The Marine Life Management Act: A Preliminary Policy Assessment of Six California Fisheries
How to cite this report

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<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>1</td>
</tr>
<tr>
<td>Background</td>
<td>1</td>
</tr>
<tr>
<td>Content</td>
<td>2</td>
</tr>
<tr>
<td>Process</td>
<td>3</td>
</tr>
<tr>
<td>Key Observations</td>
<td>4</td>
</tr>
<tr>
<td>Key Management Practices</td>
<td>5</td>
</tr>
<tr>
<td>Conclusion</td>
<td>11</td>
</tr>
<tr>
<td>California Halibut</td>
<td>13</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>13</td>
</tr>
<tr>
<td>Enabling Authorities and General Regulatory Structure</td>
<td>14</td>
</tr>
<tr>
<td>Brief Snapshot</td>
<td>15</td>
</tr>
<tr>
<td>Meeting the Goals and Requirements of the MLMA</td>
<td>19</td>
</tr>
<tr>
<td>Fishery-Specific Challenges and Opportunities</td>
<td>33</td>
</tr>
<tr>
<td>Conclusion</td>
<td>35</td>
</tr>
<tr>
<td>Dungeness Crab</td>
<td>37</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>37</td>
</tr>
<tr>
<td>Brief Snapshot of the Fishery</td>
<td>38</td>
</tr>
<tr>
<td>Enabling Authorities and General Regulatory Structure</td>
<td>42</td>
</tr>
<tr>
<td>Meeting the Goals and Requirements of the MLMA</td>
<td>46</td>
</tr>
<tr>
<td>Fishery-Specific Challenges and Opportunities</td>
<td>56</td>
</tr>
<tr>
<td>Conclusion</td>
<td>57</td>
</tr>
<tr>
<td>Market Squid</td>
<td>59</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>59</td>
</tr>
<tr>
<td>Enabling Authorities and General Regulatory Structure</td>
<td>61</td>
</tr>
<tr>
<td>Brief Snapshot of the Fishery</td>
<td>62</td>
</tr>
<tr>
<td>Meeting the Goals and Requirements of the MLMA</td>
<td>66</td>
</tr>
<tr>
<td>Fishery-Specific Challenges and Opportunities</td>
<td>84</td>
</tr>
<tr>
<td>Conclusion</td>
<td>85</td>
</tr>
<tr>
<td>Nearshore</td>
<td>86</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>86</td>
</tr>
<tr>
<td>Enabling Authorities and General Regulatory Structure</td>
<td>88</td>
</tr>
<tr>
<td>Brief Snapshot of the Fishery</td>
<td>91</td>
</tr>
<tr>
<td>Meeting the Goals and Requirements of the MLMA</td>
<td>99</td>
</tr>
<tr>
<td>Fishery-Specific Challenges and Opportunities</td>
<td>118</td>
</tr>
<tr>
<td>Challenges to Implementation</td>
<td>121</td>
</tr>
<tr>
<td>Conclusion</td>
<td>122</td>
</tr>
<tr>
<td>Pacific Herring</td>
<td>123</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>123</td>
</tr>
<tr>
<td>Enabling Authorities and General Regulatory Structure</td>
<td>124</td>
</tr>
</tbody>
</table>
Overview

Background

The Marine Life Management Act (MLMA or the Act), enacted in 1998, was designed to modernize California’s management of its ocean fisheries, and in several respects its implementation has been transformative. The MLMA is based in part on the federal Magnuson-Stevens Fishery Conservation and Management Act, making the management of joint jurisdiction fisheries relatively easier. However, some features of the MLMA have presented challenges in practice. For example, a significant constraint on the application of the MLMA is that the Act allows the Legislature to retain complete or partial jurisdiction over a number of important fisheries, setting them apart from the conservation standards, constituent involvement, and transparency provisions of the Act. In addition, state fisheries managers, California Fish and Game Commissioners, and the fishing community at-large have been faced with key challenges, including data gaps, high compliance costs, and funding and capacity constraints. These barriers have also restricted the broad development and implementation of fishery management plans (FMPs), which are envisioned by the Act to be the California’s primary fisheries
management tool. Meeting the FMP requirements within the MLMA has taken an enormous amount of time and resources, with only a handful of state fisheries currently managed under FMPs.

To review and analyze the requirements of the MLMA and begin to understand how the Act is implemented in practice, the Center for Ocean Solutions (the Center) conducted a preliminary policy assessment of six state-managed ocean fisheries in California. These analyses were sponsored by the Resources Legacy Fund (RLF) between August and December 2013, with the overarching goal of identifying and characterizing how California’s current regulations and policies reflect the MLMA’s goals and requirements. The Center reviewed how the Department of Fish and Wildlife (Department) and the Fish and Game Commission (Commission) interpreted key provisions of the MLMA through the lens of a subset of economically and geographically important state-managed fisheries, three of which are managed under FMPs and three of which are not.

Content

The reviews in this report include the Department and the Commission’s interpretation of the MLMA’s goals and requirements as evidenced in the White Seabass Fishery Management Plan (WSFMP), the Nearshore Fishery Management Plan (NFMP), the Market Squid Fishery Management Plan (MSFMP), and their corresponding regulatory actions. The reviews also encompass descriptions of the regulatory management of three additional fisheries managed without FMPs under the MLMA (California halibut, Dungeness crab, and Pacific herring). Only six fisheries were assessed due to the compressed project timeline, and these six, in particular, were selected because they represent varied approaches to management and are among the most economically and geographically important to California.

The Center reviewed the management structures of six fisheries to:

• Increase collective knowledge of how fisheries are managed in California;
• Identify pathways by which certain provisions of the MLMA might be further incorporated into management actions, where appropriate;
• Pinpoint possible opportunities for innovations in application of the law; and
• Identify challenges, barriers, and opportunities present within the management system.
These policy reviews specifically describe how the fishery management plans and regulatory strategies of the six fisheries address the MLMA’s overarching goals of ensuring the conservation, restoration, and sustainable use of California’s marine living resources. The reviews do not provide a full timeline of implementation of the MLMA or complete accounting of any given fishery’s regulatory history.

**Process**

The Center reviewed how the Department and the Commission have interpreted key provisions of the MLMA by examining ten select MLMA management goals and requirements (Box 1), and identifying the management tools deployed to achieve and implement these goals and requirements in each of the six fisheries. In addition to the FMPs and relevant statutes and regulations, the Center examined the FMP Master Plan, the MLMA Lessons Learned Report, California Ocean Science Trust’s Rapid Assessments for Selected California Fisheries, the Status of the Fisheries Reports, available documents posted to the Department’s webpage, and public comments generated during FMP, regulatory drafting and adoption processes. We also consulted with over 15 Department staff to gain further insight into details of each fishery and MLMA implementation and receive feedback on early drafts of our research and reviews.

**Box 1.**
Select MLMA goals and requirements:
1. Conserve entire ecosystems
2. Recognize non-consumptive values
3. Allow only those activities that are sustainable for resources and fisheries
4. Maintain, restore or enhance habitat
5. Restore depressed fisheries
6. Minimize bycatch
7. Minimize adverse effects on fishing communities
8. Employ adaptive management
9. Establish an external program for peer-review
10. Facilitate collaboration & stakeholder involvement
Key Observations

The Center identified several key observations during the review drafting process:

• Department staff possess vital institutional knowledge and deep understanding of California’s fisheries. Their active engagement was necessary to ensure our research and regulatory interpretations were complete and accurate; however, carefully optimizing their involvement was necessary given competing Department priorities.

• The statutory and regulatory fisheries management structure in California is extremely complex. Any given fishery may be regulated under a variety of statutes (in the Fish & Game Code) or regulations (in the California Code of Regulations), with language relevant to that fishery located in numerous Code sections. In addition to making it generally difficult to understand how the fishery is managed, this complexity can also lead to regulatory gaps and contradictions, or redundancies when also addressing federal management needs.

• In general the six fisheries we reviewed demonstrate challenges and variation in their incorporation of ecosystem-based considerations into management. For example, the managed species’ role in the ecosystem is often left general or undefined in management documents. In circumstances where higher volumes of information are available about the managed species’ role as a predator or a forage species, its role may be included in the management documents, but identifying how that information has been connected directly to management decisions remains a key challenge for managers with the exception of market squid and to a lesser degree Pacific herring.

• Some fisheries are reviewed (e.g., stock status, annual harvest levels, in-season monitoring, quota management, etc.) and adaptively managed more often than others. The level and frequency of review for state-managed fisheries ranges significantly, with some fisheries reviewed yearly, and others with much less clarity as to when the fishery management approach will be revisited and management measures (or fishery management plans) adjusted.
Key Management Practices

In addition to the above observations, the Center also identified a variety of management practices currently utilized within the aforementioned six fishery management structures that might be worth adapting for other fisheries.

1. Sustainable resource measures. The Department utilizes several practices focused specifically on managing sustainable resources, such as conducting stock assessments, setting appropriate harvest limits and implementing habitat protection measures. Some California fisheries, such as herring, nearshore species managed under the NFMP, and market squid managed under the MSFMP, use annual catch limits (ACLs). For the nearshore species complex, 10-year projections are generated for species that have been assessed, providing guidance for future harvest rates. ACLs can then be specified for future years in the absence of assessments. While conducting routine stock assessments is not feasible for each fishery because of capacity, cost and, in certain cases, biological reasons, a prioritization protocol could facilitate resource sustainability. For example, risk assessment tools could be applied to inform prioritization, which could then be used to focus management resources to address the most at risk fisheries and/or those fisheries where active intervention could yield the greatest results. One key habitat-based sustainability measure is the requirement for “light touch” trawl gear in the

1 The requirements for “light touch” trawl minimizes impact on soft bottoms and consist of: headrope not exceeding 90 feet in length, thickness of the webbing of the net not exceeding 7 millimeters in diameter, each trawl door weighing no more than 500 pounds, chain attached to the footrope not exceeding one
California Halibut Trawling Grounds, aimed at protecting soft bottom habitats while also reducing bycatch.

2. The Points of Concern and Socioeconomic Processes. The WSFMP framework includes both a Points of Concern Process and a Socioeconomic Process that supply the Commission with specific indicators of when a management change may be necessary. The Points of Concern Process lists five ecological elements that, when identified, trigger a review by the White Seabass Management Team (WSMT) to determine if a resource conservation issue exists. If an issue does exist, the WSMT recommends management measures to address the issue to the Commission. The Commission analyzes how the action will address the issue, likely impacts on other management measures and other fisheries, and economic impacts. This monitoring and evaluation policy exemplifies how adaptive management can be integrated to improve understanding and decision-making. Through the Socioeconomic Process outlined in the WSFMP, the Commission may evaluate the need for a management action to address a social or economic issue, either independently or by request. If a management action is necessary to address the issue, the Commission or WSMT must generate a report that includes a discussion on economic impacts, particularly cost to the fishing industry, and how the action is expected to accomplish at least one of a number of goals. However sufficient socioeconomic data are frequently not available. In fact, the need for a common framework for collection, analysis, and integration of social science data into fisheries management has been highlighted a number of times by academic scholars and practitioners.

3. Stakeholder engagement. Some Advisory Committees and Task Forces contribute to the MLMA’s stakeholder involvement goals and requirements. The Director’s Herring Advisory Committee (DHAC) and the Dungeness Crab Task Force (DCTF) are two such examples. The DHAC is a group of 26 representatives from the herring fishery that makes recommendations to the Department and Commission relating to herring management decisions. The relationship between the DHAC and Commission has been so effective at incorporating stakeholder comments and minimizing adverse effects on fishing communities that fishermen did not attend the August 2013 Commission meeting, when decisions relating to the 2013-14 season were made. Undertaking a similar role, the DCTF was established by the California legislature in 2009 and is composed of various stakeholders who can evaluate and inform more effective regulations in the Dungeness crab fishery. The Task Force undertakes stakeholder involvement by including members from industry, government, and non-governmental

quarter inch in diameter of link material, and no use of rollers or bobbins on any part of the net or footrope. Cal. Code Regs. tit. 14 § 124(b)(1)-(5).
organizations (NGOs) and by holding public meetings in regions along the coast. The legislature ultimately decides whether the Task Force’s recommendations are incorporated into management, but certain programs the Task Force has proposed have been accepted and implemented in the past. While advisory bodies can be a useful method for stakeholder engagement, they represent only one of several strategies for involving stakeholders in decision-making. In fact, several other effective means of partnering with stakeholders could be utilized more broadly in California fisheries management. Strategies that have been effective within some management processes include the use of key communicators, management participation in association meetings, education programs, listening sessions (a series of informal meetings in under-reached communities in which managers ask stakeholders for input, also called ‘port meetings’), social media, and websites.

4. **Timely evaluation and review of best available science.** A clear MLMA objective is to manage “on the basis of the best available scientific information.” Determining sustainable harvest levels requires resource intensive research efforts, which the Department achieves through surveys and stock assessments. The more frequently these limits are updated to reflect emerging science, the more effective the limits can be used to achieve sustainable catch levels. For example, the Department’s use of biomass estimates to set precautionary annual quotas has contributed to a more sustainably managed herring fishery. Each year, the Department estimates spawning stock biomass and age class structure for the herring population of San Francisco Bay through fisheries independent stock assessment techniques. Since 2010, the Department has recommended precautionary quotas at less than 5% of the previous year’s spawning biomass. Setting precautionary exploitation rates based on the best available science helps to “ensure adequate protection of the herring resource while taking into account accidental overages and other management uncertainties” including environmental variability.

5. **Adaptive management.** The degree of adaptive management applied in California varies widely among the six fisheries we studied. When the effectiveness of management measures is reviewed frequently and the capacity to incorporate new science and stakeholder considerations exists, adaptive management is feasible and can work well. For example in the herring fishery, the annual management review and in-season monitoring process makes that commercial fishery one of the most adaptively

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2 Cal. Fish & Game § 7056(g).
managed fisheries in California, providing an effective framework for a more sustainable fishery. In addition to regular quota updates, as described above, “management recommendations to improve or provide for the efficient harvest and orderly conduct of the herring fisheries are solicited from interested fishermen, individuals at public meetings, and the DHAC.”

Management of the nearshore fishery is also adaptive, primarily because of dedicated in-season monitoring which allows the Department to take regulatory action as needed (e.g., close a fishing season early). Adaptive management is not widely in place because of the additional staff resources it requires. However, as the herring and nearshore fisheries illustrate, adaptive management approaches can contribute significantly to sustainability when applied.

6. Regional Management. Many of California’s fisheries are managed at local to regional scales based on distinct biogeography. However of the coast-wide fisheries, only the NFMP recognizes significant geographical differences and proposes regional management tailored to specific conditions along the coast. Four nearshore fishery regional management areas have been designated in California waters based on public input. This approach aligns regional management areas with distinct geographic features or biological differences, such as local species composition in a management area. Due to budget and staffing constraints, the regional management system has not yet been fully implemented. However, this regional management approach is unique among fisheries with coast-wide distributions and has the potential to better meet socio-ecological needs based on distinct geographies in the fishery.

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4 2013 FSED, 2-10.
7. Multi-species and cross-jurisdictional management. Fishes are not constrained by political boundaries and take part in complex ecosystem interactions. Accordingly, state fisheries managers have implemented measures that encourage multi-species and cross-jurisdictional management. For example, to encourage ecosystem-level management, the MLMA and the NFMP require a shift from focusing on individual populations to the sustainability and resilience of an entire nearshore ecosystem, differentiating among regions that vary biogeographically. With a similar goal in mind, the Tri-State Committee for Dungeness crab was established to address Dungeness crab management across jurisdictions and allows coordination of fishery management across state lines. A specific achievement of the Committee is the joint implementation of the pre-season crab quality test to ensure that crabs are ready for harvest on the target opening date. Examples of joint federal-state fisheries management include the nearshore, market squid, and Pacific halibut fisheries. While the fisheries managed jointly by California and the Pacific Fisheries Management Council (PFMC) exhibit challenges, joint management can increase capacity and enhance consistency in management for species that cross state-federal waters. Although multi-species and cross-jurisdictional management are not directly related and do not address the same issues, they both can contribute to a shift towards a broader, more ecosystem-based, cooperative and comprehensive approach to fisheries management.
8. Matching Capacity to Resource Availability and Effort Limitation. A variety of methods for limiting access to state-managed fisheries exist, many with the ultimate goal of capacity reduction. For example, the nearshore FMP establishes a two-for-one rule for granting of permits. New entrants to the fishery are allowed on the condition that they purchase two permits and retire one. This method reduces overall fishing effort (in an effort to improve fishery sustainability for individual participants) and impact of the fishery while still allowing new fishermen to get involved. Another example is the market squid’s Restricted Access Program and capacity goals—developed pursuant to the Commission’s Restricted Access Policy. In the 2004/2005 fishing season the commercial market squid fleet was identified as “capable of harvesting more squid than is available under current or likely future biomass conditions”\(^5\) and a restricted access program was designed to slowly “reduce the number of [permitted] vessels in order to achieve the capacity goal”\(^6\) while minimizing disruption of the fishery. Effort is additionally limited in the commercial Dungeness crab fishery through a cap on the total number of traps allowed, in place since 2013. While such strategies can effectively lower fishing pressure, they are also a primary concern of fishermen, and thus can be a point of contention for the Department.

\(^6\) MSFMP, 1-68.
Conclusion

The six fisheries reviews found in this report showcase the diversity of fisheries managed in California, and increase our collective knowledge of the processes, tools, challenges, and barriers that exist for fisheries managers. The six reviews that follow could be extended to ascertain whether MLMA requirements have actually been successfully implemented in each of the fisheries by more fully examining their regulatory histories. In addition, as mentioned above, developing a more systematic, semi-quantitative, approach to reviewing how state- or jointly-managed fisheries are meeting the goals and requirements of the MLMA is an opportunity for further exploration, and could allow fisheries management strategies to be more objectively measured. For example, tools such as performance metrics can potentially be used to more quantitatively measure how well certain management goals are being met.

The six fishery reviews that follow were developed with significant information and feedback from Department staff. The reviews provide a close examination of how each fishery management plan or alternative strategy addresses the MLMA’s policy 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” (encompassed in Ten goals, Box 1). Each review also contains a detailed description of its management structure, followed by an analysis of how the fishery’s management reflects the MLMA’s goals and requirements.

We hope that the reference information included here provides an overview and foundation for understanding how the Department is managing California halibut, Dungeness crab, market squid, the nearshore complex, Pacific herring, and white seabass—under the requirements and goals of the MLMA. We also hope the reviews provide a useful focus for further research, answer preliminary questions, and lead to future productive conversations.

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7 Cal. Fish & Game § 7050(b).
California Halibut

**Executive Summary**

The California halibut fishery is managed through adoption of regulations by the California Fish and Game Commission (Commission)\(^8\) which are implemented and enforced by the California Department of Fish and Wildlife (Department).\(^9\) Commercial trawling within State waters is only allowed in the California Halibut Trawling Grounds (CHTG),\(^10\) and the Department controls commercial catch through limited-entry permits for trawling and gill netting,\(^11\) the establishment of a minimum legal size\(^12\) for halibut, and restrictions on gear\(^13\) and area.\(^14\) Commercial trawling in federal waters is governed by regulations associated with the federal groundfish fisheries management plan (FMP), such as observer requirements.\(^15\) Recreational fishing for halibut, which requires a valid sport fishing license, has no area restrictions except within certain Marine Protected Areas (MPAs),\(^16\) and the Department controls recreational catch through daily bag and possession limits,\(^17\) and minimum size restrictions.\(^18\)

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\(^8\) Cal. Fish & Game § 8841(b)(1).


\(^10\) Cal. Fish & Game § 8495.

\(^11\) Cal. Fish & Game § 8494(a).

\(^12\) Cal. Code Regs. tit. 14 § 28.15(b); Cal. Fish & Game § 8392.


\(^14\) Cal. Code Regs. tit. 14 § 124(a); Cal. Fish & Game § 8495(c).


\(^16\) Cal. Code Regs. tit. 14 § 632(b).


This document provides a preliminary and foundational overview of how California halibut are managed. It specifically discusses how the management of the fishery reflects certain overarching goals of the Marine Life Management Act (MLMA). The regulatory scheme of the California halibut fishery addresses the goals of MLMA in several ways. The Commission must minimize the effects on bycatch and sea floor habitat when determining which areas are appropriate to keep open as the CHTG and requires the use of “light touch” trawl gear within the CHTG to minimize the impact on soft-bottom habitats. The Department performed a stock assessment for California halibut in 2011 that included peer review by a panel of experts. This stock assessment used extensive data to determine a value for MSY that reduces the risk of overharvesting halibut biomass. Though the stock assessment contains a significant amount of information, more data is necessary to make management decisions based on a comprehensive understanding of the ecosystem in support of the broader ecosystem-based goals of the MLMA.

Enabling Authorities and General Regulatory Structure
The California halibut fishery is managed by the State but not under a state FMP; the Commission is tasked with adopting regulations for management, while the Department implements and enforces those regulations. In the past, the California State Legislature has occasionally enacted laws which directly influence the management of the halibut fishery, and which are codified in the California Fish and Game Code. To manage the commercial fishery, the Department has established

19 Cal. Fish & Game § 8495(d).
23 See generally SA Background Information.
25 Cal. Fish & Game § 7050(b)(1).
26 Cal. Fish & Game § 8841(b)(1).
27 Rapid Assessments, 36.
limited-entry permits for some gear types,\textsuperscript{28} minimum size restrictions,\textsuperscript{29} gear restrictions,\textsuperscript{30} and area restrictions.\textsuperscript{31} Similarly, the Department manages the recreational fishery through daily bag and possession limits\textsuperscript{29} and minimum size restrictions.\textsuperscript{33} Though vessels may land limited quantities of California halibut with a federal limited entry trawl permit,\textsuperscript{34} the federal government does not manage the California halibut fishery.\textsuperscript{35} Under the federal groundfish FMP, California halibut are not considered a target species\textsuperscript{36} nor are they considered subjects of the bycatch minimization measures.\textsuperscript{37} However, individuals trawling for California halibut with a federal permit are subject to other regulations associated with the federal groundfish FMP, such as observer and gear requirements.\textsuperscript{38}

**Brief Snapshot**

**Who is fishing?**

Both commercial and recreational sectors fish for California halibut. For the commercial trawl fishery, an individual may fish with a federal limited entry groundfish trawl permit,\textsuperscript{39} a state permit,\textsuperscript{40} or both.\textsuperscript{41} If an individual only has the federal trawl permit, he or she may land up to 150 pounds of halibut per trip without obtaining a state permit.\textsuperscript{42}

\textsuperscript{28} Cal. Fish & Game § 8494(a).

\textsuperscript{29} Cal. Code Regs. tit. 14 § 28.15(b); Cal. Fish & Game § 8392.

\textsuperscript{30} Cal. Code Regs. tit. 14 § 124(b).

\textsuperscript{31} Cal. Code Regs. tit. 14 § 124(a); Cal. Fish & Game § 8495(c).


\textsuperscript{34} Cal. Fish & Game § 8494(f).

\textsuperscript{35} Pacific Fishery Management Council, Final Environmental Assessment for Trailing Actions for the Pacific Coast Groundfish Trawl Rationalization Program 26 (Oct. 2011).

\textsuperscript{36} 50 C.F.R. §660.11.


\textsuperscript{38} 50 C.F.R. §§ 660.310-660.333.

\textsuperscript{39} Cal. Fish & Game § 8494(f).

\textsuperscript{40} Cal. Fish & Game § 8494(a).

\textsuperscript{41} Rapid Assessments, 36.

\textsuperscript{42} Cal. Fish & Game § 8494(f).
If the individual does not have a federal permit or lands more than 150 pounds of halibut per trip with a federal permit, California law requires him or her to possess a California Halibut Bottom Trawl Vessel Permit (CHBTVP). The CHBTVP is a limited-entry permit that must be renewed annually, and the Department is not issuing any new permits at this time. If the individual possesses both the federal and the State trawl permit, the individual may alternate the use of the permit. In such case, whichever permit the individual decides to use for a trip dictates which regulations would apply to the individual for that trip. For recreational fishing of California halibut, an individual must obtain an annual sport fishing license from the Department or an authorized license sale agent. However, a license is not required for fishing from public piers, breakwaters, and jetties, within registered aquaculture facility sites, and during two free fishing-days per year.

**What do they fish?**

California halibut must be at least 22 inches in total length in order for an individual to take the fish, whether commercially or recreationally. In addition, the minimum size requirement also applies to possession or sale of the fish in the commercial sector. The commercial sector consists of a live and dead halibut fishery. In southern California,

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43 Cal. Fish & Game § 8494(a).
44 Cal. Fish & Game § 8494(a).
45 Cal. Fish & Game § 8494(b). As of 2013, there are 48 CHBTVPs issued. Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).
46 Rapid Assessments, 36.
48 Cal. Fish & Game § 7145.
49 Cal. Fish & Game § 7153.
50 Cal. Fish & Game § 7149.7.
51 Cal. Fish & Game § 8392.
53 Cal. Fish & Game § 8392.
54 Rapid Assessments, 30-31.
the live halibut fishery has been active since 1990\textsuperscript{56} because the infrastructure exists to allow a live fish fishery, and live halibut can be priced higher than if landed dead.\textsuperscript{57}

**Where do they fish?**

Commercial trawling within State waters is restricted to the CHTG.\textsuperscript{58} In federal waters, trawling can occur anywhere except in certain closed areas.\textsuperscript{59} Commercial gillnet fishing is only permitted in southern California,\textsuperscript{60} federal waters and offshore (at least 1 mile from shore or 70 fm of depth) of the Channel Islands.\textsuperscript{61} Commercial hook-and-line fishing generally occurs in shallow nearshore waters, including the San Francisco Bay Estuarine Complex.\textsuperscript{62} Recreational fishing generally takes place from shore, private/rental skiffs, and commercial passenger fishing vessels (CPFV),\textsuperscript{63} with most of the recreational fishery catch originating from private/rental skiffs.\textsuperscript{64} In addition, some scuba divers and free divers may use spear guns or pole spears.\textsuperscript{65} Recreational fishing for California halibut is allowed in all marine and estuarine waters except in certain MPAs as long as the individual possesses a valid sport fishing license.\textsuperscript{66} Within the MPAs, categorical recreational fishing for certain species, including California halibut, may be allowed within either State Marine Conservation Areas or State Marine Parks.\textsuperscript{67}


\textsuperscript{57} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).

\textsuperscript{58} Cal. Fish & Game § 8495.

\textsuperscript{59} 50 C.F.R. § 660.330(a).

\textsuperscript{60} Cal. Fish & Game § 8664.5; Cal. Fish & Game § 8664.8.

\textsuperscript{61} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (July 2014).

\textsuperscript{62} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).

\textsuperscript{63} Rapid Assessments, 32.


\textsuperscript{65} Rapid Assessments, 32.

\textsuperscript{66} Cal. Fish & Game § 7145.

When do they fish?
Both the commercial and recreational halibut fisheries have legal or environmental season constraints. Commercial fishing for California halibut has no closed season as a general matter. However, the use of trawl gear is prohibited from March 15 to June 15 within the CHTG, in effect providing a seasonal closure. Recreational fishing is open year round, though California halibut are generally more available from spring through fall because California halibut move from deeper to shallower water in the spring and return to deeper water in the fall.

How do they fish
Commercial and recreational fisheries use similar but also different types of gear depending on the location of the fishery. In the commercial fishery, California halibut are taken primarily using trawl, hook-and-line, and set gillnet, with trawling as the most effective method. To trawl within the CHTG, the law requires a minimum mesh size of 4.5 inches in the panels of the net, a minimum mesh size of 7.5 inches for the cod end, and the use of “light touch” trawl gear. In federal waters, the use of trawl nets must conform to federal groundfish regulations adopted through the Magnuson Fishery Conservation and Management Act. In addition to trawling, southern California fishermen use bottom set gillnets, which have a requirement of mesh size at

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only at specified locations); Cal. Code Regs. tit. 14 § 632(b)(39)(D)-(E) (fishing for scientific or educational purposes allowed).

68 Cal. Fish & Game § 8391.
69 Cal. Fish & Game § 8496(a).
72 SA Background Information, A2.
75 Cal. Fish & Game § 8831.
76 Cal. Fish & Game § 8843.
77 Cal. Code Regs. tit. 14 § 124(b)
79 Rapid Assessments, 30.
least 8.5 inches\textsuperscript{80} and area restrictions that prohibit set net gear in 60 fm or less in all waters north of Point Arguello.\textsuperscript{81} For recreational fisheries, most individuals use hook-and-line gear, although scuba divers and free divers also use spear guns or pole spears.\textsuperscript{82}

**How much can they fish?**

The commercial and recreational sectors of California halibut fisheries have different regulatory catch limits. For the commercial California halibut fishery, the majority of the landings in the State are trawl-caught pursuant to the State or federal permit.\textsuperscript{83} If an individual only has a federal permit, the individual may land up to 150 pounds of halibut per trip without the State permit.\textsuperscript{84} If an individual has the State permit, he or she has no catch limit. However, the Department no longer issues new permits for the gillnet and trawl fisheries.\textsuperscript{85} For recreational fishermen, there are daily bag and possession limits depending on the area. For areas north of Point Sur, an individual may land and possess up to three fish per day.\textsuperscript{86} For areas south of Point Sur, an individual may land and possess up to five fish per day.\textsuperscript{87}

**Meeting the Goals and Requirements of the MLMA**

The MLMA contains goals to guide the sustainable management of fisheries. Many of the goals are broad and a great deal of overlap exists among them. The primary goals include: conserve entire ecosystems,\textsuperscript{88} recognize non-consumptive values,\textsuperscript{89} allow only those activities that are sustainable,\textsuperscript{90} maintain, restore, or enhance habitat,\textsuperscript{91} restore depressed fisheries,\textsuperscript{92} minimize bycatch,\textsuperscript{93} minimize adverse effects on fishing

\textsuperscript{80} Cal. Fish & Game § 8625(a).
\textsuperscript{81} 2009 Cal. COFI Report, 31.
\textsuperscript{82} *Rapid Assessments*, 32.
\textsuperscript{83} *CHTG Report*, 4.
\textsuperscript{84} Cal. Fish & Game § 8494(f).
\textsuperscript{85} *Rapid Assessments*, 36.
\textsuperscript{88} Cal. Fish & Game § 7050(b)(1).
\textsuperscript{89} Cal. Fish & Game § 7050(b)(3).
\textsuperscript{90} Cal. Fish & Game § 7050(b)(2).
\textsuperscript{91} Cal. Fish & Game § 7055(b).
\textsuperscript{92} Cal. Fish & Game § 7055(b).
communities, establish processes for adaptive management, establish a program for external peer review, and ensure collaboration and stakeholder involvement. This review is meant to be preliminary and foundational and therefore is not a comprehensive analysis of every goal and objective found within the MLMA. We focus on the listed above goals because they encapsulate several other specific goals listed in sections 7050 and 7056 of the Act. For example, the best available science requirement is reflected in the goals of restoring depressed fisheries, ensuring adaptive management and sustainability, conserving entire ecosystems, and the goal of establishing a peer review process.

Though the MLMA requires that FMPs form the primary basis for managing the State’s marine fisheries, current management of California halibut remains consistent with these goals without a formal FMP. Management measures such as gear limitations, seasonal closures, and closed areas are intended to avoid overfishing, and minimize habitat impacts and other adverse ecosystem effects of California halibut fishing activities. However, several opportunities to continue to address the MLMA’s goals remain.

**Conserve entire ecosystems [e.g., Fish and Game Code §7050(b)(1)]**
The MLMA recognizes that the health of fish populations is closely related to the health of their ecosystem. “Maintaining the health of marine ecosystems is key to productive fisheries and non–consumptive uses of marine living resources.” The MLMA broadly requires that entire ecosystems be conserved. Even without a formal FMP, California halibut management should contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.” Similar to requiring sustainability,

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93 Cal. Fish & Game § 7056(d).
94 Cal. Fish & Game § 7056(i-j).
95 Cal. Fish & Game § 7056(g), (l).
96 Cal. Fish & Game § 7062.
97 Cal. Fish & Game § 7056(h), (k).
100 Cal. Fish & Game § 7050(b)(1).
101 Cal. Fish & Game § 7084(a).
conserving entire ecosystems is an overarching goal that encompasses many of the other goals and objectives of the MLMA.

Current California halibut management measures reduce potential impacts on the ecosystem and conserve entire ecosystems by limiting the number of vessels that can fish and restricting the gear to minimize habitat disturbance. To limit the number of trawl vessels that can fish, the Department requires a limited-entry CHBTVP for individuals landing more than 150 pounds of California halibut per trip. The Department also requires the use of “light touch” trawl gear within the CHTG to minimize habitat disturbance. (See more on this below under the “Maintain, restore, or enhance habitat” goal.)

Also, the Department’s California halibut trawl closures within the CHTG reflect the MLMA’s goal to conserve entire ecosystems by only allowing trawling in areas that will not “adversely affect[] ecosystem health.” Within state waters, the Department restricts trawling activities by only allowing them within the CHTG and ensures compliance through a mandatory vessel monitoring system. While some trawl closures are due to legislative mandates driven by a variety of reasons, they may also result in reduced impacts on the ecosystem. The Department recognizes that an ecosystem approach to conservation “must take into consideration the constantly changing climate-driven physical and biological interactions in the ecosystem, the trophic relationships between fished and unfished elements of the food web, the adaptation potential of life history diversity, and the role of humans as predators and competitors.” While there is no evidence that the current regulations directly address the impacts of California halibut fishery to the entire ecosystem, the current measures “indirectly promote a healthy ecosystem by reducing potential fishery impacts on the system.” (See more on this below under the “Maintain, restore or enhance habitat” and “Minimize bycatch” goals.)

102 Cal. Fish & Game § 8494(a).


104 Cal. Fish & Game § 8495(c)(1).

105 Cal. Code Regs. tit. 14 § 124(a); Cal. Fish & Game § 8495(c).

106 CHTG Report, 5.

107 S.B. 1459 Cal. Legis. Serv. Ch. 721 (West).


109 CHTG Report, 28.
The completion of a network of MPAs in 2012 along the California coast adds to the goal of protecting portions of entire ecosystems. Within State waters, excluding the San Francisco Bay Estuarine complex, there are 70 MPAs (either SMRs or SMCAs) each with at least 1 nm² of soft bottom habitat in waters less than 300 feet (i.e., California halibut habitat),[110] and which prohibit the take of halibut.[111] Thirteen of these have greater than 10 nm² of soft bottom habitat each, and they are distributed throughout the State. These 70 MPAs contain approximately 465 nm² of soft bottom habitat and include four estuaries. The largest of these is the Vandenberg SMR in Santa Barbara County; it contains approximately 20 nm² of soft bottom habitat in waters less than 300 feet.[112] (See more on this below under the “Maintain, restore or enhance habitat,” “Allow only those activities that are sustainable”, and “Restore depressed fisheries” goals.)

**Recognizing non-consumptive values [e.g., Fish and Game Code §7050(b)(3)]**

The MLMA recognizes that marine ecosystems provide important benefits to people beyond the consumption of seafood. Important non-consumptive values include “educational, scientific, and recreational uses that do not involve the taking of California’s marine living resources.”[113] The objectives for management set out in the MLMA encourage the protection of marine resources to ensure their continued availability for non-consumptive uses.[114] One approach to addressing this goal is to identify, evaluate, and incorporate information on non-consumptive benefits into management decisions. A fishery managed under a FMP must have fishery research protocols for monitoring and identifying EFI in order to have a good scientific data about the fishery;[115] EFI includes data on the social and economic dimensions of the fishery that identify non-consumptive values.[116] While California halibut is not managed under a FMP, the Department has identified many of the EFI for California

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113 Cal. Fish & Game § 7050(b)(3).

114 Cal. Fish & Game § 7050(b)(3).

115 Cal. Fish & Game § 7081.

116 Cal. Fish & Game § 7081.
halibut in its recent stock assessment.\textsuperscript{117} However, information on non-consumptive values is not included in that analysis.\textsuperscript{118}

**Allow only those activities that are sustainable [e.g., Fish and Game Code §7050(b)(2)]**

Sustainability is identified as the primary goal of the MLMA.\textsuperscript{119} The MLMA defines sustainability as both “continuous replacement of resources, taking into account fluctuations in abundance and environmental variability,” and “securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.”\textsuperscript{120}

The MLMA broadly requires that allowable activities and uses of marine resources must be sustainable and lists several goals and objectives to guide management of sustainable fisheries.\textsuperscript{121}

**Protect spawning adults through seasonal closure of CHTG**

One way that the Department addresses sustainable harvest of California halibut is through the seasonal closure of the CHTG. Spawning adults receive some protection through a seasonal prohibition of trawling within the CHTG\textsuperscript{122} because the seasonal closure is aligned with halibut spawning season.\textsuperscript{123} The recently implemented MPAs in southern California\textsuperscript{124} may provide additional protection for spawning adults by prohibiting commercial and/or recreational fishing, though the effectiveness of these MPAs has not yet been evaluated. Protection of spawning adults allows for higher spawning biomass and output than if the spawning adults are not protected.\textsuperscript{125} (See more on this above under the “Conserve entire ecosystems” goal.)

\textsuperscript{117} See generally SA Background Information.

\textsuperscript{118} See generally SA Background Information.

\textsuperscript{119} Cal. Fish & Game § 7056.

\textsuperscript{120} Cal. Fish & Game § 99.5.

\textsuperscript{121} Cal. Fish & Game § 7050(b)(2).


\textsuperscript{123} CHTG Report, 4.

\textsuperscript{124} Cal. Code Regs. tit. 14 § 632.

\textsuperscript{125} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).
Prevent recruitment and growth overfishing with minimum size requirement
Another method the Department utilizes to ensure sustainability is the implementation of minimum size limits for both recreational and commercial fishing that are intended to prevent recruitment overfishing\textsuperscript{126} and growth overfishing.\textsuperscript{127} Studies from southern California have shown that all California halibut mature at 320 mm (males) and 590 mm (females)\textsuperscript{128} with half of the female California halibut mature at 470 mm.\textsuperscript{129} While some fishers may encounter sublegal-sized halibut, a Department study has shown good survival rates for fish less than 22 inches (559 mm) if released promptly.\textsuperscript{130} By having the minimum size restriction at 22 inches, the Department protects all immature male and most immature female halibut from being fished to allow for “spawning to occur at least once in the lifetime of a fish, and allows the optimum age classes to be fully recruited to the fishery.”\textsuperscript{131} The Department estimated the optimum harvest size range\textsuperscript{132} to preventing growth overfishing to be from 626 to 680 mm, which is well above the minimum legal size and which is a primary component of sampled landings.\textsuperscript{133} Until recently, similar maturity studies had not been done for central California.\textsuperscript{134} However, once the Department completes an ongoing maturity study for the central California population to estimate the same maturity parameters, the Department can additionally safeguard toward sustainability in that area by evaluating the current minimum size restriction with appropriate length-at-maturity data.

\textsuperscript{126} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).

\textsuperscript{127} CHTG Report, 4. Growth overfishing is defined as overfishing that occurs when the average size of the fish is “smaller than the size that would produce the maximum yield per recruit.” Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).

\textsuperscript{128} SA Background Information, A11.

\textsuperscript{129} SA Background Information, A11.

\textsuperscript{130} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).

\textsuperscript{131} Cal. Dep’t of Fish and Wildlife, Applications of Some Recommended Analytical Methods from Data-Poor Workshop (December 2008) to Department of Fish and Game California Halibut Data Sets 9 (July 2011) [hereinafter Data-Poor Analyses] available at http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=39601.

\textsuperscript{132} Optimum size range is defined as the range of the fish’s “length where the number of fish in a given year class multiplied with their mean individual weight is maximum and where thus the maximum yield can be obtained.” Data-Poor Analyses, 5.

\textsuperscript{133} Data-Poor Analyses, 9.

\textsuperscript{134} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (July 2014).
Use available data to assess the status of California halibut population

Though the California halibut fishery is not managed under a FMP, the Department uses scientific information to manage the populations through its recent stock assessment that divides California halibut into the central and southern populations at Point Conception.\textsuperscript{135} The Department has collected, and continues to collect, reliable data through ongoing monitoring of the commercial and recreational fisheries,\textsuperscript{136} and through ongoing aging of sampled fish using thin sections of California halibut ear bones (otoliths).\textsuperscript{137} The stock assessment contractor identified essential fishery information (EFI) for the halibut\textsuperscript{138} and applied the Stock Synthesis model to these data to estimate the stock size to determine the sustainable level of harvest for the California halibut.\textsuperscript{139} In addition, the Department performed independent, data poor analyses for California halibut to use as a comparison with the results from the stock assessment.\textsuperscript{140} As a result, the Department determined that the conclusions derived from the stock assessment align with that of the data poor analyses.\textsuperscript{141}

Through the stock assessment, the Department identified a reference point that should be applied to the southern population of California halibut.\textsuperscript{142} The assessment estimated the maximum sustainable yield (MSY) of the southern population at 7-12%.\textsuperscript{143} However, the assessment notes that the method of estimating MSY is problematic because the California halibut’s recruitment is independent of stock size,\textsuperscript{144} and instead suggests using MSY proxy of 25% as a reference point.\textsuperscript{145} This allows for a conservative approach to sustainability because less fishing would be allowed under the latter reference point.

\textsuperscript{135} SA Background Information, A1.

\textsuperscript{136} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013). See generally SA Background Information.

\textsuperscript{137} 2009 Cal. COFI Report, 33.

\textsuperscript{138} These EFI include: commercial and recreational catch, growth rate by age groups, sex ratio of male to female, spatial distribution, stock structure, migration pattern, size at maturity based on sex, natural mortality rate, fishing selectivity towards female halibut, spawning and recruitment patterns, catch-at-length, and age-at-length data. SA Background Information, A2-15.

\textsuperscript{139} SA Background Information, A17.

\textsuperscript{140} See generally Data Poor Analyses.

\textsuperscript{141} Data Poor Analyses, 9.

\textsuperscript{142} SA Background Information, A17.

\textsuperscript{143} SA Background Information, A17.

\textsuperscript{144} SA Background Information, A17.

\textsuperscript{145} SA Background Information, A17.
This recent stock assessment creates a strong foundation for managing the fishery sustainably, though no subsequent regulatory decisions reflecting this science have been made to date.

**Maintain, restore or enhance habitat [e.g., Fish and Game Code §7055(b)]**
The MLMA recognizes that the health of many fish populations is closely related to the health of their habitat. “Healthy habitats are important for maintaining the productivity and diversity of marine ecosystems and viable commercial and recreational fisheries.”\(^{146}\) The MLMA broadly requires that the habitat of marine wildlife is to be maintained, restored, or enhanced, where appropriate.\(^{147}\) More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.”\(^{148}\) Though the California halibut fishery does not have a formal FMP, its management strategies, nonetheless, protect different types of marine habitat.

**Rocky bottom habitats**
To protect habitat of other benthic organisms, the Commission protects rocky bottoms for some marine species by prohibiting trawling over rocky habitat within the CHTG, as required by law.\(^{149}\) In particular, the Commission must prohibit trawling within the CHTG unless such trawling “is likely not damaging sea floor habitat . . . and is not impeding reasonable restoration of kelp, coral, or other biogenic habitats.”\(^{150}\) By delineating trawl grounds that avoid rocky bottoms, management decisions avoid bycatch of species that require hard substrate for attachment such as coral (e.g., black corals, stony corals), coral-like species (e.g., sea pens, sea fans), and giant kelp, directly protecting these species as well as any other species that use these organisms as habitat. For example, the Commission chose to keep three of the four previously established CHTG areas open in 2008 because trawling in these areas would cause the least amount of disruption to rocky marine habitats.\(^{151}\) To determine that areas designated as A, C, and D remain open, while area B be closed, the Commission considered the amount of

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\(^{146}\) MLMA Guide, 31.

\(^{147}\) Cal. Fish & Game § 7056(b).

\(^{148}\) Cal. Fish & Game § 7084(a).

\(^{149}\) Cal. Fish & Game § 8495(c).

\(^{150}\) Cal. Fish & Game § 8495(c).

soft-bottom habitats in the area as one of the factors. The Commission noted that areas A, C, and D had 90%, 97% and 100% soft bottom respectively, while area B only had 72% soft bottom. By closing area B, the Commission protected these rocky bottom habitats, along with the organisms that attach to the hard substrate, from potentially disruptive trawling activities.

**Soft-bottom habitats**

Unlike the species that prefer rocky habitats, California halibut primarily reside on soft bottom, such as sand or mud, and are most commonly found from the surf zone out to 60 meters of depth. In particular, un-vegetated shallow-water embayments are important nursery habitats for California halibut. Commission decisions have minimized disruptions to the soft-bottom habitats in two ways. First, the Commission adopted a regulation to require the use of “light touch” trawl gear within the CHTG. Because “light touch” trawl gear weighs less than the traditional trawl gear, the degree of ocean bottom disturbance caused by trawling with “light touch” gear is less. The Commission adopted the “light touch” gear requirement in recognition that changing fishing gears can be as effective as restricting fishing areas in conserving habitats. The second way that the Commission protects soft-bottom habitats is through the area closures through MPA implementation in 2012. (See more on this


153 March 2008 FGC Meeting Video.

154 CHTG Report, 30.

155 Rapid Assessments, 29. The halibut has a primary geographical range from Bodega Bay south into Mexico, with occasional extensions into northern California during El Niño events. Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).

156 Rapid Assessments, 29.


158 The requirements for “light touch” trawl minimizes impact on soft bottoms and consist of: headrope not exceeding 90 feet in length, thickness of the webbing of the net not exceeding 7 millimeters in diameter, each trawl door weighing no more than 500 pounds, chain attached to the footrope not exceeding one quarter inch in diameter of link material, and no use of rollers or bobbins on any part of the net or footrope. Cal. Code Regs. tit. 14 § 124(b)(1)-(5).

159 March 2008 FGC Meeting Video.

160 March 2008 FGC Meeting Video.

In August 2013 the Department conducted a collaborative halibut trawl study in Monterey Bay with the National Marine Fisheries Service and a halibut trawl fisherman from southern California.\textsuperscript{162} Twenty tows were completed (55 halibut were caught) within the historic but now closed halibut trawl grounds using a light-touch trawl net; fifteen of the trawls collected video data of the net in operation. Video footage taken from cameras mounted on the headrope of the trawl showed that the light-touch trawl successfully caught fish with minimal disturbance to the seafloor while minimizing bycatch.\textsuperscript{163}

**Restore depressed fisheries [e.g., Fish and Game Code §7055(b)]**

The MLMA classifies a fishery as depressed if “a declining population trend has occurred over a period of time appropriate to that fishery,” or if fish populations decline below abundance levels “consistent with maximum sustainable yield.”\textsuperscript{164} A fishery may be depressed due to human impacts such as over-fishing or as a result of natural causes such as changes in ocean conditions. Regardless of the cause, the MLMA requires that all state-managed fisheries include the objective of restoring depressed fisheries to sustainable levels.\textsuperscript{165} Because the goal to restore depressed fisheries is strongly interrelated to the goal of sustainable fisheries, many of the conservation methods that relate to restoring depressed fisheries have been discussed under the “Allow only those activities that are sustainable” goal above. For example, the minimum size requirement to prevent growth and recruitment overfishing and the conservative method of using MSY proxy value of 25% help to meet the restore depressed fisheries and sustainability goals of the MLMA. Based on the reference point of MSY proxy at 25%, the southern California halibut population is considered depressed because the population is estimated to be at 14% of its unexploited biomass level.\textsuperscript{166} Because the southern population is depressed, special measures may play a role in protecting the southern population to restore the stock back to a sustainable level.

\textsuperscript{162} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (July 2014).


\textsuperscript{164} Cal. Fish & Game § 90.7.

\textsuperscript{165} Cal. Fish & Game § 7056(c).

\textsuperscript{166} SA Background Information, 2.
particular, the Commission recognized that southern California MPAs implemented in January 2012 may help the population recover to a more sustainable level by protecting soft-bottom habitat for the California halibut.\textsuperscript{167} However, due to their recent implementation, and limited data collected on their effectiveness to date, the beneficial impacts of these MPAs on California halibut are not yet known. (See more on this above under the “Conserve entire ecosystems” goal.)

**Minimize bycatch [e.g., Fish and Game Code §7056(d)]**

The MLMA defines bycatch as “fish or other marine life that are taken in a fishery but which are not the target of the fishery . . . includ[ing] discards.”\textsuperscript{168} Bycatch is often discarded dead or kept unreported and can be a serious problem, affecting vulnerable marine species.\textsuperscript{169} The MLMA requires monitoring of bycatch and discards and reduction of bycatch that is deemed “unacceptable.” For the California halibut, the Commission deems a bycatch rate higher than 100\% (i.e., the weight of bycatch species that were discarded dead compared to weight of caught halibut) as a high rate.\textsuperscript{170} The California regulation minimizes bycatch from the fishery by ensuring that trawling can occur within the CHTG only if trawling in the area minimizes bycatch.\textsuperscript{171} In deciding areas A, C, and D as appropriate CHTG in 2008, the Commission recognized that these areas have minimal bycatch rates at 2\%, 1\% and 8\% respectively.\textsuperscript{172} Moreover, the Commission addresses bycatch by closing area B to trawling due to a significantly higher bycatch rate of 38\% despite the rate being much lower than 100\%.\textsuperscript{173} Though additional bycatch data from the central California halibut trawl fishery is available through the federal West Coast Groundfish Observer Program,\textsuperscript{174} the Department is unable to obtain the data at this time because of confidentiality issues.\textsuperscript{175}


\textsuperscript{168} Cal. Fish & Game § 90.5

\textsuperscript{169} Cal. Fish & Game § 7056(d).

\textsuperscript{170} March 2008 FGC Meeting Video.

\textsuperscript{171} Cal. Fish & Game § 8495(c).

\textsuperscript{172} CHTG Report, 32; March 2008 FGC Meeting Video.

\textsuperscript{173} CHTG Report, 32.

\textsuperscript{174} 50 C.F.R. § 660.16.

\textsuperscript{175} Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).
Minimize adverse effects on fishing communities [e.g., Fish and Game Code §7056(i), (j)]
Because the MLMA is concerned with the management of fisheries, impacts on fishing communities and coastal economies are inevitable. The MLMA requires that managers consider the “long-term interests of people dependent on fishing for food, livelihood, or recreation,” and minimize adverse effects of management on local economies and communities.\textsuperscript{176} For example, the current regulatory scheme of the California halibut fishery addresses adverse effects on recreational fishing communities by allowing fishing in some State Marine Parks even though the area is protected from commercial fishing.\textsuperscript{177} The Commission also addressed adverse effects on southern California commercial fishing communities by allowing areas A, C, and D of CHTG to remain open. During one of the public meetings to determine the appropriateness of these areas, the Commission recognized that the method of obtaining bycatch data may not reflect the true bycatch rate because the method does not take into account the real fishing practices and the areas in which trawling occurs.\textsuperscript{178} This discrepancy occurs because in the trawl study, fishermen were required to trawl in pre-selected, random areas including areas where they would not usually trawl due to lack of halibut in the area.\textsuperscript{179} Because halibut may not be present in some of these areas, if the fishermen caught even one non-halibut fish, the bycatch rate was considered as at least 100%.\textsuperscript{180} (See more on this above under the “Minimize bycatch” goal.) If the Commission had not concluded that the bycatch data does not reflect the true bycatch rate and had closed areas A, C, and D from trawling, about half of trawl grounds would have been closed and resulted in increased competition for trawl grounds.\textsuperscript{181} By allowing these CHTG to remain open, the Commission allowed the commercial fishing community to continue fishing with less competition for space.

Management should be adaptive [e.g., Fish and Game Code §7056(g), (l)]
The MLMA defines adaptive management as a “scientific policy that seeks to improve management of biological resources . . . by viewing program actions as tools for learning.”\textsuperscript{182} Even if a chosen management measure fails, it “will provide useful

\footnotesize{\textsuperscript{176} Cal. Fish & Game § 7056(i-j).}  
\footnotesize{\textsuperscript{177} Cal. Code Regs. tit. 14 § 632(b).}  
\footnotesize{\textsuperscript{178} March 2008 FGC Meeting Video.}  
\footnotesize{\textsuperscript{179} March 2008 FGC Meeting Video.}  
\footnotesize{\textsuperscript{180} March 2008 FGC Meeting Video.}  
\footnotesize{\textsuperscript{181} March 2008 FGC Meeting Video.}  
\footnotesize{\textsuperscript{182} Cal. Fish & Game § 90.1.}
information for future actions.” Management is adaptive when fisheries managers are able to respond to changing environmental and socio-economic conditions, and update regulations accordingly. The MLMA requires that management decisions are “adaptive and are based on the best available scientific information.” California halibut management reflects adaptive management practices through both the Commission’s voluntary actions and a legal mandate. The Department and the Commission used adaptive management voluntarily to adopt the regulation for the “light touch” trawl gear when it recognized that the degree of disruption on habitats from trawl gear used by some local fishermen was less than that of traditional trawl gear. By amending regulations based on effective practice, the Department and the Commission managed the fishery adaptively. The Commission is also required to review the appropriateness of each CHTG every three years based on data from the federal groundfish observer program and “other available research and monitoring information.” The Commission must close a CHTG if trawling activities are not minimizing bycatch, are “likely damaging sea floor habitat, [are] adversely affecting ecosystem health, or impede[] reasonable restoration of kelp, coral, or other biogenic habitats.” By reviewing the data periodically, the Commission can manage the CHTG adaptively to changing conditions. Also, the decade-long Marine Life Protection Act (MLPA) process is itself an example of adaptive management because MPAs are recognized as an adaptive management tool under the MLPA that can be deployed to protect marine habitats, including California halibut habitat. In addition, the guidelines in the MPA Master Plan will be modified based on “lessons learned” from evaluations of existing MPAs, allowing for further adaptive management potential to protect California halibut.

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183 Cal. Fish & Game § 90.1.
184 Cal. Fish & Game § 7056(l).
185 Cal. Fish & Game § 7056(g)
186 March 2008 FGC Meeting Video.
187 Cal. Fish & Game § 8495(d).
188 Cal. Fish & Game § 8495(d).
189 Master Plan, 31.
190 Master Plan, G-4.
191 Master Plan, ii.
Establish an external program for peer review [e.g., Fish and Game Code §7062]

External peer review is identified as a tool to ensure that the best available scientific information is used in achieving the goals of the MLMA.\(^\text{192}\) The MLMA requires that documents such as FMPs and fishery research protocols undergo external peer review, and gives discretion to the Department to submit other management documents for peer review.\(^\text{193}\) Because the California halibut fishery occurs in both State and federal waters, a review panel should include members from the State and the federal agencies, as well as the local fishermen. For example, the review panel for the California halibut stock assessment consisted of various specialists from National Marine Fisheries Service (NMFS), the Department, and commercial fishermen.\(^\text{194}\) There was no formal peer review requirement\(^\text{195}\) for the 2008 report to the Commission compiled by the Department to assess the appropriateness of CHTG.\(^\text{196}\)

Collaboration & stakeholder involvement [e.g., Fish and Game Code §7056(h), (k)]

Collaboration and stakeholder involvement refers to the involvement of interested parties and members of the public throughout the management process.\(^\text{197}\) This involvement can occur through research collaborations or at the public comment stage of regulation development.\(^\text{198}\) The MLMA requires that the “management decision-making process is open and seeks advice and assistance of interested parties,” and strongly encourages collaboration with “fishery participants, marine scientists, and other interested parties.”\(^\text{199}\) To adopt different regulations for the California halibut commercial or recreational fishery, the Commission would seek input from stakeholders during a series of public meetings to implement regulations that are best for the community. For example, the Commission collaborated with local fishermen, business owners, environmental groups and biologists to determine which areas of

\(^\text{192}\) Cal. Fish & Game § 7062.

\(^\text{193}\) Cal. Fish & Game § 7062(a).

\(^\text{194}\) SA Peer Review Panel Report, 1.

\(^\text{195}\) Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).

\(^\text{196}\) See generally, CHTG Report.

\(^\text{197}\) Cal. Fish & Game § 7059(a).

\(^\text{198}\) Cal. Fish & Game § 7056(h), (k).

\(^\text{199}\) Cal. Fish & Game § 7056(h), (k).
CHTG should remain open. Also, the Commission delayed the adoption of regulations to require “light touch” trawl gear within CHTG until local fishermen, biologists, and enforcement officers reached consensus through collaboration.

Fishery-Specific Challenges and Opportunities

Data Gaps
Currently, the Department considers the California halibut as a data poor fishery because the fishery lacks continuous long-term (i.e., 30 years) sets of annual life history and sampling data. Some comprehensive data sets exist but these are short-term in nature, generally for periods of less than 5 years. The Department continues to collect fishery-dependent data in southern and central California to further assess the fisheries until a data rich analysis can be performed. Recently, with collaboration by the Department, two central California researchers initiated a socioeconomic characterization of the commercial halibut fishery. However, challenges exist for collecting data. For example, the federal West Coast Groundfish Observer program collects bycatch data from the central California halibut trawl fishery, but the Department is unable to obtain the data at this time due to confidentiality issues.

Collecting new data can facilitate assessment of non-consumptive values that potentially may benefit or impact the California halibut fishery. In addition, these long-term data sets may allow the Department to take a more ecosystem-based approach to managing the fishery. Though the current regulatory scheme takes an ecosystem

200 March 2008 FGC Meeting Video.
203 Data-Poor Analyses, 2.
207 50 C.F.R. § 660.16.
approach by considering the effects of trawling on bycatch and habitat, more information is needed about the role of MPAs and their effects on California halibut and their habitat. Further, information about the “changing climate-driven physical and biological interactions in the ecosystem, the trophic relationships between fished and unfished elements of the food web, the adaptation potential of life history diversity, and the role of humans as predators and competitors”\textsuperscript{209} may help make decisions based on comprehensive understanding of the ecosystem. As the Department collects more data, an ecosystem-based approach to California halibut management may become possible.

**Setting Total Allowable Catch**

The Department limits commercial fishing by not issuing any new permits for gillnet and trawl commercial fisheries\textsuperscript{210} and limits recreational fisheries by having a daily bag and possession limits.\textsuperscript{211} Catch is also controlled through the establishment of a minimum legal size and by restrictions on gear and areas.\textsuperscript{212} However, the current regulatory scheme lacks any limitations on how much total biomass could be taken out of the system. By collecting additional long-term data, setting total allowable catch levels may become possible.

**Additional Safeguards Toward Sustainability of the Southern Population**

The 2011 California halibut stock assessment estimated that the central population size has increased substantially since 1980,\textsuperscript{213} while the southern population was depleted to about 14\% of the unexploited biomass.\textsuperscript{214} Though the Commission is anticipating the sustainability of the southern population to be aided by the recent implementation of MPAs, additional measures exist that can act as a safeguard to prevent the collapse of the population. The various studies currently performed by the Department, along with additional data, present an opportunity for the Commission to update the regulations to reflect the new scientific information. For example, the bag and possession limit for recreational fishery in southern California is higher (5 fish per day) than in central California (3 fish per day).\textsuperscript{215} Because the southern population is depleted,\textsuperscript{216} and the

\textsuperscript{209} CHTG Report, 28.

\textsuperscript{210} Rapid Assessments, 36.


\textsuperscript{212} Cal. Code Regs. tit. 14 § 124(a); Cal. Fish & Game § 8495(c).

\textsuperscript{213} SA Background Information, A1.

\textsuperscript{214} SA Background Information, A17.


\textsuperscript{216} SA Background Information, A17.
adoption of the regulation for the daily limit preceded the stock assessment, the Commission could consider reassessing the regulation to lower the recreational catch limit in southern California. With accumulation of data over the years, the Department may have a better understanding of the drivers of the southern population’s relatively low level of biomass; until this can be addressed by managing the drivers, other measures may be necessary to assist the population in achieving a higher level of abundance.

**Conclusion**

Many regulatory mechanisms are already in place to support California halibut management in meeting the goals of MLMA. First, pursuant to legislative mandate, the effects of trawling on bycatch and habitat are explicitly considered in deciding which areas are appropriate for commercial trawling within the CHTG. The MPAs, in addition, contribute to the goal of protecting the entire ecosystem and benthic habitats, though their potential to protect spawning adults and to restore the southern population has not been evaluated. Also, the Department continues to gather as much data as possible to make up-to-date, science-based decisions. For example, the Department performed a stock assessment for California halibut in 2011 that took into account available EFI, the results, then, were subject to independent peer review by various specialists. The Department also completed a series of basic, data poor analyses of the halibut resource to use as an independent comparison with the results from the stock assessment. As a result, the Department determined that the current status of the statewide fishery is sustainable, although the biomass of the southern population was found to be lower than desired for reasons other than overfishing. The Department continues to monitor and manage the California halibut fisheries through ongoing sampling of length and sex composition, and aging of a subsample of

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218 SA Background Information, 17.
219 CHTG Report, 21-26. Currently, there are discussions about the central California trawl fishery off San Francisco for the need to better document the release mortality of green sturgeon because the bycatch of the sturgeon is small, but significant. Personal Communication with Paul Reilly, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).
220 See generally SA Background Information.
221 See generally SA Peer Review Panel Report.
222 See generally Data-Poor Analyses.
the observed catch using cross-sections of otoliths. Furthermore, the Department is conducting a study in central California to determine the size and age at first and 50% maturity for halibut to estimate the same parameters as the study performed on the southern population. Though the California halibut fishery is considered data poor, the Department shows that it can continue to make management decisions based on sound science. In addition, the Commission, along with leaders from different interest groups, put in a joint effort to reach a consensus about which trawl gear to require in the CHTG. By using regulatory mechanisms that meet the specific goals of MLMA, California halibut management complies with the MLMA’s policy for conservation and sustainable use, although several opportunities to improve the implementation of the Act remain.

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226 Data-Poor Analyses, 2.
228 Cal. Fish & Game § 7050(b).
Executive Summary

The commercial Dungeness crab fishery is consistently one of the highest value fisheries in California. In the 2011-2012 fishing season, the value of the crab before processing reached a record $95.6 million. Management of this high value fishery is unique: it is one of the last major commercial fisheries in California managed by the State legislature rather than the Fish and Game Commission (Commission). The legislature expressly declared that “the Dungeness crab fishery is important to the state because it provides a valuable food product, employment for those persons engaged in the fishery, and economic benefits to the coastal communities of the state.” To protect these interests, the legislature uses the “3-S principle,” restricting the commercial take of the crab by sex, season, and size. Commercial fishing is also restricted by number of vessels and, through recently enacted legislation, the number of traps per vessel. Stakeholders and managers of the fishery are currently working to improve management through the Tri-State Committee (a joint effort between California, Washington, and Oregon, which is overseen by the Pacific States Marine Fisheries Commission) and the California Dungeness Crab Task Force (Task Force). But because only the legislature can pass regulations for the commercial fishery, it is difficult to update and adapt management techniques. If the Commission were able to

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230 Personal Communication with Peter Kalvass, Cal. Dep’t of Fish and Wildlife (Nov. 2013).


232 Cal. Fish & Game § 8280(a).

233 *Rapid Assessments*, 53.


235 Cal. Fish & Game § 8276.5; Cal. Code Regs. tit. 14 § 132.1(c).

236 *Rapid Assessments*, 53.

237 Cal. Fish & Game § 8276.4 (pursuant to S.B. 1690 (Cal. 2009).

238 *Rapid Assessments*, 58.
issue regulations, as occurs in Oregon and Washington, management could more easily adapt to changing conditions (although regulatory changes could still take years).239

This document provides a preliminary and foundational overview of how the Dungeness crab fishery is managed. It specifically discusses how the management reflects certain overarching goals of the Marine Life Management Act (MLMA). No Fishery Management Plan (FMP) has been developed under the MLMA for the Dungeness crab, but the fishery’s management successfully achieves several of the goals of the Act. To further align with the goals of the Act, fishery management could implement a fishery research protocol to collect additional data on fish stock, the effects of the fishery on the surrounding ecosystem and habitat, bycatch, and the non-consumptive values of the fishery. Additionally, while the Task Force may be a good model for stakeholder engagement, the inclusion of additional scientists on the Task Force could make peer review of its recommendations possible.

**Brief Snapshot of the Fishery**

**Who is Fishing?**

In 1995, the California legislature restricted access to the commercial Dungeness crab fishery by issuing a limited number of vessel permits.240 Fewer than 600 permits currently exist, and approximately 450 of these permits are active during a particular season.241 No permits are required for recreational fishermen, as this fishery is limited only by bag limit, season, and size.242

**What do they fish?**

The commercial fishery is limited by both sex and size.243 Fishermen are limited to taking male crabs and no crab may be less than 6.25 inches in carapace width (except that less than one percent of any load may be between 5.75 and 6.25 inches).244

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239 Personal Communication with Peter Kalvass, Cal. Dep’t of Fish and Wildlife (July 2014).
241 Rapid Assessments, 59.
243 Rapid Assessments, 53.
244 Cal. Fish & Game § 8278.
Approximately 80-90% of legal sized males are taken each season. Recreational fishermen may take both sexes but there is a size limit of 5.75 inches in width. The regulations differ slightly for persons aboard licensed commercial passenger fishing vessels (CPFVs) from Sonoma to Monterey counties, where the minimum size is 6 inches.

When do they fish?
The commercial fishing season differs between regions since crabs in more southern regions molt earlier. The fishery is open from November 15th to June 30th in central California, and from December 1st to July 15th in northern California. Prior to each

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245 Status of the Fisheries, 2-8, 2-9.
248 Rapid Assessments, 59.
249 Cal. Fish & Game § 8276; Voices of the Bay, 3.
season, crabs are tested to determine whether they are soft shelled or of low quality.\textsuperscript{250} If so, the Director of the Department of Fish and Wildlife (Department) may delay the season in northern California.\textsuperscript{251} Crabs in central California are included in the testing procedure but not subject to opening delays by statute, partly because crabs in this region tend to molt earlier than northern crabs.\textsuperscript{252} The Director can also extend the season if, upon consideration of written findings, he concludes that an extension will not damage the resource.\textsuperscript{253} Although the fishing season extends over many months, most of the catch occurs within the first six weeks of the season, making this a “derby fishery.”\textsuperscript{254} The recreational fishery is open from November through June, except in Del Norte, Humboldt, and Mendocino counties, where it is open through July.\textsuperscript{255}

**Where do they fish?**
Both the commercial and recreational fisheries extend from the Santa Barbara area to the California-Oregon border.\textsuperscript{256} The commercial fishery is focused primarily in three areas: Crescent City, Eureka, and San Francisco-Bodega Bay.\textsuperscript{257} Commercial fishing is prohibited within one mile of Eel River, Humboldt Bay, Trinidad Bay, and Bodega Lagoon.\textsuperscript{258} Recreational fishing is prohibited in San Francisco Bay and San Pablo Bay.\textsuperscript{259}

**How do they fish?**
Commercial vessels use traps to capture Dungeness crab, and it is unlawful to use a trawl or drag net.\textsuperscript{260} The traps must contain at least two escape ports to reduce the catch.


\textsuperscript{252} Cal. Fish & Game § 8276.2(a); Fisheries Forum Report, 8.

\textsuperscript{253} Cal. Fish & Game § 8277.

\textsuperscript{254} Voices of the Bay, 3.


\textsuperscript{256} Cal. Code Regs. tit. 14 § 29.85(a)(1); Rapid Assessments, 54.

\textsuperscript{257} Voices of the Bay, 2.

\textsuperscript{258} Cal. Fish & Game § 8279.


\textsuperscript{260} Cal. Fish & Game § 8834.5.
of sublegal males261 and have a self-destruction device to allow the eventual escape of all crabs in the event the trap is not recovered, reducing the effects of “ghost fishing.”262 Traps are fished primarily at depths from 60-240 feet and are left out overnight or longer, depending on regulations and sea conditions.263 Recreational fishermen use hoop nets, crab loops, and crab traps.264 Hoop nets are used off piers and jetties while traps are generally used in shallow nearshore waters.265 Divers may only take crabs by use of their hands.266

How much can they fish?
In the commercial fishery, catch is restricted not by landing quota but rather by permit numbers and the new trap limit program that caps the total number of traps in the fishery.267 The legislature chose to start this program in the 2013 season, limiting the number of traps each vessel can use at one time.268 Allocations of trap tags are based on each permitted vessel’s landings in the five-year period from 2003 to 2008.269

Recreational fishermen have a bag limit of ten crabs per day, but there is no limit to the number of traps fished from private boats.270 On CPFVs, fishermen are limited to six crabs per person and no more than 60 total traps on the vessel.271 Historically, the recreational catch has been estimated at about one percent of the commercial catch.272

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261 Cal. Fish & Game § 9011.
262 Cal. Fish & Game § 9011.
263 Rapid Assessments, 55.
267 Cal. Fish & Game § 8276.5; Cal. Code Regs. tit. 14 § 132.1(c).
268 Cal. Fish & Game § 8276.5; Cal. Code Regs. tit. 14 § 132.1(c).
269 Cal. Fish & Game § 8276.5; Cal. Code Regs. tit. 14 § 132.1(c).
270 Rapid Assessments, 56.
272 Status of the Fisheries, 2-4.
Enabling Authorities and General Regulatory Structure

Basic Regulatory Structure
No state or federal Fishery Management Plan (FMP) has been developed for the Dungeness crab fishery even though the species spans both state and federal waters.\(^{273}\) Instead, the Pacific Management Council has given California, Oregon, and Washington primary responsibility for the management of the fishery within their state’s borders and into federal waters.\(^{274}\) Several entities are in place to manage the Dungeness crab fishery in California: (1) the California State legislature, (2) the Commission, (3) the Department, (4) the Tri-State Committee, and (5) the Task Force. The first three are discussed here briefly, the latter two are described in more detail below.

First, the commercial fishery is regulated by State legislature and any change to the current management regime must be achieved by approval of both the legislature and Governor.\(^ {275} \) Once the legislature passes a bill and the Governor signs it into law, the Fish and Game Code or the Public Resources Code is amended to reflect the changes.\(^ {276} \) Management measures align with a variety of the goals and objectives outlined in the MLMA, but no statutory mandate exists requiring that the Dungeness crab fishery be managed pursuant to the Act’s goals and objectives.\(^ {277} \) Second, the Commission manages California’s recreational Dungeness crab fishery.\(^ {278} \) Both the Department and the public make management recommendations to the Commission, which accepts, rejects, or modifies the recommendations during public meetings.\(^ {279} \) Third, the Department is responsible for enforcement and administration of the regulations for both the commercial and recreational fisheries in state and federal waters.\(^ {280} \) To monitor catch and ensure that all fishermen have the correct permits, the Department uses tools such as port sampling, CPFV logbooks, and dockside and at-sea enforcement.\(^ {281} \)

\(^{275}\) Rapid Assessments, 64.
\(^{276}\) Rapid Assessments, 64.
\(^{277}\) Rapid Assessments, 64.
\(^{278}\) Cal. Fish & Game § 200 (delegating to the Commission the power to regulate the taking or possession of fish, excluding the taking for commercial purposes); Rapid Assessments, 64; Voices of the Bay, 2.
\(^{280}\) Cal. Fish & Game §§ 200, 7857, 8280.4.
\(^{281}\) Rapid Assessments, 66.
Tri-State Committee

The Tri-State Committee (Committee) is an effort of the California, Oregon, and Washington Dungeness crab fisheries to coordinate and develop consistent management actions to address issues that affect more than one state. The Pacific States Marine Fisheries Commission (PSMFC) oversees the Committee, and the Committee operates pursuant to an interstate Memorandum of Understanding. It is comprised of one member from each state management agency, and each member has five industry advisors. The Committee is required to submit a biennial report to both the federal Senate Committee on Commerce, Science and Transportation and the House Committee on Resources. The report must contain a status update on the management of the fishery including stock status and trends, a description of research and the scientific review process used to determine the stock status, and measures implemented or planned to prevent or end overfishing. The report is reviewed by California’s Task Force (see Part III.C), but information on any additional stakeholder involvement, such as public meetings, is not available.

The Committee sets the protocols for the joint implementation of the pre-season crab quality test to ensure that crabs are ready for harvest on the target opening date. California’s legislature authorized a test that is conducted concurrently with tests in Washington and Oregon, and the states then mutually decide whether to delay the opening of the season. Despite this success, California has had trouble passing legislation to update and streamline management in coordination with Oregon and

282 Rapid Assessments, 53.

283 Rapid Assessments, 58.


285 Rapid Assessments, 65.


289 Status of the Fisheries, 2-4, 2-5.

290 Status of the Fisheries, 2-4, 2-5.
Washington because all changes must be approved by the legislature. Oregon and Washington’s departments of fish and wildlife are responsible for making regulatory changes and do not have to go through the state legislatures, allowing those states more flexibility to adjust crab regulations.

**Dungeness Crab Task Force**
The California legislature established the Task Force in 2009. The Task Force is a response to California’s difficulties in passing legislation to update and streamline fishery management and is composed of various stakeholders who can evaluate and inform more effective regulations. The 2009 legislation mandated that the Ocean Protection Council (OPC) facilitate the Task Force for a limited term, from 2009 to 2011. Subsequent legislation passed in 2011 reestablished the Task Force and, at the same time, implemented the new trap limit program proposed by the original Task Force.

**Original Task Force: