (§7056(d)) and ensuring healthy habitat maintaining/restoring/enhancing habitat (§7056(b)) also are relevant.

trends by gear type, port, and other dimensions using existing data *(building the social baseline)*; 3) identify key factors (e.g., changing environmental conditions, regulations, markets) that have affected those trends and features of the fishery *(building the social baseline, scoping)*; and 4) map the socioeconomic structure of the fishery system to enable assessment of impacts of regulatory, environmental, economic, and other types of change *(building the social baseline, select variables for investigation)*.

The research team used an iterative, mixed-methods approach combining archival research (focused on existing literature and CFIS data), semi-structured interviews, and informational meetings (Table 9) to build an historically grounded understanding of the present day fishery as well as its history. First, they reviewed the literature on the fishery and began to explore the CFIS data *(building the social baseline, scoping)*. For the CFIS data analyses, the researchers used commercial fish ticket, license, permit, and vessel registration data for all participants in the California halibut commercial fishery for the 2000-2012 period. This time period afforded sufficiently long temporal context for placing and interpreting the impacts of recent events, with 2012 the most recent year for which comprehensive data were available. Information prior to 2000 also informed the analyses and provided historical context. The analyses examined fishing *practices* by type of *operation* (e.g., gear group, mix of species landed with California halibut, and annual mix of fisheries), weight and ex-vessel *revenue* of landings, and patterns and trends in trips, vessels, buyers and prices, within and across gear groups and port groups. Combining fields in the original data enabled the examination of *relationships*, for example, within and among gear groups and port groups and among fishery participants and first receivers. In addition, the researchers used fishing license data to characterize the *demographics* of commercial fishery participants (i.e., for fishermen and first receivers, age and county of residence), and *capital* and *operations* based on fishing license, state permit and vessel registration data.[31]

Table 9. Scoping and building the social baseline to inform management of the commercial fishery for California halibut.

Methods	Data sources	Management Cycle	Social Assessment	Socioeconomic EFI-Building
Informal conversations, observation of meetings	Fishery managers, Fishery participants, environmental NGO representatives; HRDP	Identifying problems /opportunities	Scoping, selecting social variables to investigate	Operations; Practices; Values, preferences, needs; Attitudes, opinions, beliefs; Institutions; Relationships and networks; Capital; Macroeconomic factors
Literature review	Gray and refereed literature on the fishery	Identifying problems and opportunities, identifying potential options, evaluating options	Scoping, building social baseline, selecting variables to investigate	Demographics; Operations; Practices; Capital; Environmental factors; Macroeconomic factors

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[31] These analyses were limited in two key ways: 1) they did not address crew, who are not identified on fish tickets and therefore cannot readily be linked to specific fisheries; and 2) the characterization of operations and capital was limited by lack of federal permit data in the CFIS database.

Methods	Data sources	Management Cycle	Social Assessment	Socioeconomic EFI-Building
Archival data analysis	CFIS	Monitoring and evaluating, identifying problems and opportunities, evaluating options	Scoping, building social baseline	Demographics; Operations; Practices; Relationships and networks; Capital; Employment; Revenues
Semi-structured interviews	Fishery participants (fishermen, buyers), Fishery-support businesses (including ports), fishery managers and scientists	Monitoring and evaluating, identifying problems and opportunities, evaluating options	Scoping, building social baseline, assessing options	Demographics; Operations; Practices; Values, preferences, needs; Attitudes, opinions, beliefs; Institutions; Relationships and networks; Capital; Employment; Expenditures; Revenues; Environmental factors; Macroeconomic factors

Questions to guide building the social baseline and scoping related to the commercial fishery for California halibut.

- Who are the participants and what are their characteristics? ***Demographics***
  - Age, ethnicity, primary/first language, income level, city of residence, employment status, occupation, etc.

- What are their motivations for participating in the fishery?[32] ***Values, preferences, needs; Attitudes, opinions, beliefs***

- Where, when and how do people participate in the fishery? ***Practices, Operations, Expenditures, Revenues***
  - How does that participation vary within and across gear groups, types of buyers, ports and port areas?

- What are the spatial and temporal patterns in the fishery? ***Practices, Institutions, Relationships and Networks***

- What environmental, regulatory, social and economic factors affect their participation in the fishery? ***Institutions, Relationships and Networks, Capital, Environmental factors, Macroeconomic factors***

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[32] Some motivations can be characterized under more than one subcategory, e.g., social, cultural, economic, and/or sustenance.

o How does this vary within and among gear groups, buyers, port areas, and communities?

- How do changes in fishing conditions and opportunities in the California halibut fishery affect participation in other fisheries and vice verse? *Operations, Practices, Institutions, Relationships and Networks, Capital, Environmental factors, Macroeconomic factors*

- What are the implications of changing fishing opportunities and practices for associated ports, support businesses, and coastal communities? *Operations, Practices, Values, preferences and needs, Institutions, Relationships and Networks, Capital, Expenditures, Revenues*

The researchers also conducted semi-structured interviews to elicit collaborators' range of knowledge and experience related to the fishery, and their knowledge of key features of the fishery's human system, factors that have affected the fishery (i.e., how fishing is done, what it looks like today), and other relevant information *(building the social baseline, scoping)*. Using insights gained from this work, they developed three sets of summary materials for collaborator review, interpretation and further input based on the CFIS data analyses that addressed: 1) the spatial distribution of California halibut commercial fishery activity overall, 2) seasonality and mobility in the fishery, and 3) fishery activity by gear group within and across port groups *(selecting variables for investigation)*. Throughout this process, they also collected further input from CDFW scientists, fishery participants and others on emergent questions *(scoping)*. They then integrated and synthesized the resulting quantitative and qualitative information to provide a historically-grounded profile of the fishery's human system, including patterns and trends within and across sectors and associated port communities and regions, and recent and emerging opportunities and challenges facing the fishery.

Results from this study provide baseline socioeconomic EFI for the California halibut fishery and enhanced understanding of the dynamics for each of the fishery's three distinct gear-based subsectors and overall. This information can be used as a foundation for identifying management challenges and opportunities, evaluating management options, and evaluate management outcomes.

THE RECREATIONAL FISHERY FOR PACIFIC HERRING
The commercial fishery for Pacific herring is managed using a mix of measures including limited entry permitting, specific gear requirements (with implications for the type of vessel that can be used), a limited season, in-season openings and closures, and specified fishing areas. The recreational fishery for Pacific herring is not directly regulated (no bag limit), and recreational fishing from built structures (e.g., piers) does not require a license. A recent uptick in participation in the recreational fishery (often using throw-nets) has occurred, with some evidence of commercialization of the catch. In addition, CDFW and the Fish and Game Commission have received requests to include throw-nets as an allowable gear to take Pacific herring for commercial purposes.

The apparent increase in recreational fishing activity, evidence of commercialization of the catch, and interest in other options for participating in the commercial fishery highlight two MLMA objectives related to the fishery management system: responsiveness to changing conditions and concerns (§7056(l)) and coordination of commercial and recreational fisheries for the same species (§7056(f)).

Socioeconomic EFI can be used to better understand recent changes and help identify and assess potential management action(s) toward achieving these and the broader range of MLMA goals and objectives. For example, understanding why (as well as how and to what extent) commercialization of the recreational fishery is occurring, whether due fishery participants' lack of awareness that it is not

allowed, barriers to entry into the commercial fishery, or other reasons, is needed to help determine appropriate options for addressing the issue. These could include outreach to educate fishermen about appropriate recreational fishing practices (including catch disposition), developing management measures to provide an alternative for participating in the commercial fishery (provided it does not create new ecological or social problems), and/or other measures.

Socioeconomic EFI already has played a role in this case. Initial evidence of these issues emerged from informal observation of fishing *operations* and *practices* as well as discussions among CDFW staff and with some fishery participants *(scoping)* (Table 10). To validate and better understand the issues and identify further information needs, focused, systematic collection and synthesis of available information from databases and narrative sources (e.g., RecFIN/CRFS, gray and refereed literature, meeting notes, websites) can be done *(scoping, building the social baseline)* guided by the questions below**.** For information needs that cannot be met using available information, semi-structured interviews with individuals who are knowledgeable about the fishery combined with an intercept survey of fishery participants can be used to collect and build further information and understanding *(scoping, building social baseline, selecting variables for investigation, assessing options)*. The resulting information from these diverse sources can be combined, in this case, to begin to develop the social baseline, more accurately identify the problem, and enable sound scientific evaluation of the options for addressing it, including whether and how to change management of the recreational fishery, the commercial fishery, or both, as well as other options such as education, outreach, and expanded enforcement of existing regulations.

Table 10. Scoping and building the social baseline to identify and address socioeconomic EFI needs for management of the recreational fishery for Pacific herring.

Methods	Data sources	Management Cycle	Social Assessment	Socioeconomic EFI-Building
Informal conversations, interviews	Fishery managers, participants, CDPH/OEHHA fish consumption/advisory staff, shoreside support operators	Identifying problems and opportunities	Scoping, building social baseline, selecting social variables to investigate	Demographics; Operations; Practices; Values, preferences, and needs; Attitudes, opinions, and beliefs; Institutions
Literature review	Gray and refereed literature on Bay area subsistence fishing and associated communities	Identifying problems and opportunities, identifying potential options, evaluating options	Scoping, building social baseline, selecting variables to investigate	Demographics; Operations; Practices; Values, preferences, needs; Attitudes, opinions, beliefs; Institutions; Relationships and networks; Macroeconomic factors
Archival research	CRFS/RecFIN data; Seafood consumption study data	Monitoring and evaluating, identifying problems and opportunities, evaluating options	Scoping, building social baseline	Operations; Practices

Methods	Data sources	Management Cycle	Social Assessment	Socioeconomic EFI-Building
Intercept survey	Fishery participants	Monitoring and evaluating, identifying problems and opportunities, evaluating options	Scoping, building social baseline, assessing options	Demographics; Operations; Practices; Values, preferences, needs; Attitudes, opinions, beliefs; Institutions; Relationships and networks; Capital; Employment; Expenditures
Semi-structured interviews	Fishery participants (fishermen, buyers, retail markets, restaurateurs), pier/support business operators	Monitoring and evaluating, identifying problems and opportunities, evaluating options	Scoping, building social baseline, assessing options	Demographics; Operations; Practices; Values, preferences, needs; Attitudes, opinions, beliefs; Institutions; Relationships and networks; Capital; Employment; Expenditures; Revenues; Environ-mental factors; Macroeconomic factors

Questions to guide building the social baseline and scoping related to commercialization of the recreational catch in the Pacific herring fishery.

- Who are the participants and what are their characteristics? ***Demographics***
  - Age, ethnicity, primary/first language, income level, city of residence, employment status, occupation, etc.

- What are their motivations for participating in the fishery?[33] ***Values, preferences, needs; Attitudes, opinions, beliefs***
  - Cultural: symbolic value of species or fresh seafood, fishing practices, sharing the catch
  - Economic: cost-effective protein source, limited resources to purchase other (similar) foods
  - Social: leisure/sport opportunity, spending time with family and friends, sharing the catch
  - Subsistence: consumption and/or sharing food through social networks
  - Psychological: recreation, leisure, time outdoors/interacting with nature

- How is information related to fishing and handling the catch shared among fishery participants? ***Networks and relationships, Institutions, Capital***

- Where, when and how do people participate in the fishery? ***Practices, Operations, Expenditures, Revenues***

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[33] Some motivations can be characterized under more than one subcategory, e.g., social, cultural, economic, and/or sustenance.

- o Mode: shoreline/bank, structure, private boat, charter boat
- o Timing: season, week, day
- o Gear, equipment, vessels and how used
- o Shoreside infrastructure and how used
- o Distribution and use of the catch
  - ▪ Used as bait, food
  - ▪ Used by fisherman, shared with others, bartered/traded/sold
  - ▪ Distribution through social and economic networks

- What do participants know — and not know — about relevant recreational and commercial fishery management processes and regulations? ***Attitudes, opinions, beliefs; Capital***

- Where there is evidence of commercialization of the recreational fishery:
  - o Are fishery participants aware of the rules governing access to and participation in the fishery? ***Attitudes, opinions, beliefs***
  - o Why is the apparent commercialization happening? (e.g., lack of awareness of rules, disregard of rules, emerging (market) opportunity, inability to access commercial fishery) ***Institutions; Attitudes, opinions, beliefs; Values, preferences, needs; Capital***
  - o What are the opportunities and constraints to participating in the commercial fishery? ***Capital, Institutions; Relationships and networks***
    - ▪ What is needed to participate in the fishery? (e.g., license, permit, vessel, gear, equipment, unloading infrastructure, buyer, market/demand, knowledge, social capital/networks/access to these)
    - ▪ Do those interested in participating in the commercial fishery have (access to) these?

PART 3: DEVELOPING SOCIOECONOMIC NARRATIVES FOR USE IN MANAGEMENT DOCUMENTS AND PROCESSES

One approach for addressing socioeconomic considerations for use in fishery management documents or management processes is to build a narrative that describes a fishery's human system and its interactions with the ecological and management systems. This part of the guidance document provides a set of eight key questions to help guide the development of such narratives. The order of these key questions follows the stepwise process provided in Part 2. As with that process, given that fisheries and their management are dynamic, the process for building a narrative may not be linear, as illustrated by the case study examples in Part 2. References to particularly relevant sections in Part 1, Part 2, and the Appendices are provided to support narrative development. In addition, suggestions are provided as to where relevant parts of the narrative can be inserted into sections of the Enhanced Status Reports (ESRs) and Fishery Management Plans (FMPs).

The narrative developed through this process is one step in an iterative process to better understand the socioeconomics of -- and consequently to better manage -- the fishery as a dynamic social-ecological system. The narrative will expand with each iteration as additional questions are identified, new information sources become available, and specific data gaps are filled, encompassing the full scope of the fishery's social system -- including the connections among fishing, shoreside activities, and communities, as well as other fisheries. As a "living document," the narrative includes information that not only is required for ESRs, FMPs and other management documents, but also can be applied throughout the adaptive management cycle (see Figure 2 in Part 1).

Key Questions: Building a Social Baseline

1. What does the fishery's social (human) system look like?

2. How did it get to where it is today?

In particular, think about the following:
*   *What are the key components and characteristics - based on the socioeconomic EFI types - of the fishery, shoreside support system, and associated communities?*
*   *How are these components connected to one another?*
*   *How have these varied and changed over time - and why? Consider environmental, social, economic, regulatory, technological, and other factors.*

Relevant sections of the guidance to consult include:
*   Stepwise Process: Building the Social Baseline
*   Socioeconomic/Human Dimensions Information Needs
*   Examples of Human Dimensions Information Needs and Applications in California Fisheries
*   Table 2. Human dimensions topics relevant to fishery management.
*   Table 3. Human system elements (foci/units of analysis) identified in the MLMA.
*   Appendix D: Data Types and Sources
*   Appendix E: Resources for Further Information about Research Methods and Tools

The resulting information contributes to the following MLMA scaled-management document sections:
*   ESR 1/FMP 1. The Species (e.g., effects of changing ocean conditions)
*   ESR 2/FMP 2. The Fishery & Socioeconomic factors/considerations
*   ESR 3/FMP 3. Management

Key Questions: Scoping

3. How is the fishery doing relative to MLMA objectives and fishery-specific objectives?

4. What are the challenges and opportunities facing the fishery? What options might be considered for addressing them?

In particular, think about the following:
*   *What is working and not working in the fishery and its management, particularly in regard to its human dimension?*
*   *Are there specific management questions, problems or opportunities?*
*   *Who among fishery participants and which communities may be involved in or affected by the challenges or opportunities facing the fishery, or the actions being considered by management?*

Relevant sections of the guidance to consult include:
*   Stepwise Process: Scoping
*   Table 4. Examples of questions about the fisheries human system relevant to MLMA socioeconomic, management system, and ecological objectives.
*   Appendix B. Socioeconomic/Human Dimensions Questions Pertinent to the MLMA Objectives and State Fishery Management

The resulting information contributes to the following MLMA scaled-management document sections:
- ESR 3/FMP 3. Management
- ESR 5/FMP 7. Future Management Needs and Directions

Key Questions: Selecting Relevant Social Variables for Investigation
5. Based on the questions and options identified through scoping, what topics warrant investigation?

