PARTNERSHIPS IN FISHERIES MANAGEMENT:
AN EXPLORATION OF IDEAS FOR ENHANCING CAPACITY AND RESOURCES IN CALIFORNIA FISHERIES

OVERVIEW

California is embarking on a 2-year process to update the Marine Life Management Act (MLMA) Master Plan for Fisheries, which will guide how fisheries are managed in the state for years to come. This report is intended to be a springboard for discussion with the California Department of Fish and Wildlife (CDFW) and others regarding the potential role of partnerships to enhance management and how best to document these opportunities in the Master Plan. These management activites include promoting climate ready fisheries, performing data-limited assessments, experimentation on the water, conducting risk analyses, and implementing new forms of adaptive management under the MLMA. The report also seeks to acknowledge and identify the varying levels of capacity and durability that stakeholder organizations must possess in order to effectively partner with CDFW on certain tasks. The Nature Conservancy (the Conservancy) hopes to work closely with CDFW to better describe both the benefits and pre-conditions of partnerships, and to develop a set of considerations and recommendations that may help inform the Master Plan and its implementation.

The report begins with an introduction to the policy setting and the opportunities for partnerships identified within the MLMA. A general discussion follows of types of fishery partnerships, what makes them successful, and how different models of fishery partnerships could apply to California fisheries management. The remainder of the document is organized around the primary tasks related to fisheries management including: Prioritization of Management Efforts, Fishery Specific Planning, Research and Monitoring, Assessment, Decision Rules, and Compliance and Enforcement. For each management task, the report provides an overview, a description of the current status and limitations, potential opportunities for partnership-based solutions and an evaluation of the organizational needs for partners to engage in that particular management task. Finally, the appendix provides case study examples and lessons learned from existing partnerships in California.

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GLOSSARY OF TERMS

Term	Description
CDFW	California Department of Fish and Wildlife
CCFRP	California Collaborative Fisheries Research Program
CEQA	California Environmental Quality Act
COS	Center for Ocean Solutions
CSUC	California Sea Urchin Commission
CWF	California Wildlife Foundation
DCTF	California Dungeness Crab Task Force
DHAC	Department's Herring Advisory Committee
EFI	Essential Fishery Information
EFG	Essential Fish Habitat
ERA	Ecological Risk Assessment
FGC	California Fish and Game Commission
FMP	Fisheries Management Plan
LAC	Lobster Advisory Committee
NEPA	National Environmental Policy Act
MLMA	Marine Life Management Act
MLPA	Marine Life Protection Act
MOU	Memorandum of Understanding
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
NGO	Non-Governmental Organization
OPC	California Ocean Protection Council
OST	California Ocean Science Trust
RCCA	Reef Check California
RCA	Rockfish Conservation Area
SAFE	Stock Assessment and Fishery Evaluation
PSA	Productivity and Susceptibility Analysis
TAC	Total Allowable Catch

INTRODUCTION

Stretching 1,100 miles from the Oregon border south to the border of Mexico, California's coastal waters support thriving wild capture fishing industries responsible for supplying seafood to millions worldwide. Valued at over $130 million dollars in 2015 (CDFW 2016), each year California fisheries provide more than 130,000 jobs in harvesting, processing, distribution, and accessory sectors (NOAA 2016). For over a century, local fishermen have shaped California's rich cultural identity rooted in coastal communities that depend on the vibrancy and vitality of working ports and harbors.

California is a world leader in the conservation and management of our ocean ecosystems. Forward-thinking legislation such as the Marine Life Management Act (MLMA) and the Marine Life Protection Act (MLPA) have transformed ocean governance in the state and informed the creation of similar policies by governments throughout the world (Gamer et al. 2014; Voyer et al. 2015). These progressive policies are leading resource managers and decisions makers to consider new, innovative approaches to fisheries management, such as the consideration and integration of socioeconomic priorities and local ecological knowledge, and exploring opportunities to redefine stakeholder roles in decision-making processes.

Rules and regulations for the many of the state's commercial and recreational fisheries are established by the Fish and Game Commission and carried out and enforced by CDFW. Within CDFW, the Marine Region is responsible for overseeing the management of marine resources within state waters. In addition to fisheries management responsibilities, Marine Region staff are also tasked with managing a statewide network of marine protected areas (MPAs), leading environmental review processes (e.g., California Environmental Quality Act (CEQA), overseeing aquaculture initiatives, as well as interfacing with other relevant agencies to coordinate management of joint state-federally managed fisheries (e.g., Pacific Fishery Management Council and the National Marine Fisheries Service). The management responsibilities of CDFW are extensive and unfortunately are not matched with enough staffing capacity and financial resources. The pressure placed on CDFW staff to fulfill all fisheries management requirements limits the potential for managers to manage proactively.

The following list highlights several ecological, socioeconomic, and managerial challenges that confront Department staff in the process of managing commercial and recreational fisheries in California.

Ecological Challenges

- Understanding the impacts of coastal and offshore development and land use decisions on nursery grounds and nearshore habitat.
- Understanding the impacts of fishing pressure, bycatch, high grading, habitat destruction, and environmental changes on fish populations, food webs, and ecosystems.
- Understanding and mitigating climate change impacts on fishes and fisheries.

Socioeconomic Challenges

- Consideration of social and economic impacts of management decisions.
- Incorporation of local ecological knowledge and integration of management and enforcement at appropriate spatial and temporal scales that reflects local socio-ecological systems.

- Understanding of supply chain dynamics, contributions of fisheries to local economies, and the cost of different management measures and systems.

Managerial Challenges

- Limited resources available to develop FMPs as defined in statute and interpreted in the Master Plan for Fisheries. Only four FMPs have been approved and implemented creating a limited scope for understanding whether FMP objectives are being met in most fisheries.
- Cumbersome and outdated data capture systems may limit the use of information to make informed decisions in an adaptive manner.
- The need to integrate MLMA and the MLPA to improve data collection and the use of MPAs as a fisheries management tool.
- Limited fisheries independent data available to inform adaptive fisheries management.

In response to these challenges, CDFW leadership is undertaking a significant scoping process to understand how a new structure and funding system may improve management outcomes. Specifically, five key near-term priorities for advancing ocean resource management are being considered within CDFW in 2015-16:

1) Amend the MLMA Master Plan;
2) Identify and fill existing knowledge gaps;
3) Restructure staff and infrastructure to be more responsive to current and future needs;
4) Transition to digital data capture and reporting; and
5) Identify sustainable funding mechanisms.

Successfully meeting these priorities and improving conservation, social, and economic outcomes in California fisheries will require careful examination of how fisheries management tasks are currently being conducted, and how these tasks can be responsibly shared with effective partners.

POLICY SETTING - THE MARINE LIFE MANAGEMENT ACT

Enacted in 1999, the Marine Life Management Act directs the California Department of Fish and Wildlife (CDFW) to sustainably manage California's coastal fishery resources and ocean ecosystems. The MLMA seeks "to ensure the conservation, sustainable use, and, where feasible, restoration of California's marine living resources for the benefit of all the citizens of the state." Specifically, the MLMA includes nine primary management directives (MLMA 7050b):

1. Conserve the health and diversity of marine ecosystems and resources
2. Encourage only sustainable marine activities
3. Recognition of non-extractive uses of California oceans
4. Recognition of importance to the state of sustainable commercial fisheries and aquaculture and recreational fisheries
5. Support scientific research to improve management decisions
6. Manage marine living resources using the best available science

7. Involve all stakeholders in management decisions, including individuals from commercial and recreational fisheries, aquaculture industries, tourism and recreation industries, scientists, conservation organizations, local governments, and the public
8. Distribute best available information regarding resource management to the public.
9. Coordinate with adjacent states, Mexico, and Canada, and encouragement of regional approaches to management, especially for shared fisheries

The MLMA places significant emphasis on the role of expert and stakeholder involvement in achieving these objectives. This is reflected in the sections described below:

LEGISLATIVE INTENT

7050(b) - The objective of this policy shall be to accomplish all of the following: Involve all interested parties, including, but not limited to, individuals from the sport and commercial fishing industries, aquaculture industries, coastal and ocean tourism and recreation industries, marine conservation organizations, local governments, marine scientists, and the public in marine living resource management decisions.

7059(a) - The Legislature finds and declares all of the following:

1) Successful marine life and fishery management is a collaborative process that requires a high degree of ongoing communication and participation of all those involved in the management process, particularly the Commission, the Department, and those who represent the people and resources that will be most affected by fishery management decisions, especially fishery participants and other interested parties.
2) In order to maximize the marine science expertise applied to the complex issues of marine life and fishery management, the Commission and the Department are encouraged to continue to find creative new ways to, contract with or otherwise effectively involve Sea Grant staff, marine scientists, economists, collaborative fact finding process and dispute resolution specialists, and others with the necessary expertise at colleges, universities, private institutions, and other agencies.
3) The benefits of the collaborative process required by this section apply to most marine life and fishery management activities including, but not limited to, the development and implementation of research plans, marine managed area plans, fishery management plans, and plan amendments, and the preparation of fishery status reports such as those required by Section 7065.

LEGISLATIVE DIRECTION

7059(b) In order to fulfill the intent of subdivision (a), the Commission and the Department shall do all of the following:

1) Develop a process for the involvement of interested parties and for fact finding and dispute resolution processes appropriate to each element in the marine life and fishery management process. Models to consider include, but are not limited to, the take reduction teams authorized under the Marine Mammal Protection Act (16 U.S.C. Sec. 1361 et seq.) and the processes that led to improved management in the California herring, sea urchin, prawn, angel shark, and white seabass fisheries.
2) Consider the appropriateness of various forms of fisheries co-management, which involves close cooperation between the Department and fishery participants, when

developing and implementing fishery management plans.

3) When involving fishery participants in the management process, give particular consideration to the gear used, involvement of sport or commercial sectors or both sectors, and the areas of the coast where the fishery is conducted in order to ensure adequate involvement.

The Act also includes specific direction regarding stakeholder involvement and partnerships with regards to funding (7090(f)), peer review (7059(b)), Master Plan development (7073(a)), FMP development (7075(b)(d), the generation of Annual Reports (7065(a)), and research (7060)(a)). For a complete inventory of partnership related provisions, please see Appendix 7.

WHAT IS A FISHERY PARTNERSHIP?

Within the United States, co-management is typically used to define agreements among indigenous people and state or federal agencies for resolving or managing natural resource conflicts (Castro & Nielsen 2001). Being mindful of this formal aspect, the term "fisheries partnerships" is introduced in this report in an effort to ease the level of formality and increase the degree of flexibility with which CDFW can engage in partnership arrangements (e.g., Pinkerton 2009).

The concept of co-management has evolved from power-sharing arrangements between the state and a community of resource users (e.g. Pomeroy & Berkes 1997) to supporting networks and governance systems including task-oriented, problem-solving processes. In practice, partnerships between agencies, Tribes, communities, NGOs, funders, and others span a broad continuum and differ in how responsibility and authority are shared). Regardless of the exact governance arrangement, the principles of partnerships typically infer that some management or governance tasks—research and monitoring, regulatory scoping, decision-making, enforcement and surveillance, and conflict resolution—are shared with non-government actors.

Where a particular fisheries partnership falls on this continuum depends on numerous features, particularly the complexity of the task to be addressed and the capacity of the partnering entities. On the low end of this continuum, individual fishermen might participate in a one-time stakeholder engagement process, which requires minimal investment and commitment. The opposite end of this continuum includes formal partnerships where multiple entities enter an agreement for sustained collaboration towards a shared management goal. Between these two extremes lie numerous opportunities for partnerships with varying formality, investment, and duration. Key to forming a successful partnership is understanding the capacity of partnering individuals or entities to fulfill what is expected of them. The subsequent sections of this document address specific tasks that CDFW engages in as part of management. These tasks are generally ordered by the degree of capacity and durability required on the part of stakeholders in order to effectively engage in partnerships on. See Figure 1.

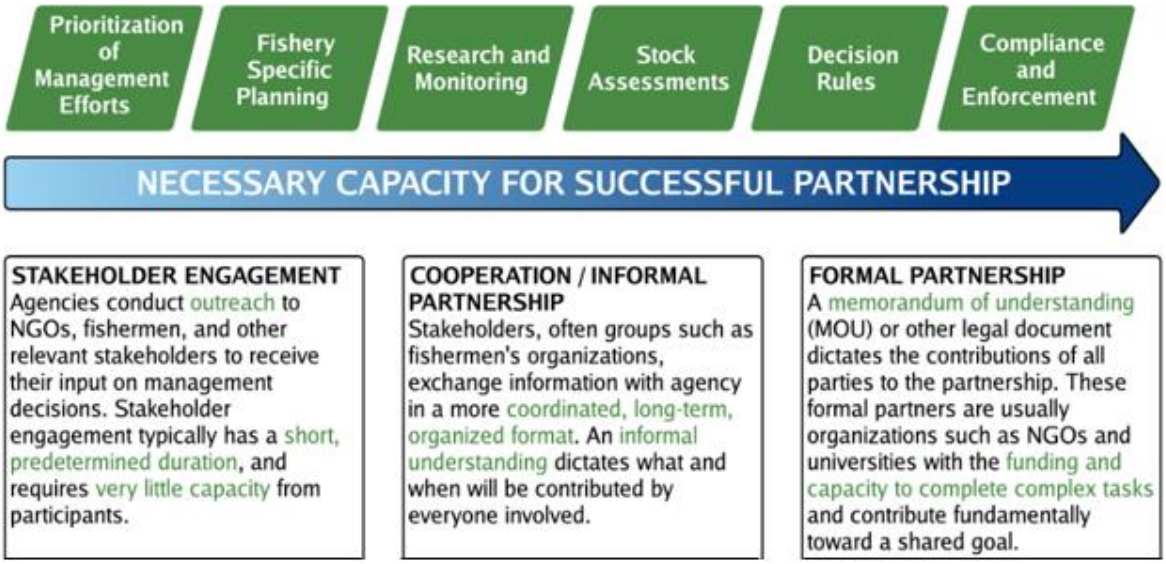

Figure 1. A spectrum of partnership-based approaches. The management tasks and types of partnerships are arranged along this continuum in terms of how much organizational capacity, funding and durability is required for successful partnerships to help meet management objectives or tasks.

All partnerships require investment. In considering new partnership opportunities to improve fisheries management, CDFW will need to evaluate whether a proposed partnership is worthwhile. The investment of funds, staff time, and other resources must be weighed against the benefits that will be realized from the partnership under consideration. As detailed in the management task sections, some management activities likely lend themselves to beneficial partnerships more than others. Nevertheless, well-conceived fisheries partnerships can enhance CDFW's ability to fulfill its mission, rather than simply burden it with additional responsibilities.

Benefits of Partnerships

When designed effectively and thoughtfully, partnerships are a powerful tool to support short and long-term management and conservation goals, as well as strengthen the scope and integrity of data used to inform management decisions. Empowering fishermen, local community members, and nonprofit organizations to become active partners in management can help tailor regulations and decisions to reflect current fishing practices and realistic on-the-water conditions. Fishermen's knowledge and expertise can provide additional context to data poor fisheries, which might otherwise be managed on a precautionary basis and lead to setting lower than necessary harvest levels, closing areas, and shortening seasons. When fishermen are empowered with scientific tools, entrusted with responsibility and made partners in decision-making processes (e.g. White Seabass Scientific and Constituent Advisory Panel), they have more of an incentive to organize, support research efforts, and collaborate with resource managers to build a more comprehensive understanding of the true stock status and adjust management strategies accordingly. Fishermen that possess an understanding of the rationale and legitimacy for certain decisions typically operate more responsible fishing practices and exhibit better compliance (McCay & Jentoft 1996; Nielsen 2003); particularly when restrictions align with users' beliefs and understanding (Singleton 2000).

In the face of increasingly variable ocean conditions, partnerships provide an effective mechanism to promote ecological and social resilience. Fisheries management systems that rely on cooperative approaches and partnerships are often better equipped to address environmental change when compared with conventional, top-down approaches (McClenachan et al. 2015). Resource users and harvesters, such as fishermen, are often first to notice changes in the environment (Dietz et al. 2003). When enabling conditions such as institutional arrangements, infrastructure and decision-making processes allow for such information to be used in management, improved conservation and fisheries outcomes are possible. Furthermore, effective climate change adaptation in marine fisheries demands improved knowledge of future ecosystem states, skills which state agencies themselves often lack. Developing collaborative partnerships with university researchers provides the opportunity to integrate best-available climate science directly into fisheries management decisions.

While the involvement of fishermen and community leaders as partners can require an investment of resources to support high start-up costs (Nielsen & Vedsmand 1997; Coglan & Pascoe 2015), the long-term investment in building support and cultivating stewardship offers ecological, economic, and social benefits, as well as direct benefits to fisheries managers. Examples are provided below of the ecological, economic, and social benefits realized through fisheries partnerships, shedding light on the potential benefits that California and CDFW could realize if they were to engage in increased fisheries partnerships.

Ecological Benefits

Potential ecological benefits that result from fisheries partnerships include:

- Maintain sustainable stock levels that are represented by long-term increases in abundance and stock health (Gutiérrez et al. 2011; Defeo et al. 2014).
- Improved conservation of sensitive habitats, nursery grounds and spawning grounds (Pinkerton 2009).

Economic Benefits

Economic benefits from fisheries partnerships seen in other cases include:

- Decreased cost of management for government agencies, especially in high value fisheries (Coglan & Pascoe 2015).
- Increased or maintained revenue streams through stabilized landings, and prevention of fishery collapse by ensuring assessments and harvest levels reflect actual stock sizes (Gutiérrez et al. 2011).

Social Benefits

Social benefits demonstrated in fisheries partnership cases include:

- Improved economic justice, political freedom, and cultural identity (Gutierrez et al. 2011).
- Increased community empowerment (Gutiérrez et al. 2011) and a more democratic and participatory system where the interests of government, fishermen, and community members become better aligned.

Benefits to Fisheries Management Agencies

Potential benefits to fisheries management agencies through fisheries partnerships include:

- Increased support for cost and task sharing opportunities (Pinkerton 1994; Pinkerton 2009) creating the potential for more efficient and productive management.
- Support and buy in for fisheries management regulations and policies leading to enhanced compliance and better working relationships with industry.

WHAT MAKES PARTNERSHIPS SUCCEED?

Lessons learned in California and elsewhere, some of which are detailed in this document's case studies (Appendix); provide some guidance and best practices for forming successful partnerships. The following elements are crucial to realize the potential of partnerships to contribute to fisheries management in California:

- The need for durable and lasting fisheries organizations and strong fishing leadership;
- The important role of change agents;
- Access to consistent funding by stakeholder organizations;
- Multi-directional generation and exchange of knowledge/information;
- Presence of strong top down governance and management regulations;
- Ability to build trust and social capital; and
- The degree to which management decisions are decided upon in an open and transparent process.

Fisheries Organizations and Fishing Leadership

Fisheries organizations, from legislatively mandated arrangements to volunteer associations, can differ in their motivation and capacity depending, in great part, on the size and scope of the fleet. Typically, high valued fisheries with complex regulations tend to be better organized and have identifiable leadership that plays a direct role in informing and/or overseeing management decisions (see Case Studies). Typically, those organizations that have a formal legal structure offer more secure partnerships with agencies like CDFW.

Fishery organizations that do not have a legal structure will only be successful in the long-term if they are designed to be durable, resilient, and flexible. However more often than not, fishermen lack the motivation and/or professional experience required to successfully carry out complex organizational activities (Pomeroy et al. 2001; Berkes 2009; Gutierrez et al. 2011). A study evaluating the effectiveness of Danish fisheries organizations identified a common need for fisheries organizations to be proficient in finance, administration, strategic planning, communications, conflict resolution and negotiation, and relationship building skills (Nielsen & Vadsmand 1997). Equally as important is building the necessary skills and expertise within natural resource managers and decision makers to effectively collaborate with fisheries organizations (Schusler et al. 2003). There is an ever- growing need to match the needs of management with the skills of agency staff such as the hiring of social scientists, economists, anthropologists, planners, and communications experts with extensive experience in fisheries management issues.

Change Agents

Through their role as intermediaries, external change agents or "bridging organizations" can help empower fishermen, scientists, resource managers, and decision makers to enhance their capabilities and functionality, and available resources (Pomeroy et al. 2001). Change agents can provide resources and expertise in plan development, brainstorming, problem solving, information gathering and sharing, and participatory facilitation and communication (Pomeroy et al. 2001). Change agents are often nonprofit organizations, academic and research institutions, or development agencies that rarely play a role in decision-making. Rather, they are objective and seek to expedite the partnership process by setting in place a process of discovery and social learning (Pomeroy et al. 2001; Romina 2014). External change agents' connection with local communities, their ability to focus on community objectives, and linkages with donors and other supportive organizations are factors that favor their catalytic role (Pomeroy et al. 2001).

Consistent Funding

Partnerships take time to become established and can take years to evolve into a process that can support collaborative decision-making. Consistent funding sources for fishery organizations and agencies contribute to the success of partnerships, providing the security for both resource managers and fishermen to invest time and resources in establishing relationships, identifying common goals, implementing collaborative efforts, and evolving from lessons learned.

Typically, there is infrastructure established to support fisheries partnerships that evolve beyond initial start-up funds and grow to diversify their funding portfolio. Fundraising and project management skills, good financial judgment, and political savvy increase a partnership's likelihood of long-term viability and success. For example, partnerships involving researchers and/or nonprofit organizations skilled in grant writing and aware of funding cycles can play important roles in the long-term sustainability of a partnership. Additionally, these entities may have mechanisms in place to receive funding from various sources (e.g., 501(c)(3) status). Roles and responsibilities of those charged with developing and implementing strategies to acquire partnership funding should be fully outlined to ensure everyone involved in the partnership is operating within the same expectations.

Knowledge Generation and Information Exchange

Generating and/or sharing information between fishermen, resource managers, decision-makers, nonprofit organizations, and others can take many forms. Informal, one-on-one conversations between fishermen and resource managers can be used to address clarifying questions or to share information about what fishermen are experiencing on the water. Agency staff may use surveys to poll fisheries lacking in fisheries independent data, and researchers may request fishermen to interpret fisheries dependent data.

Involving fishermen in the gathering, interpretation, and reporting of fisheries management data is considered a gateway or "entry point" to more comprehensive forms of collaborative management (Trimble & Berkes 2013). Fishermen involved in these projects typically see value in their participation in a collaborative research team, and see their involvement as direct recognition by resource managers and academic scientists of the quality and importance fishermen's input has in shaping research questions and designing surveys (Pinkerton 2009). Involving fishermen from the "ground up" helps build trust in the scientific process, credibility in the results, and creates an atmosphere where fishermen play a role in championing the research project within their fishery, ports, and communities (Pinkerton 2009). The exchange of

ideas and information can be equally as valuable to scientists and resource managers involved in the partnership, who gain increased experiential knowledge and the benefits of local knowledge (Hovel et al. 2015). Constructive and collaborative exchanges of information also extend to non-fishing partnership types, such as agreements between agencies and citizen science programs.

Anticipated Changes in Management Regulations

Resource managers, agency staff, decision makers, and funders are increasingly interested in understanding the motivations for the continued participation and mobilization of fisheries partnerships. Anticipated changes in management regulations can act as a catalyst to activating—or reenergizing—fisheries partnerships.

Establishing Trust and Developing Social Capital

Trust is an essential building block to successful fisheries partnerships and efficient fisheries management. Investment in relationship building and establishing confidence across partnership participants should be considered and integrated. Solid and long-lasting relationships can also act as an incentive to maintain on-going collaborative efforts

While defined broadly in the literature, the core concept of social capital is "interactions among individuals" with the inherent goal to strengthen social interactions in and between groups concerned with a given issue Wiber et al. (2009) defines social capital as a process (instead of a fixed fund) that must be nurtured through co-learning. Robust social capital protects against changes in institutional arrangements, economic crises and resource over-exploitation, and fosters sustainable partnerships. However, building trust and social capital can be a challenging and frustrating process.

Agencies are often puzzled and frustrated when they extend invitations to fishermen and others to participate in advisory bodies and councils to inform management measures, only to find there is minimal support for the outcomes or recommendations. To address this issue, Berkes (2009) suggests that time spent involving fishermen in agency decision-making should be equal to (or even less than) efforts the agency makes to meet fishermen "where they are" (e.g., resource managers spending time on the water with fishermen, attending port association meetings, etc.)

Fisheries Partnerships in California

California is already actively engaged in fishery partnerships across federal, state and local agencies, Tribes, nonprofits, universities, and fisheries organizations. State agencies, such as the OPC and state- authorized nonprofits, such as the OST, expand opportunities for ocean science research, education, and outreach by adding capacity to CDFW and fisheries managers. California is also home to several of the world's top research institutions that actively advance the state of ocean ecosystem knowledge. Throughout the state, commercial and recreational fishing groups, processors, buyers, and individuals work in partnership with state and non-governmental institutions to improve management outcomes and economic opportunities for coastal and fishing dependent communities. This strong, established foundation of working partnerships lends itself easily, to formally integrating a partnership-based approach to enhance management of state fisheries.

We highlight several existing fisheries partnerships within this document. The appendices contain four California case studies that demonstrate both best practices and lessons learned from past experiences in fisheries partnerships (see Appendix). These case studies include:

Case Study 1: California Sea Urchin Commission (for more detail see Appendix 5)

The red sea urchin fishery is California's sixth largest by value, comprising approximately 300 permits. The California Sea Urchin Commission (CSUC) was established through the California Department of Food and Agriculture to support sustainable fishing of sea urchin and build new local and international markets. Fisheries managers look to the CSUC to guide development of the fishery's management goals. The CSUC provides an example of how industry can take a leadership role in developing management decisions and working collaboratively with CDFW by streamlining the fishery's voice.

Case Study 2: Pacific Herring Fishery (for more detail see Appendix 2)

The California Pacific Herring Fishery is managed by the Commission, and informed by recommendations from CDFW, the fishing industry, and conservation organizations. Several partnerships support and inform management of the fishery, including a Director's Herring Advisory Committee (DHAC) and a Herring Discussion Group. The DHAC is a 26-member committee of California herring fishermen and buyers that review and make recommendations on fishery rules. The DHAC has been instrumental in supporting the recovery of the San Francisco Bay herring population, in part due to strong internal DHAC leadership. The six-member Herring Discussion Group comprises fishermen, CDFW staff, and staff from the two conservation NGOs and aims to establish a Pacific herring FMP. This partnership provides a model for how partners can reduce management burdens and costs from the state, by leading and securing funding for the FMP development process.

Case Study 3: Reef Check California (for more detail see Appendix 3)

Reef Check California (RCCA), a program of the global Reef Check Foundation, aims to improve California's marine resource management by utilizing citizen scientists to collect nearshore rocky reef data and make it available to resource managers. RCCA works in partnership with CDFW to develop research questions, goals, and sampling protocols to ensure utility of the data to resource managers. This cost-effective partnership is a unique example of how NGOs and government agencies can support each other to fill data gaps and inform marine resource management.

Case Study 4: Dungeness Crab Task Force (for more detail see Appendix 4)

California's Dungeness crab fishery is managed by the California Legislature and constitutes the state's second most valuable fishery. The Dungeness Crab Task Force (DCTF) is an industry-seated advisory body that also includes scientists, NGOs, and fisheries managers. The DCTF was formally created by the California Legislature and provides management recommendations to the California Legislature, CDFW, and the Commission. This partnership demonstrates the ability for stakeholders with diverse and traditionally conflicting viewpoints to build mutual trust, identify common ground, and develop ideas and recommendations that are reflective of cross-interests.

POTENTIAL ROLE OF PARTNERSHIPS IN MANAGEMENT TASKS

In the subsequent sections, we outline six fundamental management tasks and provide descriptions regarding how each of the key management tasks could benefit from fisheries partnerships, the needs and opportunities for applying best practices and lessons learned and an identification of the degree of stakeholder organization capacity, representativeness and durability required to develop effective fishery partnerships (Table 1).

- Representativeness is defined by whether the group represents the broader constituency through democratic or otherwise egalitarian means. A low level of representativeness indicates a few members of the fishery may participate effectively in this activity. A high level of representativeness indicates that in order to successfully partner in a particular management task, a representative constituency is needed.
- Capacity/funding refers to the level of organization of the group and its ability to raise funds for participatory processes. A small group of fishermen may score in the low levels of capacity and funding, whereas a marketing association (e.g. California Sea Urchin Commission) or NGO may score towards the higher end.
- Durability refers to the ability of the group to participate as a lasting partner without concern for erosion of duties and responsibilities over time. A small group of disorganized stakeholders may not be as durable as a NGO or other formally recognized entity or institution.

Table 1. Overview of the needed level of capacity and organization for stakeholder groups to effectively partner with CDFW to accomplish particular management tasks.

Management Task	Representativeness	Capacity/Funding	Durability
Prioritization of Fisheries Management	Medium	Low	Low
Fishery Specific Planning	High	Medium	Low
Research and Monitoring	Low	Low	Low
Stock Assessment	High	High	Medium
Decision Rules	High	Medium	High
Compliance and Enforcement	High	High	High

SECTION 1: PRIORITIZATION OF MANAGEMENT EFFORTS

Effective fisheries management includes both strategic and tactical planning that leads to implementation of priority efforts at multiple scales. Strategic planning takes a longer-term view and broader perspective of fisheries and policy goals, while tactical planning takes a shorter-term view with more specific operational objectives and actions (Cochrane & Garcia, 2009); this section will focus on strategic and tactical planning across fisheries and fishery management issues (fishery-specific planning is discussed in section 2). At the strategic level, it is important for management agencies to prioritize where limited capacity and funds are directed to best support overall fishery management goals. There is an increasing emphasis on managing fisheries in an ecosystem context and with an eye towards adaptability in the face of climate change and other threats. These broader goals have raised the bar for fishery managers to plan and implement management strategies that go above and beyond traditional Maximum Sustainable Yield (MSY)-type outcomes for specific fisheries. In addition to concerns about the state of the resource and the ecosystem context, it is also important to consider socioeconomic concerns and community vulnerability as fisheries change and adapt over time.

As mentioned in the introduction, CDFW has a multitude of responsibilities, but possesses limited capacity to address the many strategic and tactical needs for California's fisheries. Due to cost and capacity constraints, most fisheries in California do not yet have FMPs or formal stock assessments that are regularly updated (see Section 2 for more information). Prioritization approaches that incorporate the expertise and perspectives of stakeholders could help identify the fisheries in most urgent need of management attention. Fishery partnerships could play key roles in both helping to set strategic priorities and in implementing more tactical plans and activities.

The prioritization of fisheries management efforts is conducive to partnerships, because basic stakeholder engagement and public outreach are likely sufficient for achieving the goal of prioritizing management. Prioritization can occur on a one-time or recurring basis, but does not require an ongoing or durable partnership with the same entities. In addition, the "partners" in this case only need minimal capacity to participate (i.e. provide input as needed on prioritization issues).

Current Approach to Management Prioritization and Stakeholder Engagement

The MLMA requires that Annual Status of the Fishery reports are generated for a quarter of all state- managed fisheries each year; these reports identify whether the fishery is meeting the goals of the MLMA and includes information on landings, fishing effort, areas where the fishery occurs, and other factors affecting the fishery as determined by CDFW and the Commission (FGC §7065(b)). The MLMA also states that CDFW shall incorporate the expertise and the perspectives of outside stakeholders and experts (FGC §7065(a)).[1] While this kind of regular assessment is critical for readjusting management priorities to address the most critical needs, there has been limited capacity and no clear framework for how managers can utilize these annual assessments.

Currently, while the existing MLMA Master Plan contemplates a mechanism to involve stakeholders in prioritization, there is no formal mechanism available, besides Commission testimony or lobbying, for fishery partners to help CDFW set strategic priorities across fisheries and among cross-cutting fishery management issues. Within specific fisheries, there are good examples of fishery partnerships where stakeholders help set management and research priorities, such as with the DHAC, the legislatively-mandated DCTF, and the Lobster Advisory Committee (LAC) (see Section 2). However, outside of the development of the original Master Plan there has not been a specific role for the fishing industry and other partners to engage with managers in strategic planning or to support fisheries management as a whole. Additionally, there is no formal process by which partners could commit capacity or funding to support priority management efforts.

Opportunities to Improve Prioritization of Management Efforts through Partnerships

Drawing from the status and limitations described above, this section describes several areas of opportunity for improving the processes for prioritizing fishery management efforts, specifically by incorporating partners into these processes. Throughout the opportunities described below, there may be the opportunity to institute improved prioritization methods by incorporating these methods into the upcoming revision of the MLMA Master Plan. This list of suggestions is not

[1] On the federal side, National Marine Fisheries Service (NMFS) requires that Stock Assessment and Fishery Evaluation (SAFE) reports be prepared and reviewed annually for each fishery management plan to summarize the best available scientific information on the past, present, and future condition of the stocks, marine ecosystems, and fisheries under federal management.

exhaustive, and is intended as a starting point in a broader discussion of integrating partnerships into management prioritization.

Enable Prioritization through a High-Level Fishery Status Dashboard

CDFW could set both strategic and tactical priorities in a more transparent manner by working with partners to develop a framework to assess risk and identify concerns for each fishery on a regular basis. A prioritization process could begin with a regularly updated, publicly available "dashboard" of basic information on resource condition, management status, concerns, research gaps, and socioeconomic context of each fishery. A dashboard could fulfill, at least partially, the need for Annual State of the Fisheries reports; fishery partners could potentially help generate data and information to update and maintain these dashboards. (CDFW is currently engaging in the development of such a dashboard through the MLMA Master Plan for Fisheries amendment process).

Utilize Risk Assessment Frameworks to Identify Management Priorities

When looking across fisheries and prioritizing potential management efforts, there are a variety of risk assessment frameworks that could be used to assess which fisheries are most at risk from fishing pressure, climate change, and other threats and are therefore in most need of management focus (see Text Box 4). A prioritization framework that uses Ecological Risk Assessment (ERA; Hobday et al. 2007) or PSA-type approaches (Patrick et al. 2009) to evaluate the vulnerability of fishery stocks and ecological risk-based approaches that include ecosystem elements (e.g., bycatch and habitat impacts) could be used in the California context in combination to set tactical plans for identifying and engaging in priority management efforts.

The ecosystem protection goals of the MLMA provide a legal framework in which the application of an ERA framework could be used to identify management priorities across fisheries, in an ecosystem context, and in the face of emerging threats such as climate change. Using a quantitative risk-based approach (where all fisheries are evaluated together in a common framework) such as an ERA to set management priorities would help CDFW determine where to invest their limited resources, and where partners could best contribute additional resources to meet management goals. An ERA approach would require clear articulation of management goals, a definition of "risk," and a transparent process and role for partners in implementing the framework (OST 2014). Stakeholders and partners who are actively involved in scoping and implementing an ERA framework will likely have more buy-in for the resulting priority management actions.

While FMPs with formal stock assessments have been the traditional approach to meet the legal requirements of the MLMA, an ERA approach could help ensure that fisheries lacking FMPs or formal stock assessments are still meeting the requirements of the MLMA (OST 2014). An ERA would create a transparent mechanism to prioritize fisheries that warrant a full FMP, a simpler version of a FMP, termed "FMP-lite," or other approaches to assess stock status and develop management measures. Similarly, an ERA approach could provide the mechanism to credit fisheries for the risk reductions provided by the existing network of MPAs, which have been hard to incorporate into fishery management decisions (Wilson et al. 2010; Wilson et al. 2013; OST 2014). With CDFW's support, the OPC recently provided funds to OST to develop a risk assessment framework for California and initial results are expected in the Fall of 2016.

Involve Partners in an Ecological Risk Assessment Prioritization Process

Generally, as outlined by OST, the path toward use of ERA approaches in California identifies stakeholder involvement in each step of the process (OST 2014). However, the potential for a broader role of fishery partnerships, specifically, is less clearly articulated. The revision of the MLMA Master Plan provides an opportunity to lay out a pathway that increases involvement of fishery partnerships in setting and addressing priorities.

In some cases, CDFW's legal and regulatory requirements put them clearly in the driver's seat in setting priorities and implementing actions. However, there may be some types of prioritization that could benefit from a greater participation by fishery partnerships. Fishery partnerships could improve prioritization efforts and promote management efficiency by:

1) being directly involved in supporting, funding, advancing prioritization schemes, such as the implementation of ERAs or other approaches; or
2) taking on a greater role in more basic fishery-specific management efforts such as monitoring, data collection, and research (see Section 2) and thereby freeing up CDFW capacity to focus more on strategic planning and prioritization.

Use Test Cases to Identify Fishery Partnership Roles Based on Level of Risk to the Fishery
Similarly, the outcomes of ERA approaches could be used to identify high risk or low risk fisheries that may frame different potential roles for fishery partnerships. For example, lower risk fisheries that warrant less intensive management focus could potentially be good examples or test cases for fisheries partnerships to take on a larger role in management or to test data-limited stock assessment approaches. Conversely, identification of high risk fisheries that warrant more intensive management engagement could lead to the development of new partnership models whereby industry, NGO, academic and other partners pool resources and capacity to address the critical management needs. An example of this is the California Groundfish Collective, which includes fishing industry and NGO partners who have invested fishing quota and resources into collaborative research on distribution of overfished species. With that information and near-real-time catch monitoring; bycatch relative to the fleet at large has been successfully reduced.

Consider Socioeconomic and Community Vulnerability in High Priority Fisheries
A risk assessment approach could also incorporate socioeconomic and community vulnerability factors, as well as climate change impact factors as additional filters that get applied to all high priority fisheries. Partnerships could help to identify some of those key socioeconomic factors. A risk assessment approach also can be used to identify sources of uncertainty, data gaps, and where new information could best be used to inform priorities. If there are capacity needs at the agency level to address those information gaps, fishery partnerships could step in to collect new information to support a later reassessment of that fishery or issue. Prioritization of collaborative research needs could be addressed across fisheries during a prioritization effort (see Section 3). Formal partnerships with research institutions could help address key research gaps through student projects or contracts.

Stakeholder Organization Required

Capacity: Low
Representativeness: Low
Durability: Low

SECTION 2: FISHERY SPECIFIC PLANNING

While the previous section examined the potential for partnerships to play a larger role in prioritizing fisheries for management actions, this section examines the roles partnerships can play in shaping the management for a specific fishery through a planning process, once that fishery has been identified as a priority for management.

It is also worth noting that there is a separate effort under way lead by Kearns and West and the Center for Ocean Solutions (COS) that is examining stakeholder engagement strategies that are available to the Department for fishery planning purposes. That work will produce a tool-kit that focuses on the form and mechanics of stakeholder engagement that CDFW can use. This section is focused more on the opportunities presented by organized groups of stakeholders and working with CDFW to initiate and advance planning efforts.

Balancing Timely Fishery Management Plan Development with Costs and Stakeholder Involvement

The MLMA states that FMPs shall be the primary means of managing the state's marine fisheries (FGC §7072). In striving for a transparent process for FMP development that incorporates stakeholder input and review, CDFW has taken a thoughtful and stepwise approach to FMP development. This process includes developing an advisory body, supporting public comment, engaging stakeholders in public meetings, addressing comments, and finalizing the FMP. While important for building buy-in for management decisions, this process requires more time and resources.

As discussed to some degree in Sections 1 and 2, the burden for FMP development has fallen exclusively on CDFW, which does not have sufficient capacity to quickly develop a large number of FMPs. In addition, expectations regarding the scope and scale of what a FMP document should look like do not match available resources. For example, the Nearshore Fishery Management Plan cost more than $10 million to develop and was an enormous burden on CDFW staff and budget.

Due to these factors, four FMPs have been adopted (white seabass, market squid, lobster, and nearshore finfish) since the implementation of the MLMA and all three were mandated by statute. The lack of FMPs has been recognized as a significant barrier to successful implementation of the MLMA. A 2010 study commissioned by the OPC found that the lack of FMPs is preventing the state from realizing the benefits of the otherwise progressive and promising fisheries management law (Harty et. al. 2010).

In 2008 a legislative effort was made to revise the MLMA to create a pathway for a "FMP-lite." The hope was to reduce the burden of FMP planning and development so that the Act's goals would not fall victim to its process requirements (AB 2532 2008-2009 Reg. Sess.).

Engage External Funders and Experts to Enable Fishery Management Planning Processes

The realities of funding gaps and shortfalls can affect all parties involved in fisheries management. Pauses in funding availability can hamper momentum, reduce levels of transparency and information sharing, and hinder relationship building. Where appropriate, there may be opportunities to leverage outside funding to kick-start and carry out fisheries planning processes. The California spiny lobster fishery provides an example for how to reduce the financial burden on CDFW for FMP development by attaining outside funding. The process has not been without challenges and served to highlight some of the limitations associated with stakeholder bodies that are charged with representing a broad group of interests. The model is nevertheless an example of stakeholders partnering with CDFW to attract resources and help

define a public process. The Conservancy would value the opportunity to work with CDFW to help identify and capture the lessons learned from the lobster FMP experience to help inform future planning efforts.

One of the likely lessons learned from the lobster FMP experience is that there is opportunity to streamline the process. To this end, stakeholders in the Pacific herring fishery and CDFW are applying a similar partnership concept of outside funding and resources to the development of a herring FMP, but at roughly half the cost of the spiny lobster FMP (Pacific Herring Discussion Group 2015; Appendix 2). The streamlining is possible in part because of lessons learned during the spiny lobster FMP process and because it is a less complex fishery. This approach represents a significant next step towards expanding upon the partnership-based model of FMP development (see Appendix 2). In another example, the industry- funded California Sea Urchin Commission (CSUC) (see Appendix 5) which is in discussions with the Department regarding how it can help advance a rulemaking aimed at reducing capacity in the fleet.

Enhance Buy-In by Including Stakeholders in All Steps of Fishery Planning

The potential for fisheries partnerships in fishery-specific planning extends beyond the initiation and securing of funding. Within the process itself, stakeholders (fishermen in particular) have vital roles to play in the assembly and interpretation of essential fishery information (EFI), the development of a practical and focused research protocols, and the identification of appropriate management strategies and control rules. How the effort looks in terms of incorporating additional stakeholder input will vary based on the dynamics of the fishery. For example, for herring, the nature of the fishery allowed for a small focused steering committee to work closely with CDFW and have a high degree of involvement in process management and decision-making (Pacific Herring Discussion Group 2015; Appendix 2). Other fisheries, such as spiny lobster, are more complex in terms of user groups, gear types, and port perspectives and thus a different approach to engagement will be necessary. The Center for Ocean Solutions (COS) and Kearns and West Stakeholder Engagement tool-kit that is currently in development has the potential to be a valuable resource in determining the most appropriate structures and strategies.

The primary benefit of a partnership-based approach to planning is that it can attract the funding and provide the organization that allows for comprehensive management reform where it would otherwise not be possible. This can facilitate regulatory changes that enhance the biological and economic sustainability of the fishery. It can also focus limited research funding on the most instructive areas. Further, this partnership-based approach empowers individuals and promotes buy-in to the process and its results.

Early collaboration also provides opportunities for stronger relationships to build from the onset; solid and long-lasting relationships can act as an incentive to maintain on-going collaborative efforts (Trimble 2013). Having a hand in shaping the process itself creates a sense of ownership, which contrasts the more common planning dynamic, where stakeholders are simply told when and how they can provide input. By helping to define the process, stakeholders are more inclined to be solutions-oriented when problems arise and are less inclined to be adversarial. Further, external expertise may introduce new methods and tools that can help improve the planning process and its outcomes. When the process is designed so that stakeholders have input into who outside contributors are, it can also serve to increase their confidence in the end result.

Exploring Alternative Active Management Efforts

In addition to continuing to apply and refine the partnership-driven FMP model, there is an opportunity to explore non-FMP types of active management under the MLMA by developing fisheries-specific documents. Given their limited size and absence of resource concerns, certain fisheries may not warrant a FMP, or even a "FMP-lite," but may still benefit from the generation of an updateable status report that outlines the trends, research needs, current management strategies, and potential management response. Status reports of this kind, developed by an outside entity, in partnership with CDFW, can serve to identify gaps in MLMA compliance and help focus management attention on relevant issues. They can also be structured and housed in a way that allows for stakeholders and the research community to contribute regular updates. This approach could serve to fulfill and expand upon CDFW's requirements under the MLMA to develop Annual Status of the Fisheries Reports and advance the goals of the MLMA in broader ways outside the context of FMPs. The same resource constraints at CDFW will still exist; however, partnerships will be central to help move such approaches forward.

Stakeholder Organization and Capacity

In order to partner with CDFW to help initiate and advance planning efforts stakeholder groups need to be representative and have the capacity to help organize the effort, seek funding, and communicate with their constituents. Durability of the stakeholder group is not an issue to the same extent it is with long term efforts given the shorter term, project based nature of fishery planning.

Representativeness: High
Capacity: Medium
Durability: Low

SECTION 3: RESEARCH AND MONITORING

Following the processes to prioritize fisheries for management efforts and then plan those management efforts, another key phase in effective fishery management includes research and monitoring of the managed fisheries.

Collaborative fisheries research (CFR)—where fishermen and the fishing industry are actively involved in the design and implementation of research and monitoring that supports management—is key to helping CDFW manage fisheries in a cost-effective way. CFR is also a means of bringing fishermen's deep local knowledge to bear on our collective understanding of ocean resource conditions by providing a means to learn and share information on the water and apply it to the scientific process. Fishery partnerships can bring much needed funding, vessels to support research efforts, and science capacity to support priority management needs. For example, the California Collaborative Fisheries Research Program (CCFRP), a partnership between CPFV fishermen in central California, Moss Landing Marine Labs (MLML), and California Polytechnic State University (Cal Poly), has engaged 717 anglers and boat captains as volunteers since 2008 to monitor 4 of the 29 MPAs along California's central coast (Starr et al. 2015, Meyer et al. 2013). To date, this is one of the best long-term studies of nearshore fish

populations and effectiveness of the MPA network at protecting and rebuilding fish populations in California (Starr et al. 2015).

Additionally, it is often easier for external partners to test new data collection approaches or technology solutions that could potentially streamline future data collection and use. These external partners, such as the private sector or NGO community can augment CDFW's efforts by developing and testing new research and monitoring tools that, if successful, CDFW can implement. Importantly, these outside efforts are more likely to be successful when there are incentives (e.g., such as increased fishing opportnities) for fishermen and partners to work collaboratively with managers and scientists.

Limitations of the Current Approach to Research and Monitoring in California

CDFW takes the lead on research and monitoring of California fisheries, and recognizes the need and utility to involve stakeholders in the multiple steps in that process. The subsequent section describes several themes that set the context for fishery research and monitoring partnerships in California.

Aligning Funding Sources and Research and Monitoring Efforts

Fisheries science in California mostly operates through individual research and monitoring projects from academic or government agencies, generally with limited coordination across agencies or among independent researchers who are driven by differing perspectives, goals, and interests. California Sea Grant has played a key role in prioritizing and funding much of the fisheries research in California over the last decade; however, funding to support fisheries research is scarce and typically the limited available funding is dispersed through highly competitive request for proposal processes. There is no strategic plan to guide statewide investment in fisheries research and to secure and combine funding from state, federal, foundation, and industry partners for science priorities.

Involving Fishermen in Data Collection and Interpretation

Most fishermen lack access to the funding and science partners needed to support advancement in gear innovation or conduct focused research to improve or maintain the environmental and economic performance of their fishery. Furthermore, when fishermen are involved in research, it tends to be only during the at-sea portion of the work and not in the identification of research and monitoring priorities, design of studies, or review of data, leading to a disconnect between the perspectives of fishermen, scientists, and the fisheries management decision-makers. The result is that decision-makers often do not have access to the scientific data that regulatory or policy decisions warrant and fishermen feel relegated to a "taxi driver" role as vessel operators.

Involving fishermen in the gathering, interpretation, and reporting of fisheries management data is considered a gateway or "entry point" to more comprehensive forms of collaborative management (Trimble & Berkes 2013). In California, fishermen involved in these projects typically see value in their participation as part of a collaborative research team, and see their involvement as direct recognition by resource managers and scientists of the quality and importance fishermen's input has in shaping research questions and methodology (Pinkerton 2009).

In 2010, OPC funded the creation of an entity called CFR-West to play a coordinating role in identifying, funding, and promoting collaborative approaches to fisheries research to address critical management needs. While CFR-West obtained funding from OPC for about 15 projects, there currently is no formal plan to continue funding CFR-West, and there are broadly held

perspectives that CFR-West either was not the right model, not sufficiently funded, or not designed or managed to be an enduring enterprise. While many fishermen, researchers, and agency partners in California are committed to improving collaborative fisheries research, there are questions and impediments to supporting collaborative partnerships.

While collaborative research projects can help reduce costs towards managing fisheries by securing support and buy-in during the initial stages of a project's development (Pinkerton 2010), it is still unclear how this support translates to informing management measures. There also remains a relatively high level of skepticism and reluctance on behalf of resource managers and decision makers to accept data gathered by fishermen and/or citizen scientists as credible sources of information upon which to base management decisions (Mackinson et al. 2011). Equally as skeptical are fishermen who are wary to share fishing information, particularly socioeconomic and spatial information, fearing the information will be used to further restrict fishing access (Ecotrust 2014).

Research Vessels

Hundreds of fishermen are out on the water every day, but they are not responsible for collecting data that could be used to inform fisheries management. At the same time, CDFW has struggled to fund and support their limited vessel fleet, which is now mostly restricted to enforcement vessels. This situation could be improved by utilizing vessels from outside the agency for joint monitoring and research activities; however, there is currently no formal mechanism to link CDFW's research needs with fishing vessels that could serve as research platforms with academic partners that are able to lead projects. For example, CDFW launched a monitoring project focused on the sea cucumber fishery in southern California, but was limited due to capacity constraints. Arrangements to bring funding, vessel support, and interested graduate students may have provided CDFW with much needed basic information on this fishery.

Opportunities to Improve Research and Monitoring through Fishing Partnerships

Partner with California Academic Institutions

Academic partners, such as the extensive state college and university system, have scores of graduate students and researchers that may be eager, and can secure funding, to be involved in applied research. For example, CDFW collaborated with the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) to develop the five-year report on the Channel Islands MPAs (CDFG et. al. 2008). Effective collaborative research and monitoring partnerships can focus additional capacity on information gathering and exchange through the following types of activities:

- Strategic sharing and prioritization of research needs
- Development of data collection protocols and tools
- Data collection (fishery dependent and fishery independent efforts)
- Analysis, interpretation, review, and communication of results
- Closing the loop between research and decision-making

Create a Permitting Process for Partnering with Non-Academic Entities

Currently, research studies in California need a scientific collection permit that is typically granted by CDFW to a project principal investigator typically from an academic entity. Another

formal process to provide for a regulatory exception or waiver could be used to authorize research and experimentation by a broader range of partners, with CDFW oversight. This process could be analogous to the federal process of granting Exempted Fishing Permits (EFPs); for example, NMFS and the Pacific Fishery Management Council (PFMC) have supported fishery independent surveys (carried out by a partnership of academic, NGO, agency, and fishing interests) of overfished rockfish in the Rockfish Conservation Area in central California over the past two years (Starr et al. 2015).

Update Fishery Data Collection Systems

CDFW has demonstrated committed efforts to making fisheries information systems electronic, near-real time, and nimbler to support adaptive management. Modernizing data streams through innovative technologies such as electronic monitoring and electronic logbooks has the potential to streamline data collection efforts, collect data in a more real-time fashion, and reduce the need for paper logbooks (and redundant effort needed to enter logbook information into an electronic database). NGOs, fishermen, and the technology sector can make powerful partners to help design, test, and implement electronic solutions.

Several examples in and outside of California demonstrate how fishery partnerships have either helped improve current data collection efforts or how collaborative efforts have helped pave the way for novel approaches, such as technology innovations and development of new data collection protocols. Fishery dependent information is currently being collected by fishery partnerships through the use of electronic logbooks in the southern California recreational finfish fishery through a partnership with the Sportfishing Association of California and the Pacific States Marine fisheries Commission (PSMFC). In addition, several other efforts have been successfully piloted – such as those in the California Groundfish Collective (CGC), as well as in the southern California spiny lobster fishery. A critical part of the success with the CGC groundfish partnership was the need to share information in real-time on locations where overfished/rebuilding species were caught in an effort to help fishermen identify areas to avoid. The electronic data collected using eCatch (an electronic logbook) have been used to reduce bycatch relative to the fleet at large and to secure a 'best choice' (green) Seafood Watch ranking by the Monterey Bay Aquarium for the fish caught by the collective (Kauer & Oberhoff 2015).

Fisheries independent data collection efforts are currently underway through industry led fishermen organizations including the San Diego Red Sea Urchin community-based data collection, the market squid research program to assess paralarvae abundance in relation to environmental factors, and a southern California sportfishing tag and recapture study for kelp bass (*Paralabrax clathratus*) and barred sand bass (*P. nebulifer*).

Engage Stakeholders in Prioritization of Research and Monitoring Needs

Partnerships could enable the collection of extensive datasets via the MPA monitoring program to support fisheries management. For example, harnessing the interest of those who are eager to know if MPAs are helping to rebuild stocks provides an opportunity to test new approaches to using MPAs as reference areas for data-poor stock assessments (Wilson et. al. 2010). Industry and academic collaborations such as CCFRP have developed fishery independent surveys inside and outside state MPAs; these data are now being used to test data-poor stock assessment approaches for some common species (Wendt & Starr 2009; Starr et al. 2015; Wilson 2013). Another example of a collaborative and partnerships- based planning includes California's MPA and Fisheries Integration Workshop, in which CDFW, scientists, fishery modelers, and resource

managers gathered to discuss how MPAs could be used to inform fisheries management and how best to monitor the effects of the MPA network on California's fisheries (Wertz et. al. 2011).

Develop a Fishery Research and Monitoring Enterprise

While CFR-West perhaps did not live up to its potential, there may still be a need for an enduring CFR "enterprise" that could help to set priorities, attract funds, and support cost-effective research that is integrated with management. A CFR enterprise could bring together fishery partnerships, managers, and funders to support the highest priority research and monitoring needs. A situational analysis is needed to identify the challenges and opportunities for establishing a more enduring CFR enterprise in California that could bring diverse funds together for priority research and monitoring.

Stakeholder organization required

There is a distinction between the levels of capacity and durability required for ad-hoc research versus long term monitoring. Generally speaking, research is more short-term, and project based. Stakeholder partners do not need to be representative of the fleet, or have significant capacity beyond being able to reliably participate in the research. They also do not need to be particularly durable given the typically short-term nature of the work.

Monitoring on the other hand involves regular, consistent sampling over time to build a time series of data. Partnerships require organizations that have sufficient capacity to engage over time and are sufficiently long-standing that CDFW can be reasonably assured that efforts to incorporate the group into monitoring will be worthwhile and will not pose a threat to the stability and integrity of the monitoring effort. The organization does not need to be particularly representative as the perspectives of the broader fleet are not directly at issue.

Research:

Representativeness: Low
Capacity: Low
Durability: Low

Monitoring:

Representativeness: Low
Capacity: Med
Durability: High

SECTION 4: STOCK ASSESSMENTS

To manage a fishery effectively, it is important to understand the impact of harvesting on the productivity of the fish stock. The conventional approach to determining this interaction is through a quantitative evaluation of the relationship between a performance indicator and reference point; this process is referred to as a stock assessment. Stock assessments can range in complexity from trends in empirical data of catches or lengths of fish to statistical estimations of biomass and fishing mortality. The difference between performance indicator and reference point, known as the performance measure, informs the need for management interventions through a decision rule (see Section 5).

While the MLMA specifies that FMPs shall be the primary means of managing the State's fisheries, there is no requirement to perform stock assessments for all fisheries. Only four of the approximately 68 commercially and recreationally important marine species exclusively landed within California state waters are managed with the aid of quantitative stock assessments (Table 1). Without stock assessments (whether empirical or model-based) there is less opportunity to design adaptive control rules in order to adequately respond to changing ecological and socio-economic conditions (Bentley & Stokes 2009). In the face of limited resources for carrying out full stock assessments, alternative assessment approaches open the door for increased stakeholder participation in data collection, determination of appropriate performance indicators and reference points, as well as the selection of appropriate stock assessments.

Many federal fisheries that are jointly managed with California are managed with stock assessments. For example, 7 out of 19 species of nearshore finfish (CDFG 2002a) have undergone statistical catch-at-age stock assessments. As a result of adequate data and assessment outcomes, many of these assessed nearshore finfish fisheries have seen increases in total allowable catches (TAC) over the years as stocks have recovered from overfishing (Wilson-Vandenberg et al. 2014). For other invertebrate and finfish species managed without assessments, there is considerable concern that fishing pressure is continuing to adversely impact the resource. For some fisheries, managers have implemented precautionary management measures that create strict conservation guidelines curtailing fishing pressure. This dichotomy makes it clear that without assessments, there is little possibility to create management guidance that reflects dynamic fishery conditions and meets objectives of multiple stakeholders. In this section, we identify the role that partners can play in carrying out tasks to help meet these goals.

Status and Limitations of the Current Approach to Stock Assessments in California

Formal Stock Assessments

Given that stock assessments are not a mandated requirement for California fisheries, there is limited budget and resources allocated within CDFW to build the in-house capacity and expertise for developing integrated statistical catch-at-age stock assessments for the majority of state fisheries. Even alternative assessment approaches that are less technically challenging and costly, but still rely on MSY-based conventions such as Depletion Corrected Average Catch (DCAC; MacCall 2009) and Depletion-Based Stock Reduction Analysis (DBSRA; Dick & MacCall 2011) still require numerous life history and depletion estimates, which many fisheries do not possess.

Opportunities to Improve Assessments through Partnerships

Partnerships could play a role to help facilitate, develop, and carry out both empirical and model-based stock assessment approaches for improved management of California fisheries. Partners can be leveraged to assist with stock assessments through a variety of avenues, several of which are described below.

Collaborations with Academic Institutions

Similar to the potential collaborations and partnerships described in Section 3 regarding research and monitoring, universities and other academic institutions can play an important role in

supporting stock assessments. A strong out of state example is UW/NOAA's "JISAO", Joint Institute for the Study of the Atmosphere and Ocean (http://www.jisao.washington.edu/about-jisao). JISAO funds graduate students to work on applied fishery management issues, in particular stock assessments, primarily for federally managed fisheries. Such a program could be developed with one or more research institutions in California to add capacity to state fisheries managers, develop the next generation of stock assessment scientists and fishery managers, and reduce the financial burden of these assessments on the state by matching funding from public and private money.

Partnering with Research Groups, Stakeholders, and Non-Governmental Organizations

Private research institutions, stakeholder working groups, and NGOs are capable of fulfilling several duties associated with assessments. One example of such a partnership between CDFW and NGOs involves a novel project to apply data moderate stock assessments to a suite of California fisheries and in the process develop a California specific data limited assessment toolkit. Work will be performed to scope out several data-limited fisheries in California and through a working group structure, data will be compiled, and stock assessments will be performed. The approach has significant chance of streamlining the process of performing data poor stock assessments for a multitude of fisheries at a reduced cost to CDFW.

Similarly, a working group on data limited fisheries, funded through the Science for Nature and People (SNaPP) Partnership developed FishPath, a decision support system for choosing appropriate management strategies for data limited fisheries (Dowling et al. 2016). Management strategies include monitoring and data collection, assessments, and the management measures and associated control rules needed to meet target objectives of a fishery. FishPath can be used to standardize the process of choosing the appropriate assessment techniques given available data and the specific context of the fishery including social, economic, ecological, and governance characteristics. FishPath can also provide information regarding the potential techniques should an alternative data source become available.

Application of frameworks like these to fisheries in California could provide a standardized approach for selecting the appropriate assessment method and could be used by stakeholder working groups to support CDFW in designing management plans and choose assessment approaches.

Utilize California's Marine Protected Areas as a Stock Assessment Tool

California's MPAs offer a tremendous opportunity to simultaneously improve stakeholder participation in data collection and management, improve understanding of stock status, and use MPAs as reference areas to guide decision-making (Babcock & MacCall 2010, Wilson et al. 2010, McGilliard et al. 2011), in the face of a changing climate (see Section 3). The Conservancy and CCFRP are currently exploring an opportunity to develop the partnerships and additional research needed to propose a pilot program to explore costs and benefits of an alternative management system that relies on MPA-based stock assessments at local scales to guide decision-making.

Seek the Assistance of Fishery Organizations

The use of fishing industry funds to help hire independent contractors to fulfill stock assessment requirements is an approach that CDFW has used before and is embraced by a number of national governments across the globe (Castilla & Fernández 1998). Specifically, the California Sea Urchin Commission has funded independent research to determine biological characteristics

important to the long term sustainability of the fishery for many years (Ebert et al. 1994). Such funding has also been leveraged to understand the biological and economic value of adjusting the minimum size limit in the fishery. In the Pacific Herring fishery, the San Francisco Bay Herring Research Association, a non-profit formed with money from the Cosco-Busan spill funded a stock assessment in partnership with herring fishermen (Appendix 2).

Stakeholder Organization Required

In order to effectively engage in partnerships focused on assessments, stakeholders need a comparatively high degree of organization. Assessments are technical and even simplified approaches require funding to conduct. The use of industry funds to support assessments implies adequate representativeness to first collect funding and then sufficient structure and strategy to decide how those funds should be spent. Academic institutions typically have the capacity required to engage in assessment-based research as well as the technical abilities to assist in helping to select and conduct assessments. Because assessment work is comparatively short term and project-based, proven stakeholder group durability is potentially less of a concern.

Capacity: High
Representativeness: High
Durability: Medium

SECTION 5 - DECISION RULES

Fishery management in California is based on the premise of sustainability as defined in the MLMA (FGC §7050(b), 7056). To achieve harvest sustainability, managers are charged with prescribing a system of decision rules that meet target objectives for fisheries management such as maximizing yields or maintaining biomass at levels above MSY. Decision rules are defined by two components: 1) management measures, which are specific approaches to adjusting fishing mortality and often include input (e.g. size, season and sex) and output controls (e.g. TAC), and 2) associated harvest control rules that specify the strength of response to the management measure given the deviation of a performance indicator (e.g. biomass, fishing mortality) from a target or limit reference point (e.g. B_{MSY}, F_{MSY}) as determined through a stock assessment.

The development of decision rules is arguably the single most important component of a management strategy. For example, the choice of which decision rule is applied to a fishery can directly impact response times to achieve conservation objectives and maximize yields. Furthermore, the choice of what decision rule is utilized has important implications for economic and social outcomes in the fishery. Development of decision rules that meet multiple objectives can be enhanced through active participation among managers, scientists, industry participants and constituents (FAO 1995). Using static decision rules such as the prescription of a TAC set at a fraction of historical landings or an assumed unfished spawning stock biomass (Restrepo et al. 1998, Berkson 2011), often fails to meet the needs of a diverse set of stakeholders.

Despite the importance of adaptive decision rules in achieving conservation and management objectives, there are few instances of such flexibility in California (CDFW 2014a). Particularly in the face of climate change there is a need to develop adaptive decision rule frameworks that allow for rapid adjustments to management measures without the need for lengthy legislative, or otherwise bureaucratic approaches to fishery management. Such processes need to be transparent, objective, and simple in order to be readily integrated into state fisheries

management. Working with partners to help develop, test, and implement these systems is critical toward helping prepare for an uncertain future that will require nimbleness and flexibility in decision-making. In this section, we discuss how fisheries partnerships can help achieve these objectives.

Limitations of the Current Approach to Generating Decision Rules in California

There are several forms of decision rules currently available to managers in California ranging from catch-, gear- and effort-based restrictions to size, sex, and season restrictions. The specific choice of which management measure to implement and the strength of the response required to meet target objectives is context-dependent; there is no generic process-oriented approach.

A process-oriented, approach to choosing appropriate decision rules and working with stakeholders to ensure the integrity of decisions can help California lead in adaptive fisheries management. To date, there is a range of structure and formality in terms of stakeholder input that has been applied in California to develop and implement decision rules. On one end of the spectrum, there is legally sufficient but otherwise basic stakeholder engagement as was used in the development of a set of decision rules for Kellet's Whelk; where MRC and Commission meetings largely serve as the means for soliciting public input. On the other end of the spectrum, the White Seabass FMP and initial decision rules were developed through dedicated stakeholder input and the FMP describes a structured process for stakeholder involvement when conditions change. The development of decision rules for spiny lobster is perhaps between those two ends of the spectrum with decision rules and the FMP being developed through a dedicated public process, but with no structured stakeholder process outlined in the FMP for interpreting trends and selecting from its toolbox of possible management actions.

Opportunities to Improve Decision Rules through Partnerships

The CDFW has partnered with groups to build a stakeholder engagement toolkit. Led by Kearns and West and the Center for Ocean Solutions, the toolkit focuses on the lower end of the continuum described in the introduction. In this section the focus is on the opportunities and considerations related to partnership-based approaches for developing and implementing decision rules. Similar to streamlining FMP development, it is important that the scope and scale of the adaptive management process reflect the size and complexity of the fishery.

Adopt a Management Strategy Evaluation Framework for Selecting Among Management Options

Generic guidance in the form of a "toolbox of options," such as the one proposed in the lobster FMP could be developed and informed by a Management Strategy Evaluation (MSE) process. MSE is a procedure that allows for the objective and explicit consideration of tradeoffs between alternative management strategies including the management measures and control rules that link assessment outcomes with the management response (Smith 1994). MSE can compare which types of management measures and control rules will meet desired objectives for multiple stakeholders. The use of MSE as a guide for selection and implementation of decision rules must be informed by partners since it is dependent on a number of assumptions about stakeholder objectives, ecological dynamics and behavior of fishermen. MSE can streamline decision-making and can reduce the costs of management when appropriately designed.

Use of a Decision Support System for Selecting Decision Rules

Use of a decision support system such as FishPath for selecting appropriate decision rules can improve transparency and simplicity of the management process. Similarly, the data-limited tool-

kit provides an approach to quantitatively evaluate monitoring, assessments and decision rules (collectively referred to as a management strategy; aka management procedures). Such data-limited frameworks provide opportunity to explore a suite of possible management strategies that may be appropriate given the context of the fishery. A transparent process for stakeholders to review information and examine recommended management actions is critical to developing nimble and flexible management systems that are supported by stakeholders. International experiences show that fisheries management regulations are unlikely to succeed without support from fishermen, because fishermen often find ways of by-passing those regulations (Hanna 1995). Over the past 15 years, California has increasingly sought the active participation of fisheries organizations, industry, and other stakeholders to inform anticipated changes in management (CDFW 2015). There is nevertheless still room to expand the role stakeholders have in developing and adaptively applying decision rules.

Stakeholder Organization Required

As noted above, there is a continuum of potential stakeholder involvement with the development and adjustment of decision rules. On the lower, stakeholder engagement end, stakeholders do not need to be as well organized. CDFW can solicit specific input from stakeholders without concerns regarding the durability of organizations or their capacity. However, whether specific stakeholders represent the views of the rest of fleet will remain a concern.

On the other hand, in more formal and structured approaches, stakeholders will need to be more organized and need greater capacity to engage in framework approaches described above. Given the potential for direct consequences, fishermen in MSE working groups need to be representative of the interests of the broader fleet. The durability of stakeholder organizations is of particular concern if structured adaptive management processes identify stakeholder organizations by name (i.e. the DCTF, or DHAC). However, as in the White Seabass FMP, adaptive management structures need not be dependent on particular organizations.

Capacity: Medium
Representativeness: High
Durability: High/low depending on specificity of structure

SECTION 6: COMPLIANCE AND ENFORCEMENT

Effective law enforcement, as well as consistent voluntary compliance with fishery management measures, is critical for protecting California's marine resources and the fisheries and communities that depend on them. Strong enforcement measures are key to ensuring the efficacy of control measures including closed seasons, closed areas, catch restrictions, bag and size limits, and gear restrictions. Increasingly, the traditional role of law enforcement has expanded to include direct participation of enforcement leads and officers in all stages of the development of appropriate management measures, as well as significant outreach and educational efforts to improve regulatory awareness and compliance among fishery participants and other stakeholders.

CDFW Law Enforcement Division (LED) has primary responsibility for enforcing the Fish and Game Code, including enforcement of all state fisheries regulations, as well as other relevant state laws. CDFW is also responsible for enforcing some federal fisheries regulations (through

the existing enforcement agreement with NOAA). In coordination with NOAA, natural resource managers, the U.S. Coast Guard, and other state and federal agencies, LED leads a variety of efforts including informing fishery participants of regulations, encouraging voluntary compliance, providing monitoring and surveillance, identifying violations, and pursuing appropriate penalties, fees, and sanctions.

Current Approach to Compliance and Enforcement and Partnerships

Given the state's more than 1,100 miles of coastline and numerous existing fishery regulations, CDFW faces some significant logistical, economic, and capacity challenges in achieving desired compliance and enforcement outcomes across the state. CDFW faces the following challenges in enforcement:

- Limited marine enforcement assets and few enforcement officers dedicated to marine affairs (approximately 30 of CDFW's 300 officers).
- Due to delays in implementing an electronic reporting and records management system, paper reporting is still in place and requires more staff time.
- Continued violations of marine and fisheries regulations, including misreporting or under-reporting by commercial fishermen and fish processors, violations of protected areas, and poaching.

CDFW has already incorporated partnerships into its compliance and enforcement. In addition to partnering with managers and industry groups (e.g., the DCTF and the LAC) and providing specific fisheries-related training for local police departments and tribal entities, CDFW has:

- Supported the cautious development and improved function of 'community collaboratives', groups of citizens concerned about the proper protection of existing MPAs who provide outreach, support compliance and can be trained to initiate an enforcement response when appropriate.
- Additionally, CDFW provides support and specialized training for the Natural Resource Volunteer Program, whose members provide education and outreach regarding marine regulations in partnership with CDFW.
- Furthermore, CalTIP now has a dedicated mobile device application for ease of use in reporting violations.

Opportunities to Improve Compliance and Enforcement through Fishery Partnerships

Clearly, CDFW enforcement leadership recognizes the substantial potential of partnerships to add much-needed capacity to meet the significant challenge of adequately enforcing spatial management measures and complicated regulations across dozens of fisheries active in the state. Building off these successful existing partnerships and looking to models from around the country and the world, almost every aspect of a comprehensive compliance and enforcement strategy can be improved by expanded partnerships. However, due to the sensitive nature of enforcement activities, partnerships to improve them must be formed with a great deal of consideration and forethought. Some of the potential opportunities for enforcement partnerships described below are educational in nature and – similar to stakeholder engagement campaigns described elsewhere in this document – require little from the "partners" aside from simply participating. The remainder are fairly significant projects that would require substantial long-term investment and participation from CDFW and from the partners, which are likely to be industry organizations. Those partnership opportunities, such as enabling cooperatives to conduct

peer surveillance and oversee the application of penalties, or transitioning to electronic monitoring and reporting, would only be undertaken by CDFW after a thorough review of whether they are worthwhile.

Empower Fishery Participants to Participate in Rule-Making Processes

The expanded utilization of partnerships throughout the rule-making process, particularly with regards to recreational and commercial organizations, could improve much-needed community buy-in for necessary and effective regulations. One of the central challenges to high levels of voluntary compliance in many cases is limited engagement of stakeholders throughout the rule-making process, which can lead to low buy-in and understanding of the purpose of rules. When faced with a rule that they may not fully understand, agree with, or view as essential to protecting the resource and supporting shared fishery management objectives, otherwise well-intentioned fishery participants may commit a violation. This problem can be addressed, at least in part, by the empowerment of fishery leaders and fishing organizations to be more directly and consistently involved in the regulatory process. The benefits of this can be seen in a range of fisheries, including the Dungeness crab fishery and California's spiny lobster fishery. Engaging fishing leaders in the development of important regulations and management changes can improve the outcomes, increase buy-in and awareness and support high-levels of voluntary compliance as well as peer-to-peer education. It is well acknowledged however, that significant challenges exist with individuals not a part of the management process who operate illegally and outside of traditional communications and management channels.

Engage Stakeholders in Leading Education and Awareness Efforts

A central component for effective marine management is ensuring high levels of voluntary compliance with regulations. While effective enforcement of rules can improve compliance, the central challenge is to reach a wide range of diverse stakeholders through education and outreach. Given the limited resources and competing responsibilities of enforcement officers, outreach and education can be difficult to prioritize consistently. Here, CDFW can expand on existing models for utilizing partnerships with commercial and recreational fishermen as well as others. Industry cooperatives, advisory committees, sport fishing groups, and other organizations can provide significant assistance in improving the awareness and understanding of existing and new relevant regulations by working directly with CDFW to organize and host workshops and education sessions and distributing informational materials to members. These groups could also take on significant responsibilities in encouraging best practices among their members to support management and enforcement objectives (see Text Box 11 for an example of effective partnership-driven education and awareness).

Involve Partners in On-the-Water and Peer Surveillance

There are several important ways that surveillance activities can be supported through partnerships, such as by utilizing private sector contributions. Through the previously discussed expansion of outreach and education activities, CDFW can build and maintain close relationships and thorough understanding among a large number of fishermen and recreational boaters who spend considerable time on the water. In this way, CDFW can substantially increase the number of trained 'eyes on the water' able to recognize problematic behaviors and initiate an enforcement response through CalTIP when appropriate. This surveillance role can help address the ongoing challenges of adequately enforcing fishery-specific rules and protected area designations along California's vast coastline.

CDFW could also utilize recognized fishing cooperatives to provide additional peer surveillance of fishery-wide or cooperative-specific rules. In fisheries like Alaskan Pollock and New England groundfish, cooperatives fishing under approved plans are liable for all fishing violations of members. The regulatory framework also outlines violations reporting and response requirements. In this way, the cooperatives, their members and their hired staff serve an important surveillance and reporting function in these fisheries and have successfully improved regulatory understanding, compliance and enforcement. This model can be adapted and extended to fisheries in California with positive compliance and enforcement outcomes

Involve Partners in Designing and Developing an Updated Information Collection System
As described in Section 3, partnerships can help support, design, and develop the improved communication and information systems necessary for more effective enforcement (see Text Box 12 for an example of a fishery with improved information systems). An electronic data collection system would reduce the potentially detrimental lag between landing events and the time when enforcement officers are able to review reported information. CDFW could develop a new system with the help of academic and private-sector partners with expertise in data system design and resources to help support these upgrades.

Empower Partners to Apply Penalties and Sanctions
In addition to the potential for partnerships to enhance enforcement, cooperatives and other fishery organizations can facilitate the application of appropriate penalties and sanctions where appropriate. Utilizing fishing cooperatives and other entities to ensure the fair and timely penalties and sanctions for infractions could significantly reduce the time and resources spent by CDFW staff on these activities. An example that California may learn from is the New England groundfish fishery where managers of the fishing cooperatives (known as 'sectors') are authorized to impose immediate 'stop fishing' orders on cooperative members who have failed to adhere to reporting requirements or are suspected of violating fishery regulations. These 'stop fishing' orders are communicated to enforcement and are binding. The elected boards of these cooperatives can also impose penalties and/or sanctions for problematic vessels in accordance with their approved operational plan and private contractual agreements among all members. Implementing a system where fishing cooperatives have some authority over applying penalties and sanctions could lift some of the burden off CDFW.

Stakeholder Organization Required

Capacity: High
Representativeness: High
Durability: High

CONSIDERATIONS

Several specific considerations for fisheries partnerships have evolved out of each management task and other big picture concerns. The following is a synthesis of those cross-cutting considerations, organized by theme.

- **Establish Standardized Management Prioritization and Implementation Frameworks that Draw from Partner Expertise**

  California's large number of marine resources leads to a vast array of fisheries and potential management actions that fisheries managers, including CDFW could choose to address. Since time and resources limit managers' capacity, it is necessary to prioritize fisheries and management strategies to make the most efficient use of state resources.

  - **Select and implement appropriate risk assessment frameworks to determine priority fisheries for management efforts**: California's fisheries are subject to a range of risks that are constantly evolving, including human use and emerging factors such as climate change. CDFW may wish to outline a process for implementation of risk frameworks and prioritization tools, including roles of fishery partnerships and other stakeholders.
  - **Invest in a decision support system for selecting appropriate management strategies for data- limited fisheries**: Because each data-limited fishery has a different type and amount of data available, different biological characteristics, and a different socioeconomic context, a decision support system would be useful for determining which type of monitoring, stock assessment method, management intervention and control rule approach (collectively termed "management strategy") would be most effective for each fishery. The process of selecting appropriate management strategies through the use of available tools relies heavily on stakeholder input and local knowledge.
  - **Institutionalize process for fisheries management decision-making that incorporates partners**: Once priority fisheries are selected using a risk assessment framework, and potential management strategies are selected using a decision support system, objectively weighing the tradeoffs between different management strategies through such tools as MSE can be extremely valuable. MSE can help managers choose between management options by identifying those that are most likely to meet management objectives and stakeholder needs. Importantly, inclusion of stakeholders in the development of these approaches is paramount.

- **Modernize Information Streams, Management Tools and Analytical Approaches with Partner Support**

  To facilitate streamlined and more adaptive fishery management, CDFW can work with partners to test new systems and update its existing information and management systems including the collection, management, and synthesis of scientific and socioeconomic data. These updates would reduce duplication of effort and provide frameworks for presenting information in concise and useable formats.

  - **Establish test case fisheries to modernize fishery information systems for future**

roll- out: Partners can play an integral role in determining the most effective updates to put in place for fishery management information systems. For several test case fisheries, partners may assist in reviewing the existing data streams, information management systems, and data needs for management, and use their on-the-water and scientific knowledge to identify ways to improve the efficiency of the systems. This may include electronic logbook reporting or other methods that partners can implement in test cases. Based on lessons learned from the test cases, the system revisions could be rolled out in other fisheries.

- **Develop and regularly update fisheries information systems to help prioritize fisheries and management efforts**: Easy-to-read, fishery-specific information systems containing information such as resource condition, concerns and threats, management measures, research needs, and status of stock assessments would help illuminate priority areas for management efforts, as well as communicate the state of the fishery to the public and stakeholders. Partners may participate in the development, review, and updating of such systems.
- **Develop summary documents for fisheries without FMPs to identify areas for other types of active management**: CDFW and partners could collaboratively develop "living" fishery-specific documents containing the fishery's status, trends, management, and potential responses to change. These documents could be updated by research and stakeholder communities to identify management needs and any gaps where the fishery is not meeting the goals of the MLMA.
- **Develop a framework and guiding document for scaled FMPs**: the blueprint for cost effective FMPs. Invest in the testing of this blueprint with learning outcomes embedded in the process. For testing new methods for developing FMPs, existing test cases such as the lobster FMP and the white seabass FMP can serve as frameworks from which to build future fishery-specific plans.
- **Conduct a situational analysis of collaborative fisheries research in California**: A formal situational analysis could illuminate successful approaches, challenges, and best practices for building lasting enterprises to support collaborative fisheries research. These findings could then support fundraising and the development of potential new policies that enable collaborative fisheries research.

➢ **Engage Multiple Types of Partners at Various Steps of Fishery Management**

The MLMA Master Plan for Fisheries places emphasis on the role of stakeholders, including fishermen and marine scientists, in providing advice and assistance for developing Fishery Management Plans (FMPs). While CDFW plays the lead role in developing and presenting FMPs to the Fish and Game Commission (Commission), partners, including fisheries partnerships and academic institutions, can play crucial roles in fishery information gathering and planning.

- **Empower fisheries partnerships to contribute to fishery management**: Using the risks and vulnerabilities characterized through risk frameworks, CDFW could identify areas where fisheries partnerships can readily play a meaningful role and therefore build buy-in for management decisions. This may include fisheries partnerships taking the lead on low-risk management tasks (e.g. data collection) or adding capacity

and resources to higher-risk management tasks (e.g. aspects of decision-making). For example, members of fishery partnerships could participate in setting fishery management objectives, prioritization of research activities and at-sea data collection and surveillance.

- **Explore opportunities for academic researchers and contractors to assist with data collection and management tasks**: CDFW and its partners can foster collaborations with California universities and colleges, leveraging their scientific capacity to contribute to aspects including fishery stock assessments and data collection. Well-organized fisheries partnerships can also partner with third-party contractors to collect data, and industry groups could undertake select aspects of fisheries assessment and management.

➢ **Leverage Diverse Partners for Funding Mechanisms and Resources**

Funding is core to fishery management activities, and it will be critical to continue building diverse funding streams and utilizing third-party agents to ensure transparency and accountability, where necessary.

- **Explore opportunities for private or industry funding of stakeholder activities**: Outside partner funding can enable the establishment of stakeholder working groups or forums for discussing and promoting key management aspects, such as the use of data-limited fishery assessment tools.
- **As necessary, utilize fiscal agents to separate funding and the management process**: For fisheries that receive outside funding for management planning, it may be necessary to create firewalls to help reduce the potential for funders to influence the management processes.

➢ **Ensure Effective Partnership Activities to Advance Management Planning**

To help California achieve fishery management objectives in an efficient manner, CDFW and the Commission should strategically allocate resources among fishery management tasks. Test cases can help determine where the most strategic opportunities for impact exist.

- **Ensure Adequate Department Staff for Fisheries Partnerships**: Partnerships, while they may help managers achieve their regulatory requirements and remove burden from CDFW, require staff and resources to implement. To ensure effective fishery management, including the building and maintenance of partnerships to support fishery management, CDFW will need to allocate a sufficient amount of human and financial resources to these activities.

This may require prioritizing Departmental tasks and letting go of some lower-priority tasks, if legally feasible.

- **Use Experimental Test Cases to Vet Management Techniques**: CDFW and partners can identify test cases in which to pilot management efforts, such as by trying out new electronic reporting and data management systems. Test cases could also be used to pilot different types of participation of fishery partnerships, such as by leading low-risk management tasks (e.g. data collection) and supporting higher-risk

tasks. Partners can be involved in developing and/or selecting the elements to test, and also in collecting data to assess their effectiveness. Priority should be given to understanding the role and opportunity for Exempted Fishing Permits to be adopted and tested in California state managed fisheries to drive innovation. Such an experimental process is ripe for improving management through a partnership-based approach.

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Appendix 1: California's Fishery Partnerships Case Study: California Sea Urchin Commission

Background

The red sea urchin fishery is currently the fourth largest fishery in California by volume and sixth largest in value (CDFW 2013b). The fishery is relatively new, beginning in 1971 by the NMFS's program to develop fisheries for underutilized marine species (CDFG 2001b). Participation in the fishery began to increase in the 1980s following a decrease in the profitability of abalone and eventual closure of the abalone fishery in 1996, which led to a peak in the number of participants, landings, and value in the late 1980s and 1990s (CDFW 2014e, per comm. Bertelli).

In 2013, the fishery supported around 300 permits with 202 permits landing approximately 12.9 million pounds valued at $9.8 million (CDFW 2014e). The southern portion of California is responsible for a larger proportion of landings with approximately 67% of 2013 landings, compared to 33% coming from the north (CDFW 2014e). The proportion of landings in the north has increased in recent years, which may be attributed to a number of factors including a change in oceanographic conditions, change in the Japanese market, increase in domestic sales, differences in regional management (especially the minimum size limit which is 3.25in in the south and 3.5in the north) an increase in permit holders in the northern range of the fishery, and fishermen in the south switching to the more lucrative sea cucumber fishery (CDFW 2014e, per comm. Bertelli).

Evolution of the California Sea Urchin Commission (CSUC)
During the late 1980s when the fishery was at its height in value and participation, the California Department of Fish and Game Director's Sea Urchin Advisory Committee (DSUAC) was established to advise managers on sea urchin enhancement and management proposals (Dewees 2004). DSUAC was funded through a landings tax of $0.01 per pound and consisted if a body of CDFW-appointed fishermen/divers and processors, a California Sea Grant representative, and a member from CDFW (Dewees 2004). Meetings were organized and coordinated by CDFW. Between 1987 and 1992, nearly all of the regulatory changes that were imposed on the sea urchin fishery came out of DSUAC including, but not limited to, size limits, temporal closures in the northern fishery, and shortened work weeks in the southern fishery. (Dewees 2004). The organization also funded thousands of dollars of research to support fisheries monitoring and inform management (Dewees 2004).

In 1994, in response to concerns about the sea urchin resource, CDFW drafted an FMP which suggested setting a total allowable catch, establishing a maximum size limit, setting an October through May season statewide, and having separate permits for northern and southern California (Dewees 2004). The draft FMP did not sit well with the DSUAC and there has been no new progress toward establishing an FMP for sea urchins (Dewees 2004). The organization continued to function and support research and a partnership between managers and industry, however, DSUAC dissolved in 2002 due to differences between CDFW and industry (Dewees 2004). Some believe the falling out occurred because the fishing industry felt CDFW was no longer working in a collaborative fashion with the industry (per comm. Goering). However, according

to Dewees (2004) the falling out was "due to some degree to differences in goals and perceptions. DFG's6 orientation is towards resource conservation with interests in stock assessment, CPUE, recovery of urchin stocks to increase fishery yields in the long term, and learning more about variables affecting urchin populations. While the urchin industry shares the high priority placed on stock assessment, it has important issues related to improving CPUE, long-term economic sustainability, sustaining stocks of urchins in marketable condition, and perceived threats to the industry (sea otter range expansion, marine reserves)."

Concurrent to DSUAC's functioning, the industry established multiple entities to better organize the commercial fishing community and support their work on the DSUAC (per comm. Goering, per comm. Bertelli). The California Urchin Producers Association (CUPA).was created by legislation, composed entirely of fishermen, housed under CDFW, and imposed a mandatory assessment on fishermen (per comm. Bertelli). Although the association was initially successful at bringing fishermen together around common goals, as well as creating public relations opportunities and helping fishermen gain political influence, it ultimately disbanded due to the organization's high overhead costs, an ineffective executive director, and its limited ability to lobby, litigate, or negotiate prices with processors (per comm. Bertelli).

In the mid-1990s, CUPA was replaced with the Sea Urchin Harvester's Association of California (SUHAC) (per comm. Bertelli). Since SUHA was a voluntary fishermen's organization with few participants and limited funding, it ultimately disbanded in favor of a new organization. The CSUC was established in 2004 through the an act of the California legislature overseen by the California Department of Food and Agriculture's (CDFA) marketing division following an overwhelming vote of fishermen and processors (CSUC 2014a). Reserve funding from DSUAC was used to pay for the CDFA process to establish the CSUC. The goal of the organization is to ensure sustainable production of sea urchin and a reliable supply of quality seafood for domestic and international consumption (CDFW 2013b, CSUC 2014a). Additionally, "the [California Sea Urchin] Commission seeks to support strong local coastal communities, fair levels of income for fishermen engaged in sea urchin commercial fishing, and historically significant cultural and community resources within California's coastal areas" (CSUC 2014a).

In recent years, the CSUC has spent a lot of effort to address the fishery's capacity goals by developing mechanisms to reduce latent capacity in the fishery and minimizing loopholes that hinder capacity goals (CSUC 2014a; CSUC 2014b; CDFW 2013b). Fishery managers look to the CSUC to identify and guide development of fishery management goals that have broad support from both fishery managers and participants (per comm. Derek Stein).

The organization of CSUC's board is established in its enabling legislation, which included an equal number of fishermen and processors as part of its composition. In 2009, processors formally seceded from the CSUC, as they did not see a need to be involved in the CSUC (per comm. Bertelli; Food and Agriculture Code Section 79040; CSUC 2014a). The CSUC board is currently composed of one non-voting, public member and alternate, and five voting members and alternates representing fishermen from ports in San Diego County, Orange or Los Angeles County, Ventura County, Santa Barbara County, and Sonoma or Mendocino County, one non-voting processor one non-voting representative from CDFW, and one non-voting representative from California Sea Grant (FAC §79040). Following the establishment of a MOU, a few

processors pay a small voluntary assessment to the CSUC (per comm. Bertelli). Board members are encouraged to hold regular port meetings to channel communication with the divers.

The work of the CSUC is primarily funded through assessments on all sea urchin fishermen (FAC §79040). Each fisherman is required to pay $0.01½ for each pound of sea urchin landed. Assessment funds are used to cover the CSUC's operating costs, including salary for an executive director, board member elections, meeting costs, stipend for board members to attend meetings, etc. The funds are also used to cover non-meeting related costs including litigation, marketing tools, etc. (per comm. Bertelli).

Lessons Learned and Considerations

The following includes insights and reflections shared by Bob Bertelli, CSUC co-chair, David Goldenberg, CSUC Executive Director, and Derek Stein, Environmental Scientist with the Marine Region, CDFW during informal conversations with report authors. References to personal communications were removed from the proceeding section to improve content flow.

The CSUC provides the industry with a unified, more organized voice, which makes it easier for CDFW to work collaboratively with the sea urchin fishery. The CSUC permits its representatives to act on behalf of the industry, rather than for themselves as individuals, which streamlines the feedback loop between the CSUC, CDFW, and the California Fish and Game Commission. CDFW sees the CSUC as an important communication tool for the industry and has prioritized its investment in attending meetings, engaging with the CSUC board, and continuing to use the body to build relationships with the industry. However, since current available data for the sea urchin fishery does not suggest a significant resource concern, there is a limit to the amount of CDFW resources allocated due to other "top priority" fisheries that dominate staff time. Maintaining an open dialogue with CDFW staff and funding of research and monitoring projects that inform the fishery's management have been instrumental in keeping the sea urchin fishery top of mind for fishery managers.

Although CSUC has been successful in allowing the sea urchin fishery to function in a united fashion, the absence of processors as part of the CSUC's current board composition has recently limited the CSUC's ability to move fishermen-led management priorities forward. Reduction of the latent capacity of the fishery, transferability of permits, and adding fishing days are all topics CSUC has spent years attempting to address. Unfortunately, CSUC has experienced little forward movement in the way of regulatory changes due to internal friction between fishermen and processors, coupled with limited CDFW resources. During meetings with the Fish and Game Commission, fishermen and processors often represent opposing sides on an issue, with processors citing CDFW rationale for why management changes are not needed at this time (i.e., not a resource issue). A strengthened relationship between fishermen and processors could help improve the success of the CSUC moving regulatory changes forward and reduce attempts to undermine its efforts. The CSUC is actively working toward overcoming this dialogue.

Encouraging fishermen to play a leadership role on the CSUC board has been consistently challenging. Term limits prevent elected board members from serving on the CSUC for long periods. This can reduce the institutional knowledge of the organization, while also helping to maintain diverse perspectives in the organization. However, replacements for termed out board

members can be difficult to acquire, as few fishermen are interested in dedicating the time required to serve on the board. The lack of leadership and/or engagement may be a result of frustration with the slow regulatory process and a lack of management, policy, and science skills needed to support the CSUC's work. Additionally, some fishermen choose not to serve on the CSUC since it would prevent them from advocating their own interests that may not align with CSUC positions.

The CSUC's evolution to the CSUC has highlighted the need for open, honest dialogue, consistent funding and a skilled leadership. DSUAC was a successful organization that sponsored a long partnership between managers and industry as well as a host of research and monitoring. However, communication difficulties resulted in a lack of support from the industry to continue the organization. After CUPA dissolved, SUHAC's voluntary membership hindered the body's ability to obtain consistent funding. Strong leadership helped establish SUHAC but the organization was limited in its capabilities due to lack of funding and ultimately folded. On the other hand, although CUPA had consistent funding, its executive directors were not appropriately managing the funding, which ultimately lead to its demise.

Strong leadership within the fishing community was important in getting the CSUC off the ground, but also in maintaining the organization. Fishermen and contractors must possess skills in project, organizational, and business management, as well as communications, facilitation, and negotiation to be effective in achieving fisheries management and marketing outcomes. Additionally, strong advocacy skills and a deep understanding of moving regulatory packages forward (e.g. an Initial Statement Of Reasons (ISOR) document) are essential to help industry goals get accomplished, especially the reduction in permit capacity. This broad suite of skills may benefit from the involvement of an outside, neutral "change agent" to provide capacity and lend additional skillsets to the CSUC, including improving communications between the CSUC and the broader sea urchin fleet.

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Appendix 2: California's Fishery Partnerships Case Study: Pacific Herring Fishery

Background

The California Pacific herring fishery has produced an average ex-vessel value of approximately $5.5 million annually since 1985 with high of $19.6 million in 1996 and a low of $19,000 in 2015 (per comm. Bartling). The fishery is currently composed of a 35-vessel fleet that landed 3,198 tons of herring (predominantly sac roe) during the 2013-2014 commercial season (CDFW 2014). Historically, commercial Pacific herring fisheries occurred in four major spawning areas: San Francisco Bay, Tomales Bay, Humboldt Bay and Crescent City Harbor. However, since the herring spawning population has traditionally been larger in San Francisco than the other regions and there is a very limited fishery outside that region. As a result the San Francisco fishery is the only spawning stock currently assessed by fishery managers (CDFG 2008; CDFW 2014). The fishery is managed by the Fish and Game Commission (Commission), who is informed by recommendations provided by the California Department of Fish and Wildlife (CDFW). Input is also solicited annually from the fishing industry, interested public and conservation organizations.

Core fishery management goals are to protect herring as an important forage species in the California Current Ecosystem while simultaneously maintaining a sustainable fishery (CDFW 2014). Management is based on a precautionary approach that utilizes a variety of management tools including annual spawning biomass assessments, setting conservative annual harvest quotas, limited entry permit systems, seasonal closures, and gear restrictions (CDFG 2008; CDFW 2014). CDFW and the Commission establish the state's Pacific herring quotas through an annual rulemaking process under the Administrative Procedure Act (APA) and the California Environmental Quality Act (CEQA) (Pacific Herring Discussion Group 2015). Annual quotas are based on the previous year's spawning biomass assessment, while also considering oceanographic information and herring population age class structure and general condition.

Management of the herring fishery is supported by a number of partnerships between CDFW and the fishing industry and other organizations. The San Francisco Bay Herring Research Association, a non-profit organization formed with funds generated from the Cosco-Busan oil spill, and herring fisherman provided funds to support a herring stock assessment (OST 2013; per comm. Bartling). Additionally, The Association also provides support to CDFW's monitoring efforts by tracking herring schools and defraying some minor vessel maintenance costs. In addition to supporting research and monitoring, the Commission and CDFW also rely on a partnership known as the Director's Herring Advisory Committee (DHAC) to help inform the annual quota setting process.

Director's Herring Advisory Committee (DHAC)
The DHAC is a 26-member committee of fishermen and buyers that represent the California herring fishery. The DHAC was formed in the late 1970s to address growing concerns about the derby-type fishing occurring and increased pressure on this fishery (CDFW 2014; per comm. Bartling). Members of the DHAC are appointed by the Director of CDFW following an industry-wide nomination process, and provide input on a variety of fishery management issues including the annual review of spawning biomass estimates and other fishery data, results from the

commercial season, quotas for the upcoming season, etc. (CDFG 2001; OST 2013; CDFW 2014; Pacific Herring Discussion Group2015). More recently, the DHAC supported CDFW and the Commission in closing the 2009-2010 commercial herring season due to a record low spawning biomass in 2008-2009 (CDFW 2014; FGC 2014).

Both nongovernmental organizations (NGOs) and fishermen have expressed concern about perceived management and permitting inefficiencies in the annual rulemaking process. This, coupled with the opportunity to implement aspects of the state's forage fish policy, has led two NGOs and fishing industry leadership to recommend an overhaul to the current quota setting process and implementing a Fishery Management Plan (FMP) (Pacific Herring Discussion Group 2015; per comm. Weinstein).

Herring Discussion Group

Concerns about fishery managers' yearly rulemaking process, the absence of stock assessments outside of San Francisco Bay, depressed abundance of the stock and other signs of stress prompted two NGOs (Audubon California and Oceana) to request that CDFW make changes to the fishery to address these issues (Pacific Herring Discussion Group 2015; per comm. Bartling). After a 2-3 year consultation between the NGOs and CDFW, in 2012 the herring discussion group was formed consisting of two commercial fishermen from the DHAC, two CDFW staff, and a staff member from both Audubon California and Oceana (Audubon 2015). This effort was coordinated and funded by Audubon California and Oceana, with partial funding from the Packard Foundation, and supported by pro bono industry contributions (approximately $50,000) (per comm. Weinstein), and between 2012 and 2014. The body consulted with potential funders, consultants, the Commission and its staff, scientists, and others (Pacific Herring Discussion Group 2015). The herring discussion group successfully developed a blueprint for a FMP that not only addresses the details of the FMP development process, but also attempts to work out controversial issues, including the potential harvest control rule parameters, before the FMP development commences (Pacific Herring Discussion Group 2015).

Lessons Learned and Considerations

The following includes insights and reflections shared by Anna Weinstein, Marine Program Director with Audubon California and Ryan Bartling, Environmental Scientist with the Marine Region, CDFW during informal conversations with report authors. References to personal communications were removed from the proceeding section to improve content flow.

DHAC

The DHAC has been instrumental in supporting the Commission and CDFW's management of the herring fishery. The 2009-2010 fishery closure— a joint CDFW's and DHAC recommendation— helped support recovery of the herring population in San Francisco Bay: spawning biomass estimates for recent seasons are exceeding historical averages, recruitment of 1-year age classes are above average levels, and age classes continue to be present in the spawning population (CDFW 2014; Greiner et al 2014). This collaborative effort has helped support CDFW's management goals, which aim to prioritize the ecological importance of the fishery.

Over time, CDFW has moved some of the internal coordination responsibilities to the DHAC members including administration and facilitation of DHAC operations and meetings. This transition in "ownership" was in response to a number of factors, including an effort to decrease adversarial positions between CDFW and the industry. Strong leadership and meeting coordination skills as helped ensure the continued success of the organization under this new ownership. Clear record keeping on DHAC deliberations and how management recommendations and decisions are made has been identified as another important skill supporting DHAC.
There is some concern about the transparency and representation of DHAC due to ineffective outreach between DHAC members and their constituents. Currently, only a fraction of the 26 appointed fishermen and buyers actively participate on the DHAC board (per comm. Bartling). Outreach and communication between DHAC members and herring permit holders is an area that CDFW is currently focusing attention and are working to improve in the near term.

Herring Discussion Group
The herring discussion group is a valuable example of how partnerships can be used to leverage support for fisheries management so that fishery management plans and costs can be shared amongst state regulators, the fishing industry, and NGOs. The herring discussion group represents a progressive model to address and overcome a lack of CDFW resources to forward fisheries management interests and priorities. Traditionally, FMPs are initiated and funded by fisheries managers or through funding acquired by fisheries managers directly. Due to limited resources within CDFW, Audubon and Oceana undertook responsibility for coordinating efforts and securing funding to develop a plan, timeline, and budget to guide the FMP process through a consensus-based process (Pacific Herring Discussion Group 2015). From a process standpoint, the herring discussion group focused on building trust and developing relationships from the onset. This allowed the group to carry out many of the controversial negotiations that usually occur between fishermen, fisheries managers, and environmental groups during the FMP development process setting the stage for a more productive and successful FMP outcome.

A strong project manager (i.e., change agent or bridging organization), coupled with solid fishing leadership, empowered the herring discussion group to consider and integrate the views of the wider fishing community in all aspects of the planning efforts. Fishermen participating in the herring discussion group attempted to reach out to their constituents in an inclusive and transparent manner. As a result, most individuals involved in the fishery seemed to be aware of the herring discussion group and potential FMP.

Project managers attribute a number of successes to the herring discussion group. First, it was able to bring together disparate groups to produce an initial approach to developing a FMP. Second, the herring discussion group worked diligently to vet its products with CDFW and the broader fishing community to ensure transparency and build trust. Finally, the herring discussion group offered a forum for traditionally adversarial groups to come together and recognize their similarities, particularly across conservation and socioeconomic goals.

One of the primary goals of the herring discussion group was to develop a proposal to solicit public and/or private funding to support FMP implementation. To date, the proposal from the herring discussion group remains unfunded, although partial funding is under consideration by a

couple of entities (Pacific Herring Discussion Group 2015). While a herring FMP is a priority for fisheries managers, it is not a "top priority", which may be a concern to funders. While there are prospects for funders to step up in the near future, it has been surprising to some that funding has taken so long to acquire. Keeping this in mind, future partnership models will need to work with CDFW to better understand agency priorities, including how NGO/outside resources can be leveraged to more effectively support the state's top priority fishery management efforts.

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Appendix 3: California's Fishery Partnerships Case Study: Reef Check California

Background

The Reef Check Foundation is an international volunteer organization dedicated to empowering people to conserve tropical coral reefs and California rocky reefs. The goal of Reef Check California (RCCA), a program of the Reef Check Foundation, is to improve California's marine resource management by utilizing citizen scientists to collect nearshore rocky reef data and make it available to resource managers, scientists, educational institutions, and the general public (Freiwald and Wisniewski 2015). Volunteer SCUBA divers are trained in the Reef Check California survey protocol, which was developed in collaboration with agency and academic scientists and is based on the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) protocols (Freiwald et al. 2013). By leveraging partnerships with community volunteers, government agencies, businesses, universities, and nonprofits, RCCA "educates, trains and engages ocean users in the collection of data describing California's nearshore rocky reefs using a community-based approach that informs marine management and creates a constituency supportive of science based management." (RCCA 2007).

Reef Check California and the California Department of Fish and Wildlife
In 2007, RCCA approached the California Department of Fish and Wildlife (CDFW) to design research questions, goals, and sampling protocols to ensure data generated by RCCA's volunteer monitoring program would be useful to marine resource managers. The partnership was formalized through a memorandum of understanding (MOU) that outlined the goals of the RCCA-CDFW partnership as (MOU, 2007):

- Developing a long-term statewide community-based subtidal monitoring network;
- Design, develop, and implement a user-friendly web-based GIS application for entering and querying marine subtidal data; and
- Maintain a collaborative and cooperative relationship for the effective collection and dissemination of data.

Through this MOU, RCCA coordinates with resource managers, scientists, stakeholders, and policymakers to develop monitoring protocols and sampling designs that are cost-effective and useful to a wide range of groups/organizations (Freiwald and Wisniewski 2015).

RCCA protocols were initially designed to be most useful to inform the adaptive management of the MLPA. Since 2007, RCCA's monitoring data have been used in the MPA baseline studies in all four MLPA regions. In addition to monitoring MPAs, this partnership also has the potential to be a cost-effective vehicle to obtain fishery-independent data and inform management of key species (per comm. Wertz). RCCA and CDFW are working together to develop new fisheries-focused monitoring protocols, and the application of RCCA data, especially in data-poor fisheries, is under consideration. More recently, RCCA data has been used to inform sea cucumber management and may be used to inform the red abalone fishery management plan (FMP) process (per comm. Freiwald).

Lessons Learned and Considerations

The following includes insights and reflections shared by Jan Freiwald, Director of Reef Check California, and Steve Wertz, Senior Environmental Scientist Supervisor with CDFW Marine Region, during informal conversations with report authors. References to personal communications were removed from the proceeding section to improve content flow.

The RCCA-CDFW partnership is a unique example of how nonprofit organizations and government agencies can support one another to fill data gaps and inform marine resource management in a cost-effective way. Establishing a MOU to formalize this partnership has helped clearly outline the goals of the partnership and each partner's roles and responsibilities, and has increased the utility of RCCA data by making it available to CDFW to support any gaps in CDFW data. The MOU was instrumental in RCCA becoming a key contributor to the MPA baseline studies in all MLPA regions throughout California. The MOU has also facilitated the diving operations of RCCA, which is overseen by CDFW's scientific diving program, and has helped RCCA utilize CDFW vessels free of charge for numerous surveys. One challenge, however, is that the MOU is very "high-level" and contains mostly general information. Since it has been nearly a decade since the MOU was created and CDFW monitoring priorities are shifting, there is a need to revisit the agreement on a regular basis to ensure data collection efforts reflect CDFW's current needs and priorities. At the same time regular updates would ensure CDFW staff is informed of RCCA's capacities and changes to its monitoring protocol.

Originally, the RCCA protocol was designed to gather information to help inform adaptive management of the MLPA. Managers have indicated RCCA data has been exceedingly useful in providing MPA baseline information, and provides a valuable inventory of rocky reefs. However, since the MOU was established, state management efforts and funding opportunities have shifted from the MLPA to the MLMA, which focuses on fisheries management priorities. Though RCCA protocols were developed in partnership with CDFW staff, specific misalignments between RCCA and more recently updated CDFW fisheries monitoring protocols now present a greater challenge to resource managers trying to align MPA based assessments with fisheries management data needs. While the RCCA-CDFW partnership continues to be useful for MPA monitoring, there is the potential for the partnership to also inform fisheries management. This would require the two organizations to reassess and potentially modify existing RCCA monitoring protocols, and discuss how to ensure RCCA data can be more aligned with CDFW fisheries management needs.

Successes and challenges associated with implementing and maintaining this partnership largely depend on open lines of communication and continued cooperation between the two organizations. In general, communication difficulties hinder the partnership's utility and value. Many CDFW staff are unaware of the availability of the RCCA data and analysis, and thus fail to use the information in their management efforts. In addition to problems with internal CDFW communications, coordination between CDFW and RCCA can also be challenging. Better RCCA-CDFW coordination coupled with stronger internal communication within CDFW could allow both organizations to participate in each other's data collection efforts, and validate and enhance use of RCCA's protocols. By improving communication the two organizations would have better opportunities to develop a rapport with one another, which could involve CDFW being more successful in using the RCCA data.

Streamlining communications can also inform how RCCA data and analyses are made available to CDFW. CDFW needs for raw vs. fully analyzed and interpreted data vary, depending on the ultimate use of the information. This can be challenging for smaller nonprofit organizations like the Reef Check Foundation that have limited staff resources to work up and tailor data delivery for specific CDFW uses. If the RCCA-CDFW partnership model were to be replicated there may be benefits to increasing each partner's capacity to support data analysis, which could be outlined in detail as part of a MOU.

In addition to making the raw data available to managers, it is also important to make the data accessible and useable to a wider audience. Historically, CDFW has lacked a central, public repository or management system for receiving outside data. This has created difficulties for CDFW managers to accept and easily use RCCA data. As a result of RCCA's involvement in MPA baseline monitoring in each MLPA region, RCCA is contractually obligated to make its monitoring data and analyses available on an online public data portal, OceanSpaces.org. However, RCCA also shares data through it's own interactive map-based data portal, www.data.reefcheck.org. CDFW acknowledges a central repository for data storage is essential to make the data broadly available, however have concerns that OceanSpaces.org may not be the appropriate online tool.

Despite the many challenges with supporting and maintaining this partnership, there is a general agreement that it mutually benefits both entities. Both parties acknowledge the value of expanding the opportunity for information gathering and sharing. RCCA's access to CDFW research vessels free of charge in return for providing data to CDFW helps provide support to CDFW when staff cannot get into the field to monitor/sample. Conversely, the agreement cuts both organizations' fieldwork costs, while validating the utility of RCCA's use of citizen scientists to support data collection efforts.

Other citizen science groups, researchers, and fishermen are looking at this RCCA-CDFW partnership as a model for future relationships with CDFW. There is a desire and intention by these entities to develop similar partnerships to help fill data gaps in fisheries management and support CDFW management efforts.

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Appendix 4: California's Fishery Partnerships Case Study: Dungeness Crab Task Force

Background

The California Dungeness crab fishery maintains an average ex-vessel value of approximately $59.6 million per calendar year with an average of 19.5 million pounds per year over the last 10 years (DCTF 2015; CDFW 2014a). With consistently strong domestic and international consumer demand, Dungeness crab is the second most productive fishery in California (Hackett et al. 2009, Rogers-Bennet and Juhasz 2014) after Market squid. The commercial fishery is managed by the California Department of Fish and Wildlife with regulations enacted by the state legislature. The fishery is separated into two management zones: Central California (the Mendocino-Sonoma county line to the Mexican border) and Northern California (the Mendocino-Sonoma county line to the Oregon border) (Fish and Game Code 8276; Fish and Game Code 8276.2). Management is approached by the "3- S" principle (sex, size, and season), which allows for the harvest of only male crabs greater than 6.25 inches from mid-November or the beginning of December until the end of June or mid-July (CDFW 2013; DCTF 2015). It is widely believed this management strategy has successfully maintained the sustainability of the fishery to date (DCTF 2015), and although there has not been a formal stock assessment on the fishery since 1982 to quantitatively confirm this assumption (Wild and Tasto 1983; CDFW 2003), research indicates a high annual rate of mating success in this male-only fishery (Dunn and Shanks 2012, Oh and Hankin 2004). In general, CDFW believes the Dungeness crab fishery is operating within a sustainable level and there are currently no resource concerns.

As of 2014, the fishery is supported by 564 commercial fishing permits, of which 445 are active and 119 are inactive.[2] There is concern about the unexploited fishing potential of inactive permits and how this could effect the long-term economic stability of the fishery (OPC 2009; DCTF 2015). There is also the recognition that unused permits are a relatively low-cost means for new participants to enter into the fishery (DCTF 2014b). A commercial trap limit program—designed by fishermen in consultation with the legislature, CDFW, scientists, and NGOs—was established and implemented in the 2013-2014 season to limit the amount of gear in the water by capping the number of traps in use at the time as the maximum, thereby helping to address latent capacity concerns (DCTF 2015).

California Dungeness Crab Task Force (DCTF)

The DCTF illustrates a novel partnership between the industry, scientists, NGOs, and fisheries managers. In 2008, a group of commercial Dungeness crab fishermen, in partnership with the Environmental Defense Fund, established an industry-led body to collaborate with California fishery managers to address capacity and effort concerns in the fishery (Dungeness Crab Steering Committee 2008; Helliwell 2009; OPC 2009). The California Dungeness Crab Task Force (DCTF) was formally adopted by the California legislature via Senate Bill (SB) 1690 (OPC 2009; DCTF 2015) as an industry-seated advisory body that would provide recommendations to inform fisheries managers. The founding legislation mandated the DCTF be administered and funded by the California Ocean Protection Council (OPC) (CA Fish and Game Code 8276.4; OPC 2009). The OPC authorized approximately $250,000 and $215,000 in 2008 and 2012,

[2] Inactive permits are those permits with less than 200lbs of landings in the previous year.

respectively to support the DCTF through 2017 (OPC 2009; DCTF 2015). The DCTF's founding legislation mandated a DCTF composition of primarily commercial fishing interests, and also includes representation from CPFV and sport fishing industries and processors; CDFW, NGOs, and California Sea Grant also hold non-voting positions (Fish and Game Code 8276.4).
The purpose of the DCTF is to review and evaluate the Dungeness crab fishery with the goal of making recommendations to fisheries managers and the legislature including "prioritize[ing] the review of pot limit restriction options, current and future sport and commercial fishery effort, season modifications, essential fishery information needs, and short- and long-term objectives for improved management" (Fish and Game Code 8276.4). Since 2010, the DCTF has drafted four reports composed of fishery management recommendations that have been valuable tools in advising the FGC, CDFW, and the California Legislature in management decisions. The most notable of those recommendations was a framework for a commercial Dungeness crab trap limit program that was ultimately adopted by the California Legislature in 2011 and implemented by CDFW for the first time in the 2013-2014 season (DCTF 2015a).

Lessons Learned and Considerations

The commercial Dungeness crab fishery consists of diverse viewpoints that have traditionally been divided by production level, vessel size, and homeport location (DCTF 2015; Fisher et al. 2010; Helliwell 2009). Identifying common interests and prioritizing ecological and socioeconomic issues across industry members can be challenging for resource managers. The DCTF provides a transparent forum to work with fisheries managers, as well as the public, and allows industry members who may have traditionally disagreed to find a common ground and develop ideas and recommendations reflective of cross-interests (Fisher et al. 2010). For example, the DCTF provided a unified voice when developing a commercial Dungeness crab trap limit program as well as generating improvements to fund crab quality testing (DCTF 2015a), both topics the fleet was historically divided on (Fisher et al. 2010; Helliwell 2009; OPC 2009).

In addition to the purposes outlined in the founding legislation, the DCTF acts as an advisory body to the California Legislature and CDFW on all matters related to the Dungeness crab fishery (DCTF 2014a). CDFW looks to the DCTF to vet ideas and considerations related to the commercial and recreational Dungeness crab fisheries (CDFW 2014b). CDFW has prioritized staff resources to attend DCTF meetings and engage with the DCTF members as a way to build relationships with the industry. Additionally, DCTF members have a more direct line of communication with CDFW and the legislature. Despite the DCTF's influence and mutually beneficial relationship with managers, the uncertainty of the DCTF's long-term functioning as a result of industry disputes and funding constraints will likely impact the effectiveness of this fisheries partnership.

Without an industry-identified issue that the entire fleet believes would benefit by a unified front, it can be challenging for fisheries managers to suggest management changes absent a concern with the viability of the Dungeness crab stock. Following the implementation of the trap limit program, long-standing divides within the fishery have re-emerged as the DCTF begins to address issues that affect regional differences and priorities (e.g., crab quality testing, unbalanced effort early in the season). Some members have recently questioned the current make-up of the

DCTF and their concern that the DCTF is not representative of the composition of the commercial fleet (DCTF 2014a). Funding constraints (DCTF 2015a) and legislative timelines have made it unfeasible to adjust the DCTF's structure at this time (DCTF 2015a; DCTF 2014b). More recently, however, new issues are arising that require collaborative, regional efforts between industry, fisheries managers, scientists, and NGOs to successfully address (e.g. whale entanglements, development of a lost gear recovery program, etc.). These unifying topics have re-emphasized the valuable role the DCTF plays in undertaking these fishery-wide issues, in partnership with CDFW and others.

Since the DCTF is a legislatively mandated body, it is subject to the Bagley-Keene Open Meetings Act (Open Meetings Act), which requires meetings of public bodies and the work of the officials involved in those meetings be open to public scrutiny (CA Government Code sections 11120-11132). The Open Meetings Act has instilled a high level of transparency in the DCTF – all meetings are open to the public and all informational materials shared with the DCTF are also available to the public via the DCTF webpage (DCTF 2015b). However, the Open Meetings Act also prohibits DCTF Members from entering into serial conversations between meetings, which has caused some challenges for the body. DCTF members have struggled with being unable to converse with their colleagues between meetings on Dungeness crab fishery management topics, including creative idea generating, ahead of full deliberations by the DCTF.

Limited funding restricts the DCTF's ability to inform decision-making processes (e.g., conduct/fund research to provide managers with information to support an evaluation of the trap limit program) and support maintenance of the DCTF's structure (e.g., new elections). OPC's current $215,000 budget funds five years of limited DCTF operations (2012-2017) (DCTF 2014c, DCTF 2015a). Over the years, the DCTF has requested work beyond the DCTF's current scope and budget, including additional meetings, elections for empty seats, industry-wide opinion polls, and research and monitoring to inform their efforts (Fisher et al. 2010; DCTF 2014a; DCTF 2014b). Although the DCTF's evaluation of the trap limit program was identified as a priority by the legislature and CDFW (Fish and Game Code 8276.4), the lack of available monitoring data to inform that evaluation and other proceedings of the DCTF has caused frustration within the industry (Fisher et al. 2010; DCTF 2014; DCTF 2014b). At the same time, the pending expiration of OPC funding in 2017 offers an opportunity to revisit the DCTF's structure and representation to help ensure future membership is representative of the fleet, as well as evaluate how the DCTF's work can continue to be useful to CDFW (DCTF 2014b).

Looking ahead to any future industry-led organization that may succeed the DCTF, sufficient flexibility will need to be built into the DCTF to regularly evaluate the make-up of the body as fleet dynamics change and evolve. Securing sustainable funding will be key to sufficiently support meetings, elections, research and monitoring, while also having additional funds to respond to unforeseen issues that are deemed a priority by fisheries managers or the industry (e.g., whale entanglements). Long-term goals of any future industry-led organization will need to be identified up front, which may include providing recommendations to fishery managers and improving marketing capabilities. In order to manage and support future efforts, a neutral administrative team that is experienced in facilitation, communication, policy, fisheries management, and negotiation will be an important component to supporting successful

outcomes. By addressing these issues, any future industry-led organization will be well suited to represent the Dungeness crab fishery and work in partnership with fisheries managers to effectively support fishery management efforts.

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