6. What parts of the fishery's human system are most relevant to these topics?

7. What should be monitored to detect and assess change?

In particular, think about the following:
- *What variables can be used to represent and measure the relevant concepts in each context (i.e., commercial fishing, recreational fishing, shoreside infrastructure and fishery support, communities)?*

Relevant sections of the guidance to consult include:
- Stepwise Process: Selecting Relevant Social Variables
- Table 5. Examples of variables for each type of socioeconomic EFI.
- Table 6. General methods for collecting socioeconomic EFI (adapted from Given (2008)).
- Appendix D: Data Types and Sources

The resulting information contributes to the following MLMA scaled-management document section:
- ESR 4/FMP 4. Monitoring and Essential Fishery Information

Key Question: Assessing Outcomes
8. What are the social as well as the ecological impacts and outcomes of the options identified? How do those impacts and outcomes compare across options?

In particular, think about the following:
- *How would each management alternative change the variables of interest and the fishery's human (social) system?*
- *How do these expected changes affect achievement of MLMA objectives related to a) the fishery's human system, b) the fishery's ecological system, and c) the management system?*

Relevant sections of the guidance to consult include:
- Stepwise Process: Synthesizing and Analyzing Data to Address Management Questions
- Appendix C: Examples from the Literature: Approaches Used and Relevance to MLMA Objectives
- Appendix E: Resources for Further Information about Research Methods and Tools

The resulting information contributes to the following MLMA scaled-management document section:
- FMP 6. Anticipated effects of additional management measures

The additional questions below provide further guidance for developing the narrative description of a fishery's human system for application to ESRs, FMPs, and other management related documents and processes. These questions have been generalized from those in Appendix B to facilitate their application to the range of fishery management contexts and management objectives.

Building the Social Baseline
- How do people use the state's fishery resources?

- What social, cultural, economic, ecological, and institutional conditions/factors affect participation, effort, and outcomes in fisheries?

- What are people's values, needs and preferences related to fishing, seafood production and consumption? How are people and communities engaged in and dependent on fishing for food, livelihood or recreation?

- What is necessary (and sufficient) to sustain the fishery's human system?

- How does fishing contribute to the well-being of fishery participants, fishing communities, and fishing economies?

- What concerns, challenges and opportunities have arisen in the past that have resulted in management change?

- How has the fishery's human system created or contributed to concerns, challenges and opportunities facing the fishery?

- How has the fishery's human system responded to those concerns, challenges and opportunities?

- How have management policies and actions to address concerns, challenges and opportunities affected the fishery's human (as well as its ecological) system?

Scoping
- What concerns, opportunities and challenges face or may arise in the fishery?

- What are the options for addressing them?

- What are the potential impacts and implications for the fishery's human system?

Identifying Variables for Assessment
- What parts of the human system may be directly affected?

- What parts of the human system may be indirectly affected?

- What parts of the human system can be monitoring and assessed to predict, detect, and assess the impacts and outcomes of management change?

Assessing Impacts
- How do fishery management policies and actions, individually and cumulatively, affect the fishery's human system?

- How does management change affect the achievement of MLMA-based and fishery-specific socioeconomic (as well as ecological) objectives?

- How do management options compare in terms of their impacts on and implications for the fishery's human system?

CONCLUSION AND RECOMMENDATIONS

The MLMA establishes a suite of social as well as ecological and management goals and objectives, each of which directly or indirectly requires information about the human dimensions of fisheries. Integrating information about both the human and ecological dimensions of fisheries enables a more complete understanding of fisheries systems, which in turn supports more effective management. This document provides guidance for obtaining and using socioeconomic "essential fishery information" (EFI) to meet the goals and objectives of the MLMA. Building upon the guidance provided in the 2001 Master Plan, it identifies an expanded set of socioeconomic EFI types, from operations and practices to motivations and attitudes, relationship and networks, and diverse types of capital, which can be collected and combined in various ways to address information needs throughout the management process. It thereby more fully captures the relevant information needs, outlines a process and considerations for meeting those needs, and provides examples from California fisheries and elsewhere.

Building socioeconomic EFI to address information needs for MLMA-based fishery management requires a stepwise, iterative, scientific process that includes: 1) building a social baseline, 2) scoping to identify relevant social research questions for the particular management questions, 3) selecting relevant variables for data collection and analysis, and 4) synthesizing and analyzing those data to identify and assess management options and outcomes. Given that fisheries and their management are dynamic, this process needs to be adaptive and iterative within and across steps, sometimes requiring moving back and forth among them, especially as information gaps are identified and new questions for investigation emerge. Over time, it supports the accumulation of information and knowledge to more effectively and efficiently address management needs. This information can be captured in structured narratives that characterize fisheries' human systems, how they have varied and changed over time, and the factors that have contributed to these changes. These narratives, in turn, can be linked and integrated with regional and statewide information in analogous stepwise processes, providing baselines and enabling analysis and assessment at those scales.

MLMA objectives, particular fishery management situations, and problems and opportunities facing California fisheries require a mix of methods, tools, and approaches to build relevant, useful socioeconomic information. The knowledge of any one person, group of people, agency, or organization may be useful but is not sufficient for producing valid information. The integrated use of multiple sources and types of data — qualitative and quantitative — helps ensure the validity of data and results. In some cases, approaches used to build and apply information can be adapted and applied to other cases, enabling comparison, aggregation, and generalization. Whatever the particulars, collecting, analyzing, and applying information about fisheries social systems should involve appropriate social scientific expertise. Moreover, it requires ethical as well as culturally appropriate approaches.

In closing, we provide the following recommendations to be pursued *concurrently* in the *near term*:

- **Build an accessible inventory of available information sources and data**
  Considerable socioeconomic information is readily accessible to CDFW from its own and others' data collection efforts, databases, repositories, documents (e.g., refereed and grey literature, meeting notes), and knowledgeable people within and outside CDFW. An inventory of those sources along

with a centralized repository of available resources that staff and others assisting CDFW can access and contribute to would enhance efforts to build and use socioeconomic EFI.

- **Draft socioeconomic narratives for each fishery**
  A historically grounded understanding of the human systems associated with the state's fisheries is essential for identifying and addressing socioeconomic considerations for management. Focused narratives that describe those human systems and their interactions with the ecological and management systems can be developed using the questions and related guidance outlined in Part 3 (along with other parts) of this document. Initial drafts of the narratives can be based on readily available information and expertise, highlighting as well as addressing socioeconomic information needs. Narratives should be reviewed by individuals with appropriate fishery and social science expertise. The narratives can be expanded and refined iteratively as fishery conditions change and new information needs are identified and addressed.

- **Identify and engage individuals with relevant social science expertise**
  New and continuing partnerships with social scientists and programs in California and other states (e.g., ODFW's Human Dimensions Research Program), in diverse state and federal agencies, academia, and the private sector can be used to leverage limited financial and human resources to guide the systematic development and use of socioeconomic EFI, including the identification and use of new approaches and tools. Social scientists with methodological and substantive knowledge and expertise can be engaged as advisers, collaborators or consultants, on an ad hoc basis or via an interdisciplinary social science advisory group. They can help identify relevant questions, data sources, and methods for collecting, synthesizing, and analyzing data to provide useful information, beginning with the drafting of the socioeconomic narratives for individual fisheries as outlined in Part 3. Their engagement in information-building and peer review processes can help guard against inappropriate assumptions (about motivations, behavior, and other human dimensions), and ensure the generation of valid, robust information and its appropriate application in the management context. Appendix D provides a foundation for identifying relevant people, programs, and projects, which in turn can be integrated into the inventory suggested above.

The following recommendations are suggested for the *longer term*:

- **Build regional and statewide social baselines**
  Extract, synthesize, and analyze the fishery-related data from CDFW and other sources to develop local, regional and statewide socioeconomic baselines. This includes identifying and characterizing: fishery participants (fishermen and buyers), their activities, and interactions *within and across fisheries and communities*; shoreside infrastructure and support; and associated communities. Fishery narratives developed in the near term can be linked to illustrate the connections among fisheries, participants, and communities. Additional information from various sources (see Appendix D) can be used to further characterize the larger system, identify gaps, and extend the scope of data collection and topics addressed over time (iteratively and cumulatively). Mapping and tracking connections and feedbacks within the human system can facilitate ongoing and future work to anticipate and assess changes to the human and fishery (social-ecological) systems at local, regional, and statewide scales.

- **Conduct scoping to identify human system information needs**
  Use scoping across fisheries and fishing communities — the process of identifying questions, challenges, opportunities and options — to identify and prioritize questions and associated information needs not only for particular fisheries, but also interactions among fisheries and communities, locally, regionally and statewide.

- **Develop and implement a plan to systematically collect, analyze and apply data to meet information needs across fisheries and communities**
  This plan should identify information needs that pertain to multiple fisheries, associated communities, and the interactions among them. It also should specify appropriate methods for collecting, analyzing and applying these data to address relevant management questions. Where data or opportunities to collect those data are limited, it will help to identify gaps and overlapping needs, and prioritize subsequent work.

- **Document lessons learned throughout**
  Data collection, analysis and application afford not only new information about fisheries human systems and their interactions with ecological systems, but also insights related to what worked, what did not, and how future work might be done more effectively across fishery contexts.

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Term	Definition
Allocation	The distribution of the opportunity to fish among user groups or individuals; a quantity of catch, effort, or biomass attributed to a person, a vessel, or a fishing company. The allocation can be absolute (e.g. a number of tons) or relative (e.g. a percentage of the annual allowable catch).[34]
Benefits	Something that produces good or helpful results or effects or that promotes well-being[35]
Commercial fishery	The whole process of catching and marketing fish and shellfish for sale…[and which] and includes fisheries resources, fishermen, and related businesses[36]
Commercial Passenger Fishing Vessel (CPFV)	Recreational fishing vessels (operations) for hire (charter, party boat).
Culture	The customary beliefs, social forms, and material traits of a racial, religious, or social group; also the characteristic features of everyday existence (such as diversions or a way of life) shared by people in a place or time[37]
Depressed fishery	A fishery for which the best available scientific information and other relevant information that the Commission or Department possesses or receives, indicates that a declining population trend has occurred that may result in a non-sustainable condition[38]
Distant-water fishery	The capture of seafood by vessels that fish outside of their national waters.
Economics	A social science concerned chiefly with description and analysis of the production, distribution, and consumption of goods and services[39]
Economy	A network of producers, distributors, and consumers of goods and services in a local, regional, or national community[40]
Ecosystem	A community of organisms, including humans, in conjunction with their nonliving environment. Ecosystems involve complex interactions between organisms, their environment, and the processes that drive the system. Ecosystems are both complex and continuously changing. Humans and human institutions, beliefs and practices are integral parts of the ecosystem[41]
Essential fishery information	Information about fish life history and habitat requirements; the status and trends of fish populations, fishing effort, and catch levels; fishery effects on fish age structure and on other marine living resources and users, and any other information related to the biology of a fish species or to taking in the fishery that is necessary to permit fisheries to be managed according to the requirements of this code.[42]

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[34] UN FAO. Fisheries Glossary. http://www.fao.org/fi/glossary/default.asp

[35] https://www.merriam-webster.com/dictionary/

[36] Wallace and Fletcher (2001)

[37] https://www.merriam-webster.com/dictionary/

[38] CDFG Marine Region (2005)

[39] https://www.merriam-webster.com/dictionary/

[40] http://www.businessdictionary.com/definition/economy.html

[41] http://ecosystems.noaa.gov/EBM101/WhatareEcosystems.aspx

[42] FGC 2016 California Code: Fish and Game Code - Division 0.5 - General Provisions And Definitions Chapter 2 - Marine Life Definitions, Section 93.

Excess effort	In the short-term, fishing capacity that is greater than that required to capture and handle the allowable catch and, in the long-term, is greater than the level required to ensure the sustainability of the stock and the fishery at the desired level. Fishing capacity in excess of what is required to reach the catch or effort objectives specified by target reference points (e.g. MSY, F0.1, MEY, etc.).[43]
Fishery	(a) One or more populations of marine fish or marine plants that may be treated as a unit for purposes of conservation and management and that are identified on the basis of geographical, scientific, technical, recreational, and economic characteristics; and (b) Fishing for, harvesting, or catching the populations described in (a).[44] the collective enterprise of taking fish, usually used in conjunction with reference to the species, gear or area involved.[45]
Fishery participants	The sport fishing, commercial fishing, and fish receiving and processing sectors of the fishery.[46]
Fishing capacity	The ability to sustain, harvest, hold, or process. The maximum amount that can be produced per unit of time with existing plant and equipment, provided the availability of variable factors of production is not restricted.[47]
Fishing community	A community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and included fishing vessel owners, operators, and crew and United States fish processors that are based in such community.[48]
Fishing economy	Systems of exchange of goods and services, and the associated people, businesses, infrastructure, etc. associated with the capture, handling, and consumption of fish.
Local knowledge	The facts and information acquired by a person which are relevant to a specific locale or have been elicited from a place-based context.[49]
Maximum sustainable yield (MSY)	The largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.[50]
Open access	Condition in which access to a fishery is not restricted (i.e. no license limitation, quotas, or other measures that would limit the amount of fish that an individual fisher (sic) can harvest.[51]
Optimum yield (OY)	The amount of fish which – will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; is prescribed on the basis of the "maximum sustainable yield" (MSY) from the fishery, as reduced by any relevant social, economic, or ecological factor; and in

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[43] UN FAO. Fisheries Glossary. http://www.fao.org/fi/glossary/default.asp

[44] 2016 California Code: Fish and Game Code - FGC. Division 0.5 - General Provisions And Definitions Chapter 2 - Marine Life Definitions, Section 94.

[45] http://www.fishbase.org/Glossary/Glossary.php?q=fishery&language=english&sc=is

[46] 2016 California Code: Fish and Game Code - FGC. Division 0.5 - General Provisions And Definitions Chapter 2 - Marine Life Definitions, Section 98.2.

[47] UN FAO. Fisheries Glossary. http://www.fao.org/fi/glossary/default.asp

[48] Magnuson-Stevens Act, 1996; U.S. Code Title 16, Chapter 38, Subchapter I, § 1802.

[49] https://www.igi-global.com/dictionary/local-knowledge/17340

[50] 50 CFR 600.310(c)(1)

[51] Committee to Review Individual Fishing Quotas (1999)

the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.[52]

The amount of fish taken in a fishery that does all of the following: (a) Provides the greatest overall benefit to the people of California, particularly with respect to food production and recreational opportunities, and takes into account the protection of marine ecosystems; (b) Is the maximum sustainable yield (MSY) of the fishery, as reduced by relevant economic, social, or ecological factors; (c) In the case of an overfished fishery, provides for rebuilding to a level consistent with producing maximum sustainable yield in a fishery.[53]

Overfished	Status assigned to a fish stock or stock complex whose size is sufficiently small that a change in management practices is required to achieve an appropriate level and rate of rebuilding. A stock or stock complex is considered overfished when its size falls below the minimum stock size threshold (MSST).[54]
Overfishing	A rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.[55]
Recreational (sport) fishing	Leisure-based fishing[56] Harvesting fish for personal use, sport, and challenge (e.g., as opposed to profit or research), with the resulting catch not sold, bartered, or traded.[57]
Restricted access fishery	A fishery in which the number of persons who may participate, or the number of vessels that may be used in taking a specified species of fish, or the catch allocated to each fishery participant, is limited by statute or regulation.[58]
Small-scale fishery	A fishery (i.e., activities associated with the capture of aquatic animals) that requires relatively low capital investment and uses low technology gear and vessels to catch fish, typically for subsistence or local markets.[59]
Social factors	In addition to factors related to economics such as benefits, capital, and labor, considerations such as social structure and social organization, people's knowledge and views (norms and values) about their work and how this relates to the resource. Also referred to as: cultural factors.[60]
Social impact assessment	An effort to assess, appraise or estimate, in advance, the social consequences likely to follow from proposed actions.[61]
Social impacts	The consequences to human populations of any public or private actions-that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society. The term also

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[52] MSA section 3(28); see also 50 CFR 600.310

[53] Section 97 FGC, per CDFG Marine Region (2001)

[54] http://www.catchshareindicators.org/glossary/

[55] http://www.catchshareindicators.org/glossary/

[56] Pollnac et al. (2006)

[57] UN FAO. Fisheries Glossary. http://www.fao.org/fi/glossary/default.asp

[58] FGC Division 0.5. Chapter 2 - Marine Life Definitions, Section 99.

[59] http://www.fao.org/docrep/007/ae534e/ae534e02.htm. Defining small-scale fisheries encompasses not only attributes such as vessel length, but also variables relating to local operational range, social role in coastal communities, and the economics of the operation or sector (Natale et al. 2013). The small-scale fisheries sector typically is rooted in local communities, traditions and values, with fishermen self-employed and providing fish for direct consumption within their households or communities (http://www.fao.org/family-farming/themes/small-scale-fisheries/en/).

[60] UN FAO. Fisheries Glossary. http://www.fao.org/fi/glossary/default.asp

[61] UN FAO. Fisheries Glossary. http://www.fao.org/fi/glossary/default.asp

	includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society.[62]
Social science	The scientific study of human society and social relationships.
Social structure and organization	The networks of relationships and institutions that link individuals and social groups, based on characteristics such as kinship (family), ethnicity, status, leadership, work function, location, and so on, which varies and changes according to context.
Social-ecological system	Complex, integrated systems in which humans are part of nature.[63]
Socioeconomic	Pertaining to the combination or interaction of social and economic factors and involves topics such as distributional issues, labor market structure, social and opportunity costs, community dynamics, and decision-making processes.[64]
Subsistence fishing	Fishing activity directed at capturing fish for consumption rather than sale, for sustenance, social (e.g., community standing, relationships with others) and cultural (e.g., as source of identity) values[65]
Sustainable Sustainable use Sustainability	With regard to a marine fishery, both the (a) continuous replacement of resources, taking into account fluctuations in abundance and environmental variability; and (b) securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.[66]
Well-being	The degree to which an individual, family, or larger social grouping (e.g. community) can be characterized as being healthy (sound and functional), happy, and prosperous.[67]

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[62] Interorganizational Committee on Principles and Guidelines for Social Impact Assessment (2003)

[63] Berkes et al. (1998)

[64] UN FAO. Fisheries Glossary. http://www.fao.org/fi/glossary/default.asp

[65] Pollnac et al. (2006)

[66] MLMA Ch2 99.5. See other notes and literature on fisheries sustainability on the social-ecological system.

[67] Pollnac et al. (2006)

The following questions are suggested as a starting point for building information and understanding about the socioeconomics/human dimensions (SE/HD) of the state's fisheries to support management consistent with the MLMA. They are organized by primary focus: socioeconomic/human systems objectives, fishery management system objectives and biological/ecological objectives, although can and should be considered in combinations relevant to specific management context and questions. Most of the questions below are relevant across fishery sectors: commercial (including for-hire), recreational, subsistence. Further definition and operationalization of the questions and terms is context-specific, as illustrated in the fishery examples provided. Table B1 indicates the types of socioeconomic EFI relevant to the distilled questions for each management objective in Table 4 of the main document.

Fishery Performance Objectives
1. What are the social and ecological values, preferences and needs of those involved in the fishery management system?

2. Does the fishery's human system function in ways that are consistent with those values, preferences and needs?

3. What are the positive and negative effects of the fishery?
    a. On the ecological system and the social system
    b. In the short term and the long term

Socioeconomic/Human System Objectives
Sustainable use[68]
4. How do people use the state's fishery resources?
    a. Fishery participants and consumers
    b. Fishing practices: where, when, and how
    c. Shoreside practices: landing, receiving, handling, distribution, consumption

5. What benefits do fishery participants derive from fishing?
    a. Social: e.g., statuses, roles, relationships
    b. Economic: e.g., income, employment
    c. Sustenance: e.g., nutrition for self and/or others
    d. Cultural: e.g., identities, traditions
    e. Psychosocial: e.g., independence, satisfaction, relaxation

6. What is necessary (and sufficient) to sustain their use of the resource?
    a. Resource availability (abundance and distribution) and access
    b. Shoreside infrastructure to handle fishing and related activities and seafood production
    c. Support goods and services
    d. Quantity, quality, location and timing of activity, catch

7. Is the fishery's human system sustainable (viable ecologically and socioeconomically), i.e., are the elements necessary to sustain resource use in place?

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[68] Resource sustainability per se is addressed under Biological/Ecological Objectives below.

8. How do fishery management policies and actions affect the fisheries system, individually and cumulatively?
    a. Fishery participation, including entry, exit and change within
    b. Quantity, quality, location and timing of activity, catch, and other outcomes
    c. Functioning of shoreside infrastructure
    d. Fishery and community viability, vulnerability and resilience

Long-term well-being of fishing-dependent people observed
9. In what ways are people dependent[69] on fishing for food, livelihood or recreation?
    a. Values, needs and preferences related to fishing, seafood production and consumption
        i. livelihood, recreation, sustenance
        ii. social, cultural, economic, and psychological

10. How does fishing contribute to the well-being of fishery participants, fishing communities, and fishing economies?

11. What conditions/factors affect people's fishing for food, livelihood or recreation?
    a. Social, cultural, economic, ecological, and institutional

12. How do changes in fishery management affect their well-being?
    a. Directly, i.e., by changing when, where and how fishing occurs, and by whom
    b. Indirectly, i.e., by affecting the functioning and viability of the fishery-support system
    c. Cumulatively, i.e., in combination with other fishery management actions and other environmental, social, cultural, economic and institutional change

Adverse impacts on small-scale fisheries, coastal communities and local economies minimized
13. How do management policies and actions affect the function and well-being of:
    a. Small-scale fisheries?
        i. fishery participants as individuals, groups engaged in species-, gear-, or species-gear activities (communities of interest, occupational communities)
        ii. providers of infrastructure, goods and services that enable and support fishery activity
    b. Coastal communities?
    c. Local economies?

14. What are the likely positive and negative (adverse) impacts of fishery management options?
    a. On each of these entities and collectively
    b. Directly and indirectly
    c. Cumulatively
        i. along with other management actions
        ii. in broader context (environmental, social, economic, institutional)

15. Given multiple management options that can address resource and ecological conservation needs more or less equally well, which of these options minimizes the adverse impacts?

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[69] See the Federal West Coast GF FMP Amendment 16-3 (2004) Appendix C defines and discusses dependence on and engagement in commercial fisheries. These concepts as related to commercial, recreational and subsistence fisheries have been developed further and will be addressed in Phase 2.

a. On small-scale fisheries, coastal communities and economies individually
b. Altogether

Catches allocated fairly

16. How are fishery resources allocated among fishery participants?
    a. Within and across sectors, ports, regions, and for the fishery overall

17. How is fairness (in allocating catches, access, etc.) defined and perceived?

18. What options are available for allocating catches (or other types of fishing opportunities) among fishery participants?
    a. How do allocation actions affect:
        i. fishery participants' behavior?
        ii. social and economic outcomes for fishery participants and fishing communities?

Prevent/reduce excess effort

19. What constitutes excess effort in the fishery?
    a. What features contribute to (shape) fishing capacity of individual fishermen, fishing operations and fleets?
    b. What factors influence the development of (excess) capacity?
    c. How is capacity used (effort)?
    d. What factors influence the use of capacity (effort)?

20. What factors, etc., have led to excess effort in the fishery?
    a. Environmental (e.g., resource scarcity)
    b. Social
        i. loss of other fishing opportunities
        ii. loss of other livelihood, recreation or subsistence opportunities
    c. Economic
        i. increased prices
        ii. decreased prices (increased effort to catch more to compensate for lower price per pound)
        iii. increased buyer/processor demand
        iv. reduced opportunities on other fisheries
    d. Institutional
        i. management action creating incentives to ensure access to the fishery
        ii. management action creating disincentives in other fisheries

21. How has excess effort affected the fishery's human (as well as ecological) system?
    a. Social interactions and outcomes (conflict/coordination on the water and shoreside)
    b. Economic viability of (and outcomes for) fishery participants and operations

22. What are the implications of measures to reduce excess effort for the fishery's human system for
    a. Behavior
        i. those who qualify/stay in
        ii. those who don't qualify/are eliminated
    b. Social and economic outcomes
        i. within the fishery
        ii. in associated fisheries

        iii. for individuals, communities, economies
           1. those who qualify/stay in
           2. those who don't qualify/are eliminated
        iv. for the larger fishery system
    c. For other MLMA objectives?

Fishery Management System Objectives
Proactive/responsive to changing environmental, market or other socioeconomic factors and concerns

23. What concerns relevant to the fishery's human system and its management may arise?
    a. Environmental, e.g., changes in resource abundance or distribution, weather and/or oceanographic conditions
    b. Economic, e.g., changes in markets (e.g., loss of buyers), costs (e.g., fuel)
    c. Social, e.g., conflict or other challenges among fishery participants, with other ocean users
    d. Institutional, e.g., changes in rules governing other fisheries (state, federal, international), fishing operations and practices
    e. Infrastructural, e.g., loss of coastal or working waterfront access, infrastructure, goods and service providers

24. What opportunities relevant to the fishery's human system and its management may arise?
    a. Environmental, e.g., changing resource abundance or distribution
    b. Economic, e.g., changes in markets (e.g., new buyers, increased demand or price)
    c. Social, e.g., increased interest in locally-caught seafood
    d. Institutional, e.g., changes in rules governing other fisheries (state, federal, international)

25. What options might help address these changes (whether they pose concerns, opportunities or both)?

26. What are the implications of the changing factors or concerns and associated management responses for the fishery's ecological and human systems?

Conflict resolution

27. Where are there actual and/or potential gear conflicts?

28. What is the nature of the gear conflict?
    a. Same or different gear types
    b. Targeting same or different resources
    c. Spatial: Use in same or different places
    d. Temporal

29. What are the options for avoiding, mitigating or eliminating conflict?

30. What are social, cultural and economic impacts of
    a. gear conflict
    b. measures to avoid, resolve or mitigate that conflict?

31. Where are there potential and/or actual conflicts related to access to the resource?
    a. Open access fisheries
    b. Restricted access fisheries

c. Specific areas or times

Biological/Ecological Objectives[70]
Sustainable resource
32. How do fishing practices affect the long-term health of the resource?

33. To the extent that fishing practices negatively affect the long-term health of the resource, what are the options for modifying or eliminating those practices?

34. How would those options affect the fishery's human system?
    a. Practices
    b. Social and economic outcomes for fishery participants, communities and economies
    c. Impacts on other sectors within the fishery and other associated fisheries

Healthy habitat
35. How do fishing practices (gear, equipment and their use) affect habitat?

36. How do measures to maintain, restore and/or enhance habitat affect fisheries?
    a. Practices
    b. Outcomes
        i. Social, cultural, economic
        ii. Individual, fishery, community, state

37. How do responses of fishery participants (e.g., changes in practices) to ensure habitat health affect the fishery system?
    a. Achievement of habitat objectives
    b. Achievement of other fishery objectives (for given fishery, for other fisheries)
    c. Other fisheries'
        i. Ecological system
        ii. Human system
            1. Practices
            2. Social and economic outcomes
            3. Fishery participants, individuals, communities

Restore/rebuild depressed fisheries
38. What are the causes of the depressed fishery? (e.g., oceanographic conditions, ecological conditions/drivers, fishing practices and/or effort for the given fishery or associated with other fisheries)
    a. How does the fishery's human system contribute to or mitigate the fishery's depressed condition?

39. What are the human dimensions of a depressed fishery?
    a. What does a depressed fishery look like from fishery participants' and communities' perspectives?

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[70] Driven by ecological concerns/priorities, but affected by and affect human dimensions.

b. Note: A fishery's human system can be depressed not only due to the stocks being depressed but also due to other factors e.g., competition with other/substitute sources, consumer attitudes, etc.

40. How is the fishery's human system affected by the depressed fishery?
    a. Behavior
    b. Well-being
    c. Social, cultural, economic outcomes

41. What management options might be used to rebuild the depressed fishery?

42. How would management options for rebuilding the depressed fishery affect the human system?
    a. Fishery participation, including entry, exit and change within
    b. Quantity, quality, location and timing of activity, catch
    c. Functioning of shoreside infrastructure to support fishing, seafood production and related activities
    d. Behavior and outcomes in associated fisheries
    e. Other objectives for the fishery

43. How would human system responses, in turn, affect the depressed fishery system?

Bycatch limited
44. What fishing practices (gear, equipment, particulars of us) are associated with (unacceptable types and amounts of) bycatch?

45. What are the options for modifying these practices to address bycatch concerns?

46. What are the costs and benefits, variously defined, of modifying these practices? (e.g., light touch trawl gear v. standard groundfish trawl gear; hook-and-line v. trawl or gillnet; costs of new/modified gear, learning how, when and where to use it effectively)
    a. Benefits: Increased efficiency in catching, sorting, unloading
    b. Costs
        i. Financial: New equipment, gear required
        ii. Technical: Learning how, when and where to use alternative practices (including gear) effectively
        iii. Social: Gaining access to fishery/grounds/markets and social networks typically occupied/used by others

47. How do such modifications affect behavior, and social and economic outcomes?
    a. In this and associated fisheries
    b. on the water: spatial, temporal patterns of use
    c. shoreside
        i. infrastructure, goods and service providers equipped/suited to handle change
        ii. community interactions, needs

Table B1. Summary questions and associated types of socioeconomic EFI associated with MLMA socioeconomic, management system, and ecological objectives.

Questions by MLMA objective focus	Types of Socioeconomic EFI												
	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships & networks	Capital	Employment	Expenditures	Revenues	Environmental factors	Macroeconomic factors
Socioeconomic Objectives													
Sustainable use													
How do people use the state's fishery resources?		X	X						X				
What social, cultural, and economic benefits do fishery participants derive from fishing?				X			X	X			X		
What is necessary (and sufficient) to sustain resource use?		X		X		X	X					X	
Is the fishery's human system sustainable, i.e., viable ecologically and socioeconomically?			X				X			X	X		
How does fishery management affect the viability of the fishery's human system?		X	X	X			X	X	X				X
Long-term well-being of fishing-dependent people observed													
How are people dependent on fishing for food, livelihood, or recreation?	X		X	X			X		X		X		
How does fishing contribute to the well-being of fishing-dependent people, communities and economies?				X	X		X		X		X		X
What conditions/factors affect people's fishing for food, livelihood or recreation?						X	X					X	X
How do changes in management, individually and cumulatively, affect their long-term well-being?				X	X		X	X	X				

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Questions by MLMA objective focus	Types of Socioeconomic EFI												
	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships & networks	Capital	Employment	Expenditures	Revenues	Environmental factors	Macroeconomic factors
Adverse impacts on small-scale fisheries, coastal communities and local economies minimized													
What are the impacts of management on the function and well-being of small-scale fisheries, communities and economies?		■	■	■			■	■	■	■	■		
What are the _cumulative_ impacts of management (and other factors) on their function and well-being?		■	■	■			■	■	■	■	■	■	■
Catches allocated fairly													
What are the criteria for allocating resources among fishery participants (e.g., equal shares, need, fishing history)?	■			■	■	■							
How is fairness defined and perceived by fishery participants?				■									
Do allocation options meet criteria for fairness?	■		■								■		
What are the social and economic impacts and implications of allocation options for the fishery's human system?	■	■	■	■	■	■	■	■	■	■	■		
How do human system responses, in turn, affect achievement of MLMA objectives?		■		■					■	■	■		
Prevent/reduce excess effort													
What constitutes excess effort in the fishery?		■	■			■						■	
What factors contribute to excess effort in the fishery?		■			■				■	■	■		■
How does excess effort affect the fishery's human (as well as ecological) system?		■	■		■		■		■	■	■		

Questions by MLMA objective focus	Types of Socioeconomic EFI												
	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships & networks	Capital	Employment	Expenditures	Revenues	Environmental factors	Macroeconomic factors
What are the impacts and implications of measures to reduce excess effort for the fishery's human system?		X	X	X	X	X	X	X	X	X	X		X
How do human system responses, in turn, affect achievement of MLMA objectives?		X	X	X	X	X	X	X	X		X		
Management system objectives													
Proactive/responsive to changing environmental, market or other socioeconomic factors and concerns													
What *environmental* factors or concerns affect the fishery?			X		X							X	
What *social* and *market* (and broader *economic*) factors or concerns affect the fishery?	X		X	X	X			X					X
Are there new/emerging opportunities in the fishery?		X	X									X	X
Are there new/emerging challenges in the fishery?			X								X	X	X
What are the impacts and implications of changing circumstances for the fishery's human system?		X	X			X	X	X	X	X			
What are the impacts and implications of management to address changing circumstances for the fishery's human system?	X	X	X	X	X	X	X	X	X	X	X		
How do human system responses, in turn, affect achievement of MLMA objectives?			X	X	X	X			X				

Questions by MLMA objective focus	Types of Socioeconomic EFI												
	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships & networks	Capital	Employment	Expenditures	Revenues	Environmental factors	Macroeconomic factors
Conflict resolution													
Are there actual or potential conflicts related to gear, access to the resource, or other aspects of the fishery?		X	X	X	X								
What are the impacts and implications of conflict for the fishery's human (as well as the ecological) system?	X	X	X	X	X	X	X		X		X		
What are the options for avoiding, mitigating or eliminating conflict?			X	X	X	X	X	X				X	
What are the impacts and implications of measures to avoid, resolve or mitigate conflict for the human system?	X	X	X	X	X	X	X		X				
How do human system responses, in turn, affect achievement of MLMA objectives?			X	X	X	X	X				X		
Ecological objectives													
Sustainable resource													
How do fishing practices affect the long-term health of the resource?			X									X	
What are the options for modifying or eliminating fishing practices that negatively affect the long-term health of the resource?		X	X	X		X		X	X				
What are the impacts and implications of measures to avoid, resolve or mitigate conflict for the human system?	X	X	X	X	X	X	X	X	X	X	X	X	

Questions by MLMA objective focus	Types of Socioeconomic EFI												
	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships & networks	Capital	Employment	Expenditures	Revenues	Environmental factors	Macroeconomic factors
How do human system responses, in turn, affect achievement of MLMA objectives?			X	X	X	X			X				
Healthy habitat													
What are the impacts of fishing practices (gear and equipment use) on habitat?		X	X									X	
What are the impacts and implications of measures to maintain, restore and/or enhance habitat for the fishery's human system?	X		X	X				X	X	X		X	X
How do human system responses, in turn, affect achievement of MLMA objectives?			X		X	X						X	
Restore/rebuild depressed fisheries													
What factors contribute to the depressed fishery?			X									X	X
What are the impacts and implications of the depressed fishery for the human system?	X	X	X	X			X	X	X	X	X		
What are the impacts and implications of measures to rebuild the depressed fishery for the human system?	X	X	X	X			X	X	X	X	X		
How do human system responses, in turn, affect achievement of MLMA objectives?			X	X				X	X	X	X		
Bycatch limited													
What fishing practices contribute to unacceptable types and amounts of bycatch?			X	X	X			X					

Questions by MLMA objective focus	Types of Socioeconomic EFI												
	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships & networks	Capital	Employment	Expenditures	Revenues	Environmental factors	Macroeconomic factors
What are the impacts and implications of measures to limit bycatch for the human system?	■	■	■	■	■	■	■	■	■	■	■		
How do human system responses, in turn, affect achievement of MLMA objectives?			■		■	■			■			■	■

The following tables provide a *sampling* of the extensive literature on the development and use of socioeconomic information in fishery management. The examples provided here are by no means exhaustive, but illustrate some the diverse ways that socioeconomic information has been developed and applied to address various fishery management contexts and needs. Table C1 provides a synopsis of each example followed by an indication of the scope of data collection and the steps in the stepwise process addressed; Table C2 indicates the relevance of each example to the MLMA objectives, whether it addresses California fisheries specifically or provides a relevant example from a US context other than California. Full references for these sources are included at the end of this appendix.

Abbreviations and acronyms used

AK: Alaska	FMP: Fishery management plan	OR: Oregon
CA: California	HD: Human dimension	SBC: Santa Barbara Channel
CCLME: California Current Large Marine Ecosystem	IEA: Integrated ecosystem assessment	SE: Socioeconomic
	MLMA: Marine Life Management Act	SIA: Social impact assessment
CPFV: Commercial passenger fishing vessel	MLPA: Marine Life Protection Act	US: United States
EBFM: Ecosystem-Based Fisheries Management	MPA: Marine protected area	WC: West Coast
	NC: North Coast (of California)	

Table C1. Examples from the literature: Scope of data collection and social factor analysis and assessment steps addressed. Shaded cells in second column indicate data or knowledge possessed by CDFW.

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
CA commercial spiny lobster fishery: SE impacts of Channel Islands MPAs (Guenther 2010) Used a social-ecological approach, integrating CFIS data, interviews and mapping with fishermen, ecological community monitoring data, and literature review, to 1) characterize CA spiny lobster fishery participants' responses to establishment of MPAs at the Northern Channel Islands and 2) test hypotheses related to their socioeconomic outcomes using econometric program evaluation and linear regression.	✓	✓	✓			✓	✓
CA Dungeness crab commercial fishery: Excess capacity and effort (Dewees et al. 2004; Hackett et al. 2003; Hackett et al. 2004) Used CFIS data, a literature review of capacity-reduction approaches in other fisheries, a mail survey of Dungeness crab fishery permittees, and informal and semi-structured interviews with seafood processors to: 1) determine the nature and extent of excess fishing capacity and effort and of the consolidated processing sector; 2) assess fishery participants' opinions and preferences related to management options for addressing capacity and timing issues; and 3) explore whether economic conditions of the processing sector could be improved by eliminating derby fishery.	✓	✓	✓	✓	✓	✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
CA halibut commercial fishery: Collaborative research to build HD information (Pomeroy et al. 2016) Used an iterative approach, integrating analyses of CFIS data, literature, and interviews with knowledgeable fishery participants, scientists, and managers to: 1) build understanding of the fishery's human system (by gear group, region, and overall); 2) determine trends and factors that affect key features of the fishery's human system; and 3) map the socioeconomic structure of the fishery to support the design and evaluation of management options and assessment of impacts of change.	✓	✓	✓	✓	✓		
CA market squid/wetfish commercial fishery: SE organization (Pomeroy et al. 2002) Used archival data, literature review, and ethnographic methods (semi-structured interviews with fishery participants, harbor personnel, fishery managers, and others knowledgeable individuals; participant observation) to develop a historically grounded characterization of the fishery's human system to inform the design and evaluation of fishery management and MPA options, and port and fishing community decision-making.	✓	✓	✓	✓	✓		
CA recreational abalone fishery and site valuation (Reid et al. 2016) Used the travel-cost method, incorporating recreational red abalone report card data and responses from a telephone survey of fishermen, to estimate the Northern California fishery's value to fishermen and the impact of regulations imposed following a harmful algal bloom (HAB) in Sonoma County in 2014. Also used expert opinion of CDFW personnel to examine site-level variables influencing fishermen's site choices. Key site selection criteria included 1) impacts of a harmful algal bloom in Sonoma County, 2) protection from northwest ocean swell, and 3) presence of amenities such as boat launches and restrooms. Results indicate approximately 31,000 fishermen altogether derive an estimated $24-44 million per year of recreational value from the fishery, with that value declining nearly $12M following the 2014 HAB and associated regulations.	✓	✓	✓	✓		✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Commercial fishery trends and infrastructure needs for SBC ports (Culver et al. 2007)) Conducted trends analysis of PacFIN data, content analysis of literature on relevant fisheries and ports, semi-structured interviews, site visits to catalog port infrastructure, and a workshop with port personnel, fishery participants and fishery managers to: 1) identify and explain fishery trends of the SBC region and its port infrastructure; 2) characterize the current fishery-support infrastructure; and 3) identify the expected fishery trends and infrastructure needs by port.	✓	✓	✓	✓	✓		
HDs of the CA Current IEA (Breslow et al. 2013) Provides a conceptual model of the California Current Large Marine Ecosystem (CCLME) socio-ecological system (SES), discusses relevant social science approaches and frameworks, and summarizes five examples of work to inform development and measurement of CCLME SES indicators related to coastal community vulnerability, vessel- and port-level fisheries diversification trends, subsistence practices among commercial fishermen using "personal use" data from fish tickets as a proxy, the relationship between water supply and agricultural production in Central California, and a survey of marine-oriented recreational expenditures.	✓	✓	✓	✓		✓	✓

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Impacts of bass fishery regulations on CA CPFV fishery (Bellquist et al. 2017) Conducted a survey of CPFV captains to assess perceptions of the status of two bass species and the impacts of the new regulations imposing stricter minimum size and bag limits, and analysis of CPFV logbook data to compare captains' perceptions with actual changes catch per unit effort. Results indicated 1) differences in perceptions of species health between captains with more experience compared to those with less experience, 2) the increased minimum size limits had the greater short-term impact on fishery participants' experiences, and 3) agreement between captains' perceptions and logbook analyses, leading to the conclusion that captains are a valuable resource for informing fisheries management.	✓	✓	✓	✓			
Integrating HD info into EBFM (Pomeroy et al. 2005) Used PacFIN (fishery landings) data and results of previous ethnographic and survey research on the California squid and wetfish fisheries to demonstrate the relevance of information on the social, economic, and spatial organization of fisheries (i.e., home port, port of landing/receiving, processing/handling location) for informing management design and impact assessment. The approach used and information generated address critical limitations of input/output models and other such tools, thereby enhancing the accuracy and validity of the analytical results.	✓	✓	✓	✓	✓	✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
NC region and fishing community profiles (Pomeroy et al. 2010) Used PacFIN, CPFV logbook, US Census and other federal economic data, literature review, field observation, focus group meetings, and semi-structured interviews with fishery participants, state and federal agency personnel and other community members to: 1) develop profiles of commercial and recreational fisheries, shoreside systems, and communities for four major North Coast fishing (port) communities; 2) characterize and explain fishery patterns and trends; and 3) identify opportunities and challenges facing those fisheries, communities, and the region.	✓	✓	✓	✓	✓		
San Francisco Bay seafood consumption study (SFEI and California Department of Health Services 2000) Informed by an extensive review of other studies from the gray and refereed literature and an advisory group composed of public health personnel, natural and social scientists, and outreach specialists, conducted an intercept survey of shore-based recreational fishermen at San Francisco Bay area sites selected based on analysis of RecFIN data. Collected data on catch, fishing and consumption practices, and demographics. Compared results to recommendations in posted health advisories to identify education and outreach needs and inform the development of strategies for meeting those needs. Results indicated that about 10% of respondents who eat fish from the bay eat more than the recommended amount, and Asian anglers stood out as a group of concern due to their large numbers, consumption rates, and methods of preparation and consumption.	✓	✓	✓	✓	✓	✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
CA commercial fishery stayers/leavers in four fisheries (Hackett et al. 2015) Conducted a regulatory event study using the team's previous research, literature review, and CDFW landings data to test hypotheses related to the relevance of economic attributes (greater revenue diversification from multi-fishery participation, lower interannual income variation, higher annual gross fishing income) of participants who remain active following regulatory events that reduce opportunities. Found consistent and (in some cases) significant support for hypothesized associations, especially interannual fishing income stability, suggesting the value of designing fisheries regulations to include flexible, multi-fishery participation.	✓	✓				✓	✓
CA commercial salmon fishery: Costs and revenues (Hackett and Hansen 2008) In consultation with CDFW staff knowledgeable of the fishery, integrated data from a recent survey of commercial fishermen with CFIS data to create a complete dataset for estimated costs and revenues for California commercial fishermen targeting salmon or albacore during the 2006 salmon season to enable 1) evaluation of aggregated cost, revenue, and profit conditions for California's commercial salmon fishermen, and 2) economic impact analyses of management and other events affecting commercial fishing activity and landings in California.	✓	✓		✓			

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Impact of catch shares on diversification of fishermen's income and risk (Holland et al. 2017) Used PacFIN data to calculate Herfindahl-Hirschman Index (HHI) scores as a metric of fishing revenue diversification for individual vessels to evaluate whether fishing revenue diversification levels, trends, and variation changed after implementation of catch shares for vessels in 13 US commercial fisheries (including three West Coast groundfish fishery sectors active in California). Compared outcomes for vessels that remained in the catch share fishery and those that exited but remained active in other fisheries. Diversification, which can be useful for mitigating risk (e.g., of climate change impacts) generally decreased after implementation of catch shares; significant changes in interannual variation of revenues occurred in few cases.	✓	✓				✓	✓
Spatial valuation of CA marine fisheries (Miller et al. 2017) Used spatially explicit time series data for 1931-2005 collected by CDFW and included in the California Catch Reconstruction Database (CalCOM) and literature review to describe the spatiotemporal dynamics of ecosystem services and quantify the economic value of California commercial fisheries removals to help inform and manage trade-offs among cumulative or competing activities in marine environments. Findings include increasing reliance on invertebrates over the last 25 years, with evidence of substantial variation in species composition by depth and latitude, and spatial shifts in catch locations for some taxonomic groups over time.	✓	✓		✓		✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
CA commercial fishing industry: Economic model for valuation and economic impact assessment (Hackett et al. 2009) Used CFIS data and data from a mail survey and semi-structured interviews with fishermen and seafood buyers/processors to adapt IMPLAN (an input-output model for assessing economic impacts) to create the California Ocean Fish Harvester Economic (COFHE) model, for use as a tool for estimating the value and economic impacts of the state's commercial fishery(ies) on the California economy and its coastal regions.	✓		✓	✓			
CA shrimp trawl fishery (Frimodig et al. 2009) Used CFIS landings and logbook data, interviews, and observation (from dockside sampling) to describe and explain the sharp decline in production (landings) in the fishery from 1992 to 2007. Concluded that the decline in production may be attributed to decreased market prices related to changes in the processing sector and demand, leading to reduced participation and production in the fishery.	✓		✓			✓	✓
CA spiny lobster FMP: Economic valuation (Hackett et al. 2013) Used key informant interviews with commercial spiny lobster fishery participants to update annual expenditure estimates for the California Ocean Fish Harvester Economic model (COFHE, Hackett et al. 2009) along with recent landings (CFIS) data to estimate the economic impacts of the commercial fishery, and developed and used a spiny lobster recreational fishing sampling design and survey questionnaire to collect data on and estimate California recreational spiny lobster fishing expenditures.	✓		✓	✓			

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
SBC fishing family adaptation (Endter-Wada and Keenan 2005) Used semi-structured interviews with CDFW personnel and fishery participants, observation, and a survey of fishing families to 1) build information and understanding of the ways that fishermen and their households adapt to changing socio-ecological systems; and 2) explore how their diverse, individualized strategies might explain why collective action strategies to mitigate or adapt to change have not been successful.	✓		✓	✓	✓	✓	✓
Quantifying and predicting responses to a US WC salmon fishery closure (Richerson and Holland 2017) Used PacFIN (fishery landings) data for the US West Coast commercial salmon troll fishery before, during, and after the 2008 and 2009 closures to explore the direct impacts of changed resource availability on fishing behavior within the fishery and the economic and ecological effects on other fisheries where there is substantial cross-participation by fishers. Various models developed as part of this work predict that another restricted salmon season would cause economic disaster and lead to a large fraction of vessels exiting fishing, but that effects on fisheries linked by cross-participation were likely to be low.	✓					✓	✓
Spatial history of the development of the CA groundfish fisheries (Miller et al. 2014) Using historical data for 1933-2010, constructed a generalized linear model to quantify the relationship between spatiotemporal trends in commercial and recreational groundfish fishing catches, distance from port, depth, and ocean conditions, to improve population models and evaluate stock assessment model assumptions. Results indicate that catches have taken place in increasingly deeper habitat, at a greater distance from ports, and in increasingly inclement weather conditions.	✓			✓		✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Characterizing fisheries connectivity in marine social-ecological systems (Fuller et al. 2017) Informed by discussions with West Coast fishermen, observers, and fisheries and social scientists, analyzed PacFIN fish ticket data to define commercial fisheries (based on species targeted), identify clusters of trips (based on gear and landings revenue and species composition), and their connectivity (i.e., extent to which vessels participate in a particular set of fisheries) for all major ports in the California Current Large Marine Ecosystem (CCLME) region. Applied theoretic metrics based on a social vulnerability framework (Adger 2006) to port-group level data to illustrate the relevance of connectivity to vulnerability and resilience of coastal fishing communities, and their sensitivity and capacity to adapt to perturbation.		✓	✓	✓		✓	
Contaminated fish consumption (Shilling et al. 2010) Conducted an intercept survey with recreational and subsistence fishermen in California's Central Valley to collect information on fish preferences, rates of consumption, the ways that they receive health information, and basic demographics, to help address questions related to the economic and cultural impacts of advising subsistence anglers to eat less fish with the economic costs of reducing mercury concentrations in fish. The majority of anglers reported catching fish in order to feed to their families, with a broad range of ethnic groups involved in catching, distributing, and eating the catch. Rates of fish consumption for certain ethnicities were higher than the rates used by state agencies for planning pollution remediation.		✓	✓	✓		✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Fishery management monitoring systems and data layering in data-poor environments (Petterson and Glazier 2008) Assembled and analyzed multiple data sets (in a low-information environment) to identify use areas, gear, seasonality, social conflicts, and effort shifts resulting from past and present fishery management actions to provide guidance for monitoring and assessing social impacts of California MPAs. Demonstrates GIS data-layering and analysis, and network analysis to guide informant selection and maximize response reliability as essential requirements of a robust system for tracking change over time related to MPAs and other regulatory changes affecting fishermen's behavior.		✓	✓	✓		✓	✓
Fishing as therapy: Impacts on job satisfaction and fishery management implications (Seara et al. 2017) Conducted face-to-face intercept surveys of fishermen in the NE US, Puerto Rico, and four non-US Caribbean and Central American countries to assess job satisfaction and well-being. Used non-parametric analysis of variance to compare measures across sites and, using additional data from a 1977 survey (in one NE community), over time.		✓	✓	✓		✓	
NC Pre-MLPA community-based SE characterization and risk assessment (Impact Assessment Inc 2010) Used archival research and semi-structured interviews data to describe basic sociodemographic and economic context and fisheries-specific aspects of the MLPA NC Region study area and document important social, economic, and spatial relationships between commercial and recreational fisheries and: 1) the NC nearshore marine environment, 2) shoreside support businesses, and 3) and associated coastal communities. Assessed risks of area-based fishery closures to the region's fishery participants and communities to help inform efforts to minimize socioeconomic costs and maximize biophysical and human benefits of a network of marine reserves.		✓	✓	✓	✓	✓	✓

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
San Diego area recreational fishery participants' perspectives on climate change (Zhang et al. 2012) Conducted a face-to-face survey of San Diego area CPFV captains to characterize their perspectives and responses related to climate variability. While survey results indicated that these captains have observed and adapted to changes in the environment and fish populations associated with climate variability, only 13% of respondents agreed that global climate change might be a source of that variability. A semiparametric discrete choice model identified determinants of these divergent beliefs on climate change as fishermen's experience and observations of the phenomena associated with climate variability.		✓	✓	✓		✓	
WC commercial fishing communities (Langdon-Pollock 2004) Synthesized data extracted from PacFIN, the US Census Bureau, chambers of commerce, historical societies, literature, and websites, coupled with phone interviews with fishing community members to develop consistent descriptions of West Coast coastal counties and associated (commercial and recreational) fishing communities meeting criteria for engagement in and dependence on commercial fisheries. Developed GIS maps depicting demographics (e.g., population, per capita income, percent unemployed, percent in poverty) for identified fishing ports.		✓	✓	✓			

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
CA market squid fleet analysis (Natural Resources Consultants Inc 2014) Conducted archival research using US Coast Guard and Canadian vessel documentation files; CDFW, ODFW and NMFS license, permit and landings data; and State and Federal FMPs and related documents to characterize and assess changes in wetfish and squid purse seine fleet capacity since the implementation of limited entry in the two fisheries. Results indicate substantially increased fleet capacity for fishing and holding squid following the growing practice of replacing permitted vessels with Canadian-built purse seiners.		✓		✓		✓	✓
Developing SE profiles for CA state-managed fisheries (Point 97 2014) Outlined an approach to develop coarse socioeconomic profiles to rapidly assess the status of state-managed fisheries using readily available data (collected by CDFW and from selected studied conducted by the authors); used it to characterize and assess state-managed fisheries for sea urchin, market squid, and CA halibut; and provided recommendations about the scope of analyses feasible with current data, information gaps that limit rapid socioeconomic fisheries assessments, and ways to align data collection efforts with information needs to better enable state agencies' design and implementation of ecosystem-based and adaptive fishery management.		✓		✓			

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
CA tribes' fish use (Shilling et al. 2014) In collaboration with tribal partners, conducted field interviews, which included mapping of waterways used for fishing, and an online survey of tribal fishermen, combined with archival research to collect information about and characterize current and traditional patterns of fish use by members of tribes across the state, to inform water regulations being drafted by the State Water Resources Control Board and the US Environmental Protection Agency. Results indicated that compared to tradition patterns and fish use, tribes use fish in similar patterns (fish types and source-waters), but for many tribes the current rate of fish use (frequency and consumption rate) was suppressed compared to historic use, an outcome attributed primarily to water quantity and quality issues.	✓	✓	✓	✓			
Overcapitalization in WC groundfish trawl fishery (Economic Subcommittee - Scientific and Statistical Committee PFMC 2000) Used focused discussions at a workshop that convened the PFMC's Science and Statistical Committee, federal fisheries economists, fishing industry representatives, and PFMC representatives, advisory group members, and staff, along with literature review and PacFIN data analysis, to: 1) describe and evaluate capacity trends and status of the West Coast groundfish fishery, 2) review alternative programs for reducing and managing fishing capacity, and 3) evaluate a range of alternatives for reducing capacity in the fishery. Findings included a determination of severe excess capacity in the fishery, an urgent need to develop stringent mechanisms to reduce it, and the critical need for the PFMC to engage industry to help identify, evaluate and select strategies for achieving that goal.	✓	✓	✓	✓	✓	✓	✓

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Socioeconomics of the Moss Landing commercial fishing industry; Market channels and value added to fish landed at Monterey Bay ports (Pomeroy and Dalton 2005; Pomeroy and Dalton 2003) Conducted archival research, literature review, ethnographic observation, semi-structured interviews with fishery participants and other community members, and a survey of seafood processors and port managers to 1) describe the commercial fishery's human system, 2) characterize and assess trends within and across fisheries, 3) estimate the value of commercially caught species landed at Moss Landing, 4) compare infrastructure and fishery production trends across the three major Monterey Bay ports, 5) identify needs, opportunities and constraints facing the Moss Landing Harbor commercial fishing industry, and 6) develop recommendations to the Monterey County Office of Economic Development on how it might help address those needs.	✓	✓	✓	✓	✓		
Taxonomy of US East Coast fishing communities: Social vulnerability and resilience (Pollnac et al. 2015) Developed a set of indicators of social vulnerability and resilience for US Southeast and Northeast coastal communities to support prediction and assessment of the impacts of changing coastal environments on coastal fishing communities. Applied cluster analysis to develop a taxonomy of coastal fishing community vulnerability for the region. Used semi-structured interviews combined with brief site visits to ground-truth the taxonomic method. Results indicate that the clusters are adequate for use in selecting communities for in-depth research for social assessment.	✓	✓	✓	✓	✓	✓	

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
WC fishing community profiles (Norman et al. 2007) Used available federal fishery permit, landings, and demographic data to develop and apply Indices of dependence and engagement to rank and prioritize for profiling communities associated with permittees. Guided by a template identifying features of interest, used secondary data (e.g., federal fishery permit, landings, and US Census data, literature) to characterize communities, with targeted phone interviews and selected site visits to validate and expand information, producing uniform narrative "short-form" profiles of West Coast communities associated with federal commercial fishery permittees, to serve as a consolidated source of baseline information for use in socioeconomic impact assessments for fishing communities.	✓	✓	✓	✓			
Central and northern CA commercial fisheries dynamics and change across ports (Speir et al. 2014) Applied rank correlation analysis to fishery landings data to determine whether changes in overall fishing activity (as measured by total regional fishing trips, revenues, and landings) affected fishing activity in each of central and northern California's 30 coastal fishing ports. Used results of recent and ongoing research on the region's fisheries and fishing communities to interpret and explain results. Found that the relative distribution of fishing activity across ports - as measured by port rankings - is not stable over time, indicating that impacts of management and other sources of change affect individual ports and communities differently.	✓	✓				✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Development of social indicators of fishing community vulnerability and resilience in the US southeast and northeast regions (Jepson and Colburn 2013) Used data from more than 2,900 coastal communities in 19 US East Coast and Gulf of Mexico to create 14 social vulnerability and fishing dependence indices for use in fisheries social impact assessment (SIA), followed by cluster analysis to select a group of 20 communities to evaluate the indices. Each index was developed using factor analysis of secondary data obtained primarily from government sources, supplemented by non-government sources. The availability of these secondary data ensures replicability and feasibility under the time constraints usually available for completing SIAs. These indices can be used for cross-community and cross-regional comparisons, and are slated for development and use in SIAs for all federally managed marine fisheries.	✓	✓		✓			
Evaluating indicators of human wellbeing (Breslow et al. 2017) Used literature review and expert opinion to develop a framework, adaptable to various scales and contexts, for identifying and evaluating indicators and measuring human well-being for EBM and assessing environmental decision-making tradeoffs. Concluded that existing indicators and data are of limited use, and new indicators are critically needed to capture linkages between environmental change and human well-being (especially for social equity and social justice).	✓	✓					

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Indicators of climate change and social vulnerability in East and Gulf coast fishing-dependent communities (Colburn et al. 2016) Used new indicators of climate change vulnerability, built on the existing Community Social Vulnerability Indicators (CSVIs), to assess a) the impact of sea level rise on critical commercial fishing infrastructure and b) the dependence of communities on species identified as vulnerable to the effects of climate change. Provide examples to demonstrate the utility of these new indicators to policy makers for decision-making to meet the goal of resilient coastal communities that are environmentally and economically sustainable. Integration of CSVIs and the new climate change vulnerability indices highlight community needs for unique solutions in order to adapt to environmental and social changes and maintain their well-being.	✓	✓		✓	✓	✓	✓
Modeling the economic impacts of marine reserve fishing restrictions (The Research Group LLC and Golden Marine Consulting 2012) Used available fisheries economic data, Oregon Recreational Boat Survey data, commercial fishery logbooks, and seafloor habitat mapping data to develop a model for conducting regional economic impact analyses of potential displacement of fishing effort due to area-based fishing closures (e.g., marine reserves, wave energy projects).	✓	✓		✓			

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Social indicators of gentrification pressure in fishing communities: Context for SIA (Colburn and Jepson 2012) Used US Census, NMFS, and other secondary data sources to develop social indicators for about 3,000 US East Coast and Gulf of Mexico coastal communities to evaluate gentrification pressure in select communities highly engaged in fishing. Gentrification often precipitates a move toward non-marine based economies that can displace local residents dependent on fishing as a way of life with resulting impacts to local economies and cultures. Complementary work to groundtruth these results and combine with time-series assessments is expected to lead to improvements in fishing community vulnerability and resilience assessments for use in fisheries social impact assessments.	✓	✓		✓		✓	✓
Toward a model for fisheries SIA (Pollnac et al. 2006) Developed a conceptual model for fisheries-focused, quantitative social impact assessment in Federal and state fishery management contexts to facilitate social research tailored to examine (e.g., by correlation, causality, prediction, simulation) the interactions among an array of social variables (e.g., individual and community attributes, social problems, job and other satisfactions, policy decisions) and their effects on community and individual well-being.	✓	✓				✓	

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
SE data requirements for fisheries regulatory analysis (Thomson 2010) Based on federal regulatory analysis requirements, identifies commercial fishery data sources (i.e., landings receipts, observer, logbook and port sampling programs, vessel registration files, state and federal permit files, and socioeconomic data collection efforts), demonstrates their utility for measuring key concepts (e.g., dependence, economic impact, distributional fairness), and identifies considerations for their use and relevance to regulatory analyses (evaluating options and outcomes). Using PacFIN landing receipt data for California, provides examples that can be used to characterize fishing vessel and first receiver behavior relevant to regulatory analysis. Suggests additional data that could be collected via existing mechanisms to expand the scope and depth of evaluations of socioeconomic effects of management.	✓			✓		✓	
Community resilience related to marine reserve implementation (ODFW Marine Reserves Program 2016) Used qualitative interviews to augment related survey research on the resilience and subjective well-being of individuals in coastal communities, to identify anticipatory decision-making strategies in response to marine reserve implementation including effort shift among fishermen and how tourism and business sectors of the community may choose to capitalize on marine reserves.		✓	✓	✓			

Examples and Synopsis	Data Collection Scope			Social analysis and assessment steps			
	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Role of recreation specialization in site substitution (Oh et al. 2013) Used a statewide mail survey of Texas anglers to collect data on demographics, specialization, experience preferences, consumptive orientation, place attachment, and site substitution. Developed a model to evaluate the relationship between specialization (i.e., behavior reflected by equipment and skills used and activity site preferences) and resource substitution (i.e., the interchangeability among sites and/or target species in satisfying anglers' motives, needs, and preferences). Results indicate that as specialization increases, dependence on and attachment to specific resources or sites increases and willingness to substitute alternatives decreases.		✓	✓	✓			
Social and economic characterization: Coastal community profiles (ODFW Marine Reserves Program 2016) Used existing qualitative and quantitative data (history, demographics, economic and census data) to characterize place-based communities associated with Oregon marine reserves to enable comparison among communities and sites and serve as a baseline for monitoring changes over time. Collected additional data through interviews with community members on characteristics of community resilience, adaptation and communication to explore communities' resilience/adaptability to both opportunities and stresses created by external events (e.g. change in marine conservation policy, environmental or economic changes).		✓	✓	✓			

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Coastal community resilience and subjective well-being: Individual responses to change (ODFW Marine Reserves Program 2016) Used mail and online survey research to assess social and psychological variables related to individual attitudes, values and perceived well-being in response to the marine reserves and other socioeconomic or environmental changes (stressors) within their coastal community. Where Community Profiles are focused on community level response to change such as reserve implementation, this project focuses on the individual.			✓	✓			
Demographic variability in seafood consumption rates among recreational anglers (Allen et al. 1996) Used an intercept survey (conducted in multiple languages) with recreational fishermen in Santa Monica Bay, California to collect data on fishing practices by mode, catch, seafood consumption practices, and demographics, and catch. Used the resulting data to calculate consumption rates, which averaged less than the national average rate. However, consumption rates of potentially contaminated species and angler awareness of health risks varied widely by ethnic group, suggesting a need to communicate health risks by targeting habits and languages of high-risk anglers.			✓	✓	✓	✓	✓
Fisheries privatization, social transitions, and well-being in Kodiak, AK (Carothers 2015) Used mixed methods (ethnographic interviews and observation, survey) to explore the impacts of fisheries privatization (catch shares) on fishery systems in Kodiak, AK. Results suggest privatization has led to significant change with divisive, negative impacts including changes in core social values of (e.g., hard work, opportunity, fairness), shifts in power, status, and livelihoods of crew members, and substantial financial barriers to entry, contributing to concern about the future of fisheries access in the community for the next generation and sense of a need for more entry-level opportunities for all fisheries.			✓	✓	✓	✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Integrating detailed ethnographic data into assessments of fishing community vulnerability (Lyons et al. 2016) Used ethnographic interviews guided by a "means, meanings, and contexts" framework to characterize relationships among place, people, and lifestyle in communities as a foundation for assessing community vulnerability to change. Results are summarized at three levels of detail: detailed textual description, tabular summary, and graphical summary. This qualitative methodology captures detail, historical context, and power dynamics, which are not readily captured in quantitative indices of vulnerability. Using two Pribilof Island (Alaska) communities as examples, results differ markedly from those using quantitative indices.			✓	✓	✓	✓	
Sociocultural assessment of the WC trawl catch share program (Russell 2016; Russell et al. 2016) Used semi-structured interviews, in-person and mail surveys, and observation to establish a social baseline in 2010, prior to implementation of catch shares in the West Coast groundfish trawl fishery, and at two intervals following (2012, 2015), to measure associated social changes and impacts on individuals and communities. Variables included percent of income from fishing, multiple jobs worked, job stability, job satisfaction, standard of living, and how individuals were personally affected. Results indicate mixed results across communities categorized by percentage of quota share permit owners that live in each community, and variation between owners, with some able to fish their allocations and others needing to lease more to fish.			✓	✓		✓	✓

	Data Collection Scope			Social analysis and assessment steps			
Examples and Synopsis	In-house data and knowledge	Other available sources	Primary data collection	Building baseline	Scoping	Selecting variables	Assessing for management
Subsistence fishing in Los Angeles county (Pitchon and Norman 2012) Used an intercept survey, semi-structured interviews, and participant observation to characterize the demographics, fishing practices, dietary significance of the catch (i.e., subsistence), risk awareness and perceptions, and sociocultural aspects of four pier-based fishing communities in Los Angeles County. Applied a mix of ethnographic, demographic, sociological, and risk analysis and perception methodologies to data collection and analysis, toward: 1) expanding the examination of communities in fisheries management, and 2) advancing potential environmental justice research related to fishery dependence, management, and marine resource toxin risk.			✓	✓			

Table C2. Examples from the literature: Relevance to MLMA objectives.

Example	Socioeconomic Objectives					Ecological Objectives				Management Objectives		
	Sustainable use	Long-term interests considered	Adverse impacts minimized	Fair allocation	Excess effort prevented/ reduced	Habitat protected/ restored	Depressed fisheries rebuilt	Bycatch limited	Sustainable resource	Responsive to change	Conflict resolved/ addressed	Management coordinated
CA commercial spiny lobster fishery: SE impacts of Channel Islands MPAs (Guenther 2010)	✓	✓	✓			✓				✓		
CA Dungeness crab commercial fishery: Excess capacity and effort (Dewees et al. 2004; Hackett et al. 2003; Hackett et al. 2004)	✓	✓			✓					✓		
CA halibut commercial fishery: Collaborative research to build HD information (Pomeroy et al. 2016)	✓	✓	✓							✓		
CA market squid/wetfish commercial fishery: SE organization (Pomeroy et al. 2002)	✓	✓	✓		✓					✓		
CA recreational abalone fishery and site valuation (Reid et al. 2016)	✓	✓	✓				✓			✓		
Commercial fishery trends and infrastructure needs for SBC ports (Culver et al. 2007))	✓	✓	✓							✓		
HDs of the CA Current IEA (Breslow et al. 2013)	✓	✓	✓							✓	✓	✓
Impacts of bass fishery regulations on CA CPFV fishery (Bellquist et al. 2017)	✓	✓	✓		✓		✓			✓		
Integrating HD info into EBFM (Pomeroy et al. 2005)	✓	✓	✓		✓				✓	✓		
NC region and fishing community profiles (Pomeroy et al. 2010)	✓	✓	✓		✓		✓		✓	✓	✓	✓
San Francisco Bay seafood consumption study (SFEI and California Department of Health Services 2000)		✓	✓							✓		✓
CA commercial fishery stayers/leavers in four fisheries (Hackett et al. 2015)	✓	✓	✓		✓					✓		✓
CA commercial salmon fishery: Costs and revenues (Hackett and Hansen 2008)	✓	✓	✓				✓			✓		

Example	Socioeconomic Objectives					Ecological Objectives				Management Objectives		
	Sustainable use	Long-term interests considered	Adverse impacts minimized	Fair allocation	Excess effort prevented/ reduced	Habitat protected/ restored	Depressed fisheries rebuilt	Bycatch limited	Sustainable resource	Responsive to change	Conflict resolved/ addressed	Management coordinated
Impact of catch shares on diversification of fishermen's income and risk (Holland et al. 2017)	✓	✓	✓							✓		
Spatial valuation of CA marine fisheries (Miller et al. 2017)	✓	✓							✓	✓		✓
CA commercial fishing industry: Economic model for valuation and economic impact assessment (Hackett et al. 2009)	✓	✓	✓							✓		
CA shrimp trawl fishery (Frimodig et al. 2009)	✓	✓	✓				✓		✓	✓		✓
CA spiny lobster FMP: Economic valuation (Hackett et al. 2013)	✓		✓									✓
SBC fishing family adaptation (Endter-Wada and Keenan 2005)	✓	✓	✓						✓	✓		
Quantifying and predicting responses to a US WC salmon fishery closure (Richerson and Holland 2017)	✓	✓	✓		✓					✓		✓
Spatial history of the development of the CA groundfish fisheries (Miller et al. 2014)	✓	✓			✓	✓	✓		✓	✓		
Characterizing fisheries connectivity in marine social-ecological systems (Fuller et al. 2017)	✓	✓	✓		✓					✓		✓
Contaminated fish consumption (Shilling et al. 2010)		✓	✓									✓
Fishery management monitoring systems and data layering in data-poor environments (Petterson and Glazier 2008)	✓	✓	✓	✓		✓					✓	✓
Fishing as therapy: Impacts on job satisfaction and fishery management implications (Seara et al. 2017)			✓							✓		
NC Pre-MLPA community-based SE characterization and risk assessment (Impact Assessment Inc 2010)	✓	✓	✓	✓						✓		✓
San Diego area recreational fishery participants' perspectives on climate change (Zhang et al. 2012)			✓							✓		
WC commercial fishing communities (Langdon-Pollock 2004)	✓	✓	✓	✓			✓			✓		✓

Example	Socioeconomic Objectives					Ecological Objectives				Management Objectives		
	Sustainable use	Long-term interests considered	Adverse impacts minimized	Fair allocation	Excess effort prevented/ reduced	Habitat protected/ restored	Depressed fisheries rebuilt	Bycatch limited	Sustainable resource	Responsive to change	Conflict resolved/ addressed	Management coordinated
CA market squid fleet analysis (Natural Resources Consultants Inc 2014)	✓	✓			✓				✓	✓		
Developing SE profiles for CA state-managed fisheries (Point 97 2014)	✓		✓		✓					✓		
CA tribes' fish use (Shilling et al. 2014)	✓	✓	✓							✓		✓
Overcapitalization in WC groundfish trawl fishery (Economic Subcommittee - Scientific and Statistical Committee PFMC 2000)	✓	✓	✓		✓	✓	✓		✓	✓		✓
Socioeconomics of the Moss Landing commercial fishing industry; Market channels and value added to fish landed at Monterey Bay ports (Pomeroy and Dalton 2005; Pomeroy and Dalton 2003)	✓	✓	✓				✓			✓		✓
Taxonomy of US East Coast fishing communities: Social vulnerability and resilience (Pollnac et al. 2015)	✓	✓	✓							✓		
WC fishing community profiles (Norman et al. 2007)	✓	✓	✓							✓		✓
Central and northern CA commercial fisheries dynamics and change across ports (Speir et al. 2014)	✓	✓	✓				✓			✓		✓
Development of social indicators of fishing community vulnerability and resilience in the US southeast and northeast regions (Jepson and Colburn 2013)	✓	✓	✓							✓		✓
Evaluating indicators of human wellbeing (Breslow et al. 2017)		✓	✓	✓						✓		
Indicators of climate change and social vulnerability in East and Gulf coast fishing- dependent communities (Colburn et al. 2016)	✓									✓		
Modeling the economic impacts of marine reserve fishing restrictions (The Research Group LLC and Golden Marine Consulting 2012)		✓	✓	✓								
Social indicators of gentrification pressure in fishing communities: Context for SIA (Colburn and Jepson 2012)		✓	✓							✓		

Example	Socioeconomic Objectives					Ecological Objectives				Management Objectives		
	Sustainable use	Long-term interests considered	Adverse impacts minimized	Fair allocation	Excess effort prevented/ reduced	Habitat protected/ restored	Depressed fisheries rebuilt	Bycatch limited	Sustainable resource	Responsive to change	Conflict resolved/ addressed	Management coordinated
Toward a model for fisheries SIA (Pollnac et al. 2006)	✓	✓	✓	✓	✓					✓	✓	✓
SE data requirements for fisheries regulatory analysis (Thomson 2010)	✓	✓	✓		✓		✓			✓		✓
Community resilience related to marine reserve implementation (ODFW Marine Reserves Program 2016)		✓	✓							✓		
Role of recreation specialization in site substitution (Oh et al. 2013)		✓	✓									
Social and economic characterization: Coastal community profiles (ODFW Marine Reserves Program 2016)		✓	✓	✓								
Coastal community resilience and subjective well-being: Individual responses to change (ODFW Marine Reserves Program 2016)		✓	✓									
Demographic variability in seafood consumption rates among recreational anglers (Allen et al. 1996)		✓	✓	✓						✓		✓
Fisheries privatization, social transitions, and well-being in Kodiak, AK (Carothers 2015)		✓	✓							✓		✓
Integrating detailed ethnographic data into assessments of fishing community vulnerability (Lyons et al. 2016)	✓	✓	✓							✓		
Sociocultural assessment of the WC trawl catch share program (Russell 2016; Russell et al. 2016)	✓	✓	✓	✓						✓		
Subsistence fishing in Los Angeles county (Pitchon and Norman 2012)		✓	✓	✓						✓		

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The following tables identify sources of information about the human dimensions of fisheries. Sources include 1) government bodies and selected subprograms which collect and/or catalog information, 2) types of people with relevant knowledge and information, 3) examples of other types of information-building efforts, and 4) types of documents and other media that provide raw data and/or synthesized or analyzed information. Note that other organizations -- other agencies, academic institutions, and private sector entities - also are valuable sources, and are captured under People, Examples of other types of efforts, and Documents. Table C1 indicates the contexts these sources are most relevant to; Table C2 indicates the types of SE EFI they can provide; and Table C3 provides web links (where available) and short descriptions of the sources identified in tables C1 and C2, consolidating sources that provide information through multiple subprograms or source types, and highlighting phrases that may be useful for locating particular subprograms or information.

The information provided here is not exhaustive. Also, each source addresses some aspects of the contexts and SE FI types as indicated but seldom if ever addresses all information needs that might arise. Moreover, each source is associated with a particular mission and perspective, which in turn influences the type, focus and content as well as the quality and quantity of information. Therefore, it is important to keep these considerations in mind and use multiple sources to triangulate information.

Table D1. Data types and sources and the fishery system contexts for which they provide socioeconomic EFI.

Information sources	Commercial Fishing	Recreational Fishing	Shoreside infrastructure and support	Communities
Organizations				
CA Department of Fish and Wildlife (CDFW)				
CA Recreational Fisheries Survey (CRFS)		✔		✔
CA Ocean Fish Harvesters Economic model (COFHE)	✔			✔
Commercial Fisheries Information System (CFIS)	✔		✔	✔
Compliance/enforcement data	✔	✔	✔	
Fishery management documents (e.g., FMPs, regulatory/environmental analyses)	✔	✔	✔	✔
Recreational fishing license data		✔		✔
Sport fishery report cards		✔		
CA Fish and Game Commission (CFGC)	✔	✔	✔	✔
National Marine Fisheries Service (NMFS) Office of Science and Technology				

Information sources	Commercial Fishing	Recreational Fishing	Shoreside infrastructure and support	Communities
Annual survey of US seafood processors/products			✔	✔
Human Dimensions Program	✔	✔	✔	✔
Marine Recreational Fisheries Expenditure Survey (MRFES)		✔	✔	
Seafood trade data			✔	
Social indicators of coastal community well-being	✔	✔	✔	✔
Voices from the Fisheries	✔	✔	✔	✔
NMFS West Coast Region				
Logbooks	✔	✔		
Permit data	✔		✔	✔
NMFS Northwest Fisheries Science Center (NWFSC)				
Fisheries Economics Explorer (FISHEyE)	✔		✔	✔
Pacific Coast Groundfish Trawl Fishery Social Study	✔		✔	✔
West Coast Groundfish Observer Program	✔		✔	
NMFS Southwest Fisheries Science Center (SWFSC)				
SWFSC Economics and Social Research Program (La Jolla Lab)	✔	✔	✔	✔
SWFSC Fisheries Economics (Santa Cruz Lab)	✔	✔	✔	✔
NOAA Office of National Marine Sanctuaries: West Coast Region	✔	✔		✔
NOAA Office for Coastal Management (OCM)				
Digital Coast	✔	✔	✔	✔
Economics: National Ocean Watch (ENOW)	✔	✔		✔
Pacific Fishery Management Council (PFMC)				
Fishery management documents (e.g., FMPs, regulatory/environmental analyses)	✔	✔	✔	✔
Pacific States Marine Fisheries Commission (PSMFC)				
Fisheries Economic Data Program (EFIN)	✔	✔	✔	✔
Pacific Fisheries Information Network (PacFIN)	✔		✔	✔
Sea Grant (National, cross-cutting, state programs)				
CA Sea Grant (CSG)	✔	✔	✔	✔

Information sources	Commercial Fishing	Recreational Fishing	Shoreside infrastructure and support	Communities
University of Southern CA Sea Grant (USCSG)			✔	✔
Tribal governments*	✔	✔	✔	✔
CA Coastal Commission (CCC)			✔	✔
CA Department of Public Health (CDPH)		✔	✔	
CA Division of Boating and Waterways (CDBW)	✔	✔	✔	
CA Department of Finance				
State Census Data Center-Department of Finance (SCDC)	✔		✔	✔
CA Employment Development Department (EDD)	✔		✔	✔
CA Environmental Protection Agency (CalEPA)				
Office of Environmental Health Hazard Assessment (OEHHA)		✔	✔	
CA Ocean Science Trust (CalOST)				
CA OceanSpaces	✔	✔	✔	✔
US Bureau of Economic Analysis (BEA)			✔	✔
US Bureau of Labor Statistics (BLS)	✔	✔	✔	✔
US Bureau of Ocean Energy Management (BOEM)	✔	✔	✔	✔
US Census Bureau				
American Community Survey				✔
American FactFinder				✔
County Business Patterns		✔	✔	✔
Nonemployer Statistics	✔	✔	✔	✔
US Coast Guard (USCG)	✔	✔		
US Environmental Protection Agency (EPA)	✔	✔	✔	✔
People				
Fishing community members (e.g., participants, support providers, organizations, agency advisory groups)	✔	✔	✔	✔
Government Personnel				
State (e.g., CalOST, CCC, CDBW, CDFW, CDPH, CFGC, OEHHA, SCC, Legislature)	✔	✔	✔	✔

Information sources	Commercial Fishing	Recreational Fishing	Shoreside infrastructure and support	Communities
Federal (e.g., BOEM; EPA; NOAA: NMFS, NOS, OCM; USCG; PSMFC (interstate))	✔	✔	✔	✔
Local (e.g., city, county)	✔	✔	✔	✔
Other stakeholders (e.g., coastal community leaders/members, seafood consumers, NGO staff, etc.)	✔	✔	✔	✔
Researchers (e.g., academic, NGO, private sector)	✔	✔	✔	✔
Sea Grant Extension Personnel	✔	✔	✔	✔
Tribal representatives*	✔	✔	✔	✔
Examples of other types of information-building efforts				
Fishery/community profiles	✔	✔	✔	✔
Issue-specific studies				
Bycatch/protected species interaction studies	✔	✔		
Climate change/adaptation studies	✔	✔	✔	✔
Ocean space use/siting studies	✔	✔	✔	✔
Safety risk/assessment studies	✔	✔	✔	
Seafood consumption studies	✔	✔		✔
Working waterfront/port infrastructure studies	✔	✔	✔	✔
Documents and other media				
Environmental assessments/reviews related, e.g., to ocean management, seafood consumption, public health, working waterfronts, communities	✔	✔	✔	✔
Government documents (e.g., laws, regulations, local coastal plans; local, regional, state, national)	✔	✔	✔	✔
Gray literature (e.g., non-peer-reviewed reports, issue papers, policy statements)	✔	✔	✔	✔
Documentaries and oral histories	✔	✔	✔	✔
Peer-reviewed literature (e.g., journal articles, technical reports; in social, biophysical, policy sciences)	✔	✔	✔	✔

Information sources	Commercial Fishing	Recreational Fishing	Shoreside infrastructure and support	Communities
Popular media (e.g., newspapers, magazines, radio and television programming)	✔	✔	✔	✔
Social media (e.g., websites, blogs, Facebook)	✔	✔	✔	✔
Public comment (written, oral)	✔	✔	✔	✔

* *Tribal entities' sovereign status requires a distinct approach.*

Table D2. Examples of data types and sources and the types of socioeconomic EFI they provide.

Information sources	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships, networks	Capital	Employment	Expenditures	Revenue	Environmental factors	Macroeconomic factors
Organizations													
CA Department of Fish and Wildlife (CDFW)													
CA Recreational Fisheries Survey (CRFS)	✓	✓	✓										
CA Ocean Fish Harvesters Economic model (COFHE)		✓	✓				✓	✓	✓	✓	✓		
Commercial Fisheries Information System (CFIS)	✓	✓	✓			✓	✓	✓	✓	✓	✓		
Compliance/enforcement data		✓	✓			✓							
Fishery management documents (e.g., FMPs, regulatory/environmental analyses)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recreational fishing license data	✓		✓							✓			
Sport fishery report cards		✓	✓					✓					
CA Fish and Game Commission (CFGC)		✓	✓	✓		✓							
National Marine Fisheries Service (NMFS) Office of Science and Technology													
Annual survey of US seafood processors/products		✓	✓						✓	✓	✓		
Human Dimensions Program	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Marine Recreational Fisheries Expenditure Survey (MRFES)	✓	✓	✓						✓		✓		
Seafood trade data			✓				✓			✓	✓		
Social indicators of coastal community well-being	✓		✓				✓		✓		✓	✓	✓
Voices from the Fisheries	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NMFS West Coast Region													
Logbooks	✓	✓	✓				✓		✓			✓	
Permit data	✓	✓				✓	✓	✓		✓			
NMFS Northwest Fisheries Science Center (NWFSC)													

Information sources	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships, networks	Capital	Employment	Expenditures	Revenue	Environmental factors	Macroeconomic factors
Fisheries Economics Explorer (FISHEyE)	✓	✓	✓					✓	✓	✓	✓		
Pacific Coast Groundfish Trawl Fishery Social Study	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
West Coast Groundfish Observer Program		✓	✓										
NMFS Southwest Fisheries Science Center (SWFSC)													
SWFSC Economics and Social Research Program (La Jolla Lab)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SWFSC Fisheries Economics (Santa Cruz Lab)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NOAA Office of National Marine Sanctuaries: West Coast Region		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
NOAA Office for Coastal Management (OCM)													
Digital Coast	✓		✓			✓			✓	✓	✓	✓	
Economics: National Ocean Watch (ENOW)	✓								✓		✓		
Pacific Fishery Management Council (PFMC)													
Fishery management documents (e.g., FMPs, regulatory/environmental analyses)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pacific States Marine Fisheries Commission (PSMFC)													
Fisheries Economic Data Program (EFIN)	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓
Pacific Fisheries Information Network (PacFIN)		✓	✓								✓		
Sea Grant (National, cross-cutting, state programs)													
CA Sea Grant (CSG)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
University of Southern CA Sea Grant (USCSG)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tribal governments*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CA Coastal Commission (CCC)	✓	✓	✓			✓			✓		✓	✓	
CA Department of Public Health (CDPH)	✓		✓		✓							✓	
CA Division of Boating and Waterways (CDBW)		✓	✓			✓		✓				✓	
CA Department of Finance													

Information sources	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships, networks	Capital	Employment	Expenditures	Revenue	Environmental factors	Macroeconomic factors
State Census Data Center-Department of Finance (SCDC)	✓								✓	✓	✓		✓
CA Employment Development Department (EDD)	✓								✓	✓	✓		✓
CA Environmental Protection Agency (CalEPA)													
Office of Environmental Health Hazard Assessment (OEHHA)			✓			✓						✓	
CA Ocean Science Trust (CalOST)													
CA OceanSpaces	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
US Bureau of Economic Analysis (BEA)								✓	✓	✓	✓		✓
US Bureau of Labor Statistics (BLS)	✓								✓	✓	✓		✓
US Bureau of Ocean Energy Management (BOEM)	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
US Census Bureau													
American Community Survey	✓								✓	✓	✓		✓
American FactFinder	✓								✓	✓	✓		✓
County Business Patterns									✓	✓			
Nonemployer Statistics									✓		✓		
US Coast Guard (USCG)		✓	✓			✓							
US Environmental Protection Agency (EPA)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
People													
Fishing community members (e.g., participants, support providers, organizations, agency advisory groups)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Government Personnel													
State (e.g., CalOST, CCC, CDBW, CDFW, CDPH, CEC, CFGC, OEHHA, SCC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Federal (e.g., BOEM; EPA; NOAA: NMFS, NOS, OCM; USCG; PSMFC (interstate))	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Local (e.g., city, county)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Information sources	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships, networks	Capital	Employment	Expenditures	Revenue	Environmental factors	Macroeconomic factors
Other stakeholders (e.g., coastal community leaders/members, seafood consumers, NGO staff, etc.)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Researchers (e.g., academic, NGO, private sector)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sea Grant Extension Personnel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tribal representatives*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Examples of other types of information-building efforts													
Fishery/community profiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Issue-specific studies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bycatch/protected species interaction studies		✓	✓	✓	✓	✓						✓	
Climate change/adaptation studies		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
Ocean space use/siting studies	✓	✓	✓	✓	✓	✓			✓			✓	
Safety risk/assessment studies	✓	✓	✓		✓	✓		✓		✓		✓	
Seafood consumption studies	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓
Working waterfront/port infrastructure studies		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
Documents and other media													
Environmental assessments/reviews related, e.g., to ocean management, seafood consumption, public health, working waterfronts, communities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Government documents (e.g., laws, regulations, local coastal plans; local, regional, state, national)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gray literature (e.g., non-peer-reviewed reports, issue papers, policy statements)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Documentaries and oral histories	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peer-reviewed literature (e.g., journal articles, technical reports; in social, biophysical, policy sciences)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Popular media (e.g., newspapers, magazines, radio and television programming)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Information sources	Demographics	Operations	Practices	Values, preferences, needs	Attitudes, opinions, beliefs	Institutions	Relationships, networks	Capital	Employment	Expenditures	Revenue	Environmental factors	Macroeconomic factors
Social media (e.g., websites, blogs, Facebook)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Public comment (written, oral)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Tribal entities' sovereign status requires a distinct approach.

Table D3. Information sources, main website address (where applicable), and highlights related to socioeconomic EFI.

Information Sources	Description
CA Coastal Commission *www.coastal.ca.gov*	Leading state authority for coastal zone planning and regulation, including *Local Coastal Plans*, which provide information about land and water use for 76 coastal cities and counties. Leads Federal consistency review for activities in the coastal zone. Generates and archives *data and documents* related to *coastal zone and associated community activity*; reviews and acts on *port master plans* and amendments; maintains archives that include *public comment*.
CA Department of Finance: State Census Data Center (SCDC) *www.dof.ca.gov/Forecasting/Demographics/Census_Data_Center_Network*	State *repository* and dissemination point for *US census data*, provides access to *American Community Survey*, *Decennial Census*, and other data sources, *summary tables and reports*, and supporting *information for characterizing (census-defined) places*, cities, counties, and the state.
CA Department of Fish and Wildlife (CDFW) *www.wildlife.ca.gov*	As lead state agency for fisheries management, collects, manages and disseminates fisheries-related data through multiple efforts including: *CA Fisheries Information System (CFIS)*, a relational database containing commercial fishery *landings, vessel registration, state license, permit and logbook data, and CPFV logbook data*; *CA Ocean Fish Harvester Economic (COFHE)* input-output model and documentation useful for estimating the contribution of the state's commercial fisheries to the economy; *California Recreational Fisheries Survey (CRFS)*, which generates *catch, effort and participation data* for CA recreational finfish fisheries, in coordination with the *Ocean Salmon Project (OSP)*, and the *Recreational Fisheries Data Project*, which gathers, reviews, and analyzes recreational fishery data including *licenses and sport fishery report cards* for selected fisheries, to meet management needs and coordinate with other states, PSMFC and PFMC. *Staff (within and outside Marine Region)* possess extensive knowledge and experience about fisheries, associated human systems, and management. CDFW and/or contractors develop and contribute to *FMPs, fisheries status reports, other grey and refereed publications, blogs* and other information resources.
CA Department of Public Health (CDPH) *www.cdph.ca.gov/*	CDPH's *Environmental Health investigations Branch (EHIB)* collects, analyzes, interprets, and distributes *health data (e.g., seafood quality, catch and consumption)* to inform public health practice. The *Food and Drug Branch (FDB)* monitors seafood and shellfish for contaminants, issues permits to seafood handlers and producers, and conducts education and outreach with seafood producers to help ensure *consumers safety*.
CA Division of Boating and Waterways (CDBW) *www.dbw.ca.gov*	Lead state agency for recreational boating-related matters, including *public access, safety and education, marine law enforcement,* and *consumer and environmental protection*. Sponsors applied research and infrastructure improvement projects, and collects and disseminates data on *boating and waterway infrastructure and use*, including *boater surveys* and *biennial reports*.

Information Sources	Description
CA Employment Development Department (EDD) *www.edd.ca.gov*	EDD is responsible for state programs related to ***unemployment insurance, disability insurance, payroll tax collection,*** and ***job training/workforce services***. Its ***Labor Market Information Division (LMID)*** collects, analyzes, and publishes information about ***California's labor markets; economic development and planning; industry and occupational characteristics, trends, and wage information;*** and ***social and demographic information.***
CA Environmental protection Agency (CalEPA) *calepa.ca.gov/fish*	OEHHA monitors and evaluates ***seafood safety risks*** related to chemical and biological contaminants, collaborates in the conduct of ***seafood consumption studies***, develops and disseminates ***fish advisories*** to the general public and populations to protect and enhance public health, and makes ***recommendations regarding fishing safety and closures*** in response to marine oil spills, harmful algal blooms, and other such events.
CA Fish and Game Commission (CFGC) *www.fgc.ca.gov*	The lead state regulatory agency for fisheries, the CFGC collects ***public comment*** formally (***through Commission meetings***) and less formally through ***meetings of its Marine Resources and Tribal Committees***, and workshops on topics such as ***fishing community needs and concerns***. As such, the Commission is a source of ***written and oral public comment, meeting summaries,*** and ***supporting documents associated with these efforts***, along with ***staff knowledge*** about ***fisheries governance, fishery participants***, and ***other stakeholders***.
CA Legislature *fisheries.legislature.ca.gov*	With law-making authority for some commercial fisheries and other ocean-related matters overall and through committees, the California Legislature is a source of information including ***public comment, legislative reports,*** and ***knowledge of legislators and staff,*** especially those who serve on the ***Joint Committee on Fisheries and Aquaculture***.
CA Ocean Science Trust (CalOST) *www.oceansciencetrust.org*	CalOST convenes and coordinate working groups and other efforts to synthesize information to address coastal and marine issues affecting the state, with information available via an ***online resource library, OceanSpaces***, which archives ***state MPA baseline and monitoring project information***, and the ***California Fisheries Data Explorer***.
CA State Coastal Conservancy (SCC) *scc.ca.gov*	A non-regulatory state agency, the State Coastal Conservancy provides ***technical assistance and grant funding*** for a range of projects with goals such as ***revitalizing working waterfronts*** and ***preparing communities for the impacts of climate change***. ***SCC staff*** are knowledgeable about the regions and topics for which they oversee projects awarded, and ***project reports*** variously provide information on ***fisheries, shoreside infrastructure,*** and ***coastal communities***.
Local government agencies	Local government entities such as ***cities, counties, and ports/harbors (e.g., special districts)*** are sources of information related to fisheries especially as they interface with local infrastructure, businesses, and community groups, local policy-making and enforcement processes. These entities

Information Sources	Description
	may sponsor and/or participate in related research, and collect and archive data, reports, public comment, and other information. ***Agency personnel*** may have ***knowledge and experience*** related to fisheries, including ***fishery participants and other they interact with, shoreside infrastructure and support businesses***, the larger ***community context,*** and how these affect and are affected by management and other ***sources of change.***
National Working Waterfront Network (NWWN) *www.wateraccessus.com*	The National Working Waterfront Network (NWWN), which includes businesses, industry associations, nonprofits, local governments and communities, state and federal agencies, universities, Sea Grant programs, and individuals, collects and archives information about ***working waterfronts***, associated ***communities,*** and challenges and opportunities they face. NWWN resources include ***case studies, oral histories***, and a "***Sustainable Working Waterfronts Toolkit***" that provides information related to ***law and policy, financing, economics, community engagement, and historic trends,*** along with news about upcoming and past conferences and other ***information-sharing events***.
NMFS Northwest Fisheries Science Center (NWFSC) *www.nwfsc.noaa.gov*	NMFS NWFSC is responsible for federal fisheries science for the northern portion of the US West Coast, associated fisheries, and communities. ***Economics and Social Research Program staff and partners*** collect and analyze ***economic data*** from participants in the federally-managed groundfish and salmon fisheries and state-regulated crab and shrimp fisheries; survey anglers, (recreational) shellfish harvesters, and charter boat operators; assess ***community dependence on marine resources;*** and consider the ***economic and social impacts of fishery management alternatives on coastal communities***. The ***West Coast Groundfish Catch Share Economic Data Collection (survey)*** and ***Pacific Coast Groundfish Trawl Fishery Social Study*** are longitudinal projects to assess economic and social impacts of the federal groundfish trawl catch share program implemented in 2011. ***FISHEyE*** is an interactive tool for exploring the economic data collected. The ***West Coast Groundfish Observer Program*** provide data on observed ***fishing practices*** and ***operations*** for commercial fishery sectors (species-gear groups) that interact with federally managed groundfish species as directed catch or bycatch.
NMFS Office of Science and Technology *www.fisheries.noaa.gov/about/office-science-and-technology*	NMFS Office of Science and Technology integrates and disseminates state and federal statistics and other information about the ***economic and socio-cultural dimensions of fisheries and fishing communities***. Examples of programs and products include: 1) an ***annual survey of seafood processors*** operating in the US, which collects ***data on quantity and value of products, monthly employment, etc.***; 2) periodic ***surveys of recreational fishery participants*** to collect ***data such as participation, effort, expenditures, demographics***, and (for a "high-level national snapshot") ***anglers' motivations, characteristics of successful trips***, and ***preferred management objectives***; 3) ***commercial and recreational fisheries economics***; 4) national and regional human dimensions data collection and analysis projects including ***community profiles, social indicators***, and ***social and cultural studies***; 5)

Information Sources	Description
	V*oices from the Fisheries*, a repository for consolidating, archiving, and disseminating *oral history interview recordings and transcripts* related to US fisheries and associated communities; and 6) *data portals and applications for accessing a range of quantitative and qualitative data* for these programs as well as commercial and (estimated) recreational *landings, trade and market data* for selected fisheries, and more. (A separate "*NOAA Fisheries Permits*" page provides data on Federal West Coast fishing and seafood permits.)
NMFS Southwest Fisheries Science Center (SWFSC) *swfsc.noaa.gov/textblock.aspx?id=1038&ParentM enuId=109*	One of two NMFS Science Centers that conduct research on federally-managed fisheries off California and the larger West Coast, the SWFSC collects and analyzes *data to document the economic status of commercial and recreational fisheries*, and analyzes *economic and community impacts of alternative management measures*. The *Santa Cruz Lab* focuses on groundfish and salmon fisheries and the *La Jolla Lab* focuses on coastal pelagic species, highly migratory species, and protected species.
NMFS West Coast Region *www.westcoast.fisheries.noaa.gov/index.html*	NMFS's West Coast Region office is responsible for *fisheries management, enforcement,* and *habitat restoration* as well as research, across the region's four states: California, Oregon, Washington, and Idaho. With oversight for *federal commercial fishery logbook, permit and observer programs*, it is a source of data, reporting and other documentation, and knowledge and experience of staff associated with those programs.
NOAA Office for Coastal Management (OCM) *coast.noaa.gov*	NOAA's *Digital Coast* provides coastal data, including *economic, demographic, jurisdictional, ocean uses*, from multiple (vetted) sources, along with *tools, training, and information needed to support the use of those data*. The program's *Economics: National Ocean Watch (ENOW)* provides selected *economic time-series data* for six ocean-dependent sectors of the economy at county, state, regional, and national scales in a variety of formats. Note that ENOW addresses commercial fisheries as part of the *"Living Marine Resources"* sector and recreational fisheries (private and for-hire) as part of the *"Tourism and Recreation"* sector.
NOAA Office of National Marine Sanctuaries: West Coast Region *sanctuaries.noaa.gov/about/westcoast.html*	With four national marine sanctuaries (NMSs) in California, NOAA's Office of National Marine Sanctuaries and its *West Coast Region* conduct and support conservation-related research, education and outreach. Staff and contractors use secondary and primary data to *characterize, monitor, and assess NMS uses* and conditions, with a primary focus on *economic valuatio*n. NMS information resources include NMS *management plan*s and other publications, a *Conservation Series* with documents that address selected human dimensions of the NMSs, their use, and management, and educational materials that describe *historic and recent fishery activity* within the NMSs.
Pacific Fishery Management Council (PFMC) *www.pcouncil.org/resources*	One of eight regional fishery management council established by the 1976 Magnuson Act, the PFMC manages fisheries off California, Oregon, and Washington via *FMPs* for salmon, groundfish, coastal

Information Sources	Description
	pelagic species, and highly migratory species, and participates in international fishery management organizations for many of these species. The PFMC website is a *repository* for the FMPs, supporting *environmental (including socioeconomic) assessment documents*, and *written and oral public comment*, which altogether provide *descriptions of the human (social, cultural, economic) environment* of federally managed fisheries and associated fishing communities. *Staff, council members, advisory panel members,* and *other affiliates* variously have extensive knowledge, experience, and perspective on the human as well as the ecological systems associated with these fisheries.
Pacific States Marine Fisheries Commission (PSMFC) *www.psmfc.org*	An interstate compact agency with members from California, Oregon, Washington, Idaho, and Alaska, PSMFC's mission is "to promote the better utilization of fisheries," by coordinating research, monitoring fishing, and facilitating a range of projects, including the collection and management of *data on fish and fisheries* and *interstate fishery management discussions*. PSMFC manages several data programs including: 1) *EFIN*, a repository of survey instruments (used in the past), reports, and data sets useful for *monitoring and measuring economic performance* of West Coast fisheries, and a bibliography (not updated recently) of research addressing the *social, cultural and economic aspects of fisheries, fishing communities and management*; 2) *RecFIN*, a regional program that integrates state and federal marine recreational fishery sampling efforts, providing *biological and some social and economic data*; and 3) *PacFIN*, a regional commercial fisheries data network based on state data sources (e.g., *CA fish tickets*). (PSMFC is developing a c*lassification scheme for West Coast commercial fishing vessels and processors* (e.g., by homeport, current and historical participation by species, vessel features, permit ownership, and/or geographical range of landings).) PSMFC also maintains an *archive of interstate fishery coordination efforts* (e.g., the *Tri-State Commission for Dungeness crab*), and coordinates at-sea observers and dockside samplers for state and federal agencies. *Staff, Commissioners, and contractors* (e.g., observers) variously have knowledge and experience related to the human dimensions of fisheries.
Sea Grant College Program (National (NSG), University of California (CSG), University of Southern California (USCSG) *seagrant.noaa.gov* *caseagrant.ucsd.edu* *dornsife.usc.edu/uscseagrant*	The National Sea Grant (NSG) College program is a network of 33 university-based programs in US coastal states and territories, the *NSG Law Center* and the *NSG Library*, that supports research, education and outreach to address coastal and marine information needs. Its *Social Science Community of Practice* has diverse coastal and marine expertise, and has produced a *Directory of North American Social Scientists*. As part of NOAA's Office of Oceanic and Atmospheric Research (OAR), NSG -- along with NOAA's Climate Program Office, and the Office of Weather and Air Quality -- coordinates the larger *NOAA Social Science Network webinar series* and is developing NOAA *Social Science Learning Series*. *California Sea Grant* and *USC Sea Grant* sponsor *applied coastal and marine research* and have *Extension Specialists,* based in coastal communities whose work variously

Information Sources	Description
	addresses the biophysical and human dimensions of fisheries and their management, interactions with other uses and interests, and other topics.
Tribal governments	Tribal governments have *fisheries/natural resource management, social and cultural programs*, and personnel as well as tribal members with knowledge, experience, and expertise related to the range of socioeconomic EFI related to *commercial, recreational and subsistence fisheries*, across contexts. Some of this information is available on the web and in documents produced by *Tribal members, staff, and tribal and non-tribal researchers*. Tribal entities' sovereignty requires a distinct approach to information collection as well as use, with engagement related to fishery management and other purposes guided by consultation agreements between those entities and government agencies.
US Environmental Protection Agency (EPA) *www.epa.gov*	The primary federal agency for protecting human health and the environment, the US Environmental Protection Agency (EPA) reviews and comments on *federal FMPs and Amendments* (among other major Federal actions) that significantly affect the quality of the human environment. The US EPA also conducts *research; archives and disseminates reports, journal articles, presentations and other materials* (in its *Science Inventory and National Service Center for Environmental Publications*) and with information about the human environment; and provides *methods, tools, and databases* to support related research efforts. The *Enviro-Atlas* is a web-based mapping system for interactive analysis of *spatial data on environmental conditions, human health statistics, socioeconomics of communities, and basic information about ecosystem goods and services*. The *Sustainable and Healthy Communities research program* is designed to develop research and tools to expand community capabilities to consider the s*ocial, economic, and environmental impacts of decision alternatives on community well-being* and provide associated research and technical support.
US Bureau of Economic Analysis (BEA) *www.bea.gov*	The US Bureau of Economic Analysis (BEA) collects data, conducts research and analysis, develops and implements estimation methodologies, and disseminates statistics related *economic activity*, by region, state, metropolitan area, and county, with a focus on *industries (i.e., sectors of the economy)* and *gross domestic product*. BEA produces *income and product statistics* for regional geographies, including NOAA-defined coastal areas, and for *Regional Input-Output Modeling System (RIMS II)*.
US Bureau of Ocean Energy Management (BOEM) *www.boem.gov* *www.boem.gov/pacific-region*	The US Bureau of Ocean Energy Management's (BOEM) *Pacific Outer Continental Shelf (OCS) Region* is responsible for managing the development of conventional (oil and natural gas) and renewable energy resources (wind and wave) and mineral resources on the offshore California, Oregon, Washington and Hawaii. BOEM produces and provides information needed to predict, assess and manage *effects from offshore energy and marine mineral exploration*, d*evelopment and production activities* on human, marine and coastal environments, develops *NEPA documents* for *OCS energy and alternate use projects*, and partners with federal and state agencies on information-building efforts such as 1) the

Information Sources	Description
	Marine Cadastre, with *NOAA,* a *repository for spatial data* including human uses of the coast and ocean, and 2) the *Offshore Renewable Wind Energy Gateway*, with the *California Energy Commission*, to assemble *geospatial information* on *ocean wind resources, ecological and natural resources*, and *ocean commercial and recreational uses*. *Pacific OCS staff* are knowledgeable, for example, of aspects of California fisheries and their interactions with other uses, and coastal infrastructure and other relevant topics.
US Census Bureau *www.census.gov*	As the federal government's largest statistical agency, collects and provides *facts and figures about America's people, places, and economy* through several programs. Censuses include the *decennial census, the economic census, and the census of governments*. Bureau surveys include the *American Community Survey (ACS)*, economic surveys conducted at regular intervals for selected sectors to supplement the *Economic Census*; and sponsored *demographic and economic surveys* conducted for other government agencies. The ACS collects information annually on *demographics (e.g., age, sex, race, ethnicity), social and economic characteristics (e.g., language spoken at home, educational attainment, employment), and housing*, with results summarized as 1-, 3- and 5-year averages, and at the place, city and state level. Data have been used, for example, to create *indices of personal disruption, population composition, and community poverty for risk and vulnerability studies, and social assessments*. *American FactFinder* is an online tool that can be used to search for *data on a variety of population, economic, geographic,* and *housing measures* generated from the Bureau's various data collection efforts. *County Business Patterns (CBP)* is an annual data series that provides e*conomic data by industry (with some exceptions) for businesses with paid employees* within the US and its territories, at the national, state, county, metropolitan area, zip code, and Congressional District levels. The *Nonemployer Statistics (NES)* is an annual data series that provides *economic data for businesses that have no paid employees* -- mostly self-employed individuals operating unincorporated businesses or "sole proprietorships," as is the case with many commercial fishing operations. The *data include the number of businesses and total receipts by industry*, at the national, state, county, metropolitan statistical area, and combined statistical area geography levels.
US Coast Guard (USCG) *www.uscg.mil* *www.uscgboating.org/statistics/index.php*	The US Coast Guard's (USCG) responsibilities include maritime safety, search and rescue, law enforcement; port and waterway security; and ocean and marine life protection. It *investigates maritime accidents, licenses mariners, documents US flagged vessels, implements safety programs, and maintains statistics and generates reports related to these efforts*. USCG's 11th District, encompassing California, Arizona, Nevada and Utah, has multiple units located at ports along the California coast. The *volunteer Coast Guard Auxiliary* focuses on *boating safety*, providing recreational boat inspections and teaching life jacket safety. *USCG personnel and Auxiliary members* are knowledgeable about commercial and recreational fisheries as they relate to their respective

Information Sources	Description
	functions.
US Department of Labor *www.dol.gov*	The US Department of Labor (DOL) is responsible for occupational safety, wage and hour standards, unemployment insurance benefits, reemployment services, and some economic statistics. DOL's Bureau of Labor Statistics (BLS) is the federal agency with primary responsibility for collecting and analyzing data related to *labor economics*, including *prices, employment and unemployment, compensation and working conditions, labor productivity, work-related injury and fatality information*. *BLS's Western Information Office* website provides direct access to *data summaries and reports on these topics* for California and by metropolitan statistical area.
Aquatic Sciences and Fisheries Abstracts (ASFA) *proquest.libguides.com/asfa*	Maintained by the United Nations Food and Agriculture Organization, ASFA is searchable abstracting and indexing service (database) for literature (popular, grey, refereed) on the science, technology, management, and conservation of marine, brackish water, and freshwater resources and environments, including their *socio-economic* and *legal aspects*."
Journals with relevant content	Many journals commonly publish articles with relevant fisheries, coastal and marine social science content including: CalCOFI Reports, Coastal Management, Fish and Game Bulletin (CDFW), Fish and Fisheries, Fishery Bulletin (NOAA), Fisheries Magazine, Human Ecology, Human Organization, Marine Policy, North American Journal of Fisheries Management, Ocean and Coastal Management, PLoS, and Society & Natural Resources.
Place- and interest-based organizations	Place- and interest-based organizations outside of government such as *community, conservation, fishing, and trade groups* may sponsor or participate in relevant research, generating reports and/or educational materials, and include individuals with relevant knowledge.
People	Individuals directly involved in or otherwise associated with *fisheries, associated support businesses, ports and harbors, and organizations* as well as *local, state and federal agency personnel* have knowledge and experience related to fisheries, shoreside infrastructure and support, and associated communities.
Popular/social media	Popular media provide information and insight into a range of socioeconomic EFI. Examples of such sources include local newspapers (including fishery-specific columns), radio and television news and special interest programs, trade/hobby magazines such as Pacific Fishing, National Fisherman, and Sport Fishing Magazine, websites sites such as FishingNetwork.net, commercial and recreational fishing association sites and blogs, and others that can be identified by agency staff, fishery participants, and community members.

Information Sources	Description
Social science researchers	Applied social scientists in academia, government, and the private sector (e.g., consultants, NGO staff) use one or more methodologies to collect, synthesize and analyze primary and/or secondary, qualitative and/or quantitative data to help identify problems and opportunities, describe and explain baseline conditions, patterns and trends, and identify potential impacts and outcomes of changing environmental, regulatory, and socioeconomic conditions for individuals, groups or sectors, and fisheries systems as a whole.

The following is a selection of documents and websites with information about and guidance for using applied social science research methods and tools with particular relevance to natural resource management.

Babbie, E. 2016. *Practice of Social Research*. 14th ed. Boston, MA: Cengage Learning.

Provides a comprehensive, straightforward introduction to the field of research as practiced by social scientists with an emphasis on the research process, including design and construction of projects, various primary data collection approaches (including online surveys), and guidance for analyzing both qualitative and quantitative data.

Beebe, J. 2014. *Rapid Qualitative Inquiry: A Field Guide to Team-Based Assessment*. 2nd. ed. Lanham, MD: Rowman & Littlefield.

Provides guidance for conducting Rapid Qualitative Inquiry (RQI), a team-based, applied research method designed to quickly develop perspective on and preliminary understanding of complicated "on-the-ground" situations. RQI includes the use of iterative data collection, data analysis, and additional data collection; triangulation of data from multiple sources; and applies techniques and concepts from ethnography and case study research. Examples demonstrate that "rigorous RQI depends on flexibility rather than an arbitrary list of techniques," highlighting its benefits and potential pitfalls.

Conservation Strategy Fund (CSF). 2015. Economics Guidance Document. Prepared for the California Department of Fish and Wildlife: 6p.

Developed for CDFW, provides a concise overview of methods commonly used for economic valuation and assessment of fisheries and other natural resource systems.

Miles, M.B., A.M. Huberman, and J. Saldaña. 2014. *Qualitative Data Analysis: A Methods Sourcebook*. 3rd ed. Thousand Oaks, CA: SAGE Publications, Inc.

Provides a concise and practical guide to the fundamentals of qualitative research design and data management; five distinct methods of analysis: exploring, describing, ordering, explaining, and predicting, illustrated using examples from the authors' research; and key guidance on relevant to application of results in chapters "Drawing and Verifying Conclusions" and "Writing About Qualitative Research." Note: fourth edition to be published in January 2019.

NOAA Office for Coastal Management. *Digital Coast*. https://coast.noaa.gov/digitalcoast/.

Developed to meet the needs of the coastal management community, provides coastal data from multiple sources, along with tools, training, and information to facilitate its use.

NOAA Performance Risk and Social Science Office. *Social Science Basics*. http://training.weather.gov/nwstc/socialscience/presentation_html5.html.

An online social science mini course deveoped for NOAA staff but accessible and applicable to others, this 35-minute video provides an overview of social science disciplines and applications as relavant to

NOAA functions including fishery management. The course inludes three lessons: 1) Social Science Basics, 2) Exploring the Research, and 3) Working With Social Scientists.

Oregon Department of Fish and Wildlife (ODFW) Marine Reserves Program. *Human Dimensions Research*. http://oregonmarinereserves.com/science/human-dimensions/.

Provides information about ODFW's Human Dimensions Research Program, established as part of the agency's Oregon Marine Reserves Program, including research foci, guiding questions, partners, and research categories, complemented by a resource library (http://oregonmarinereserves.com/library/) which includes documentation of completed and ongoing agency and contracted human dimensions research on fisheries and non-consumptive uses, shoreside support and associated communities.

US Fish and Wildlife Service. *US Fish and Wildlife Service Human Dimensions Resource Portal*. https://my.usgs.gov/hd/.

An interactive informational website and a portal of interagency, academic, and non-government resources focused on the human dimensions of natural resources, providing links to online information including methods, tools, publications, trainings and events.

Yin, R.K. 2016. *Case Study Research: Design and Methods*. 5th ed. Los Angeles, CA: Sage Publications.

Provides a practical guide to the design and use of the case study method as a valid research tool, including and analysis techniques, with case study examples, tutorials at the end of relevant chapters, coverage of values and ethics, and discussion of logic models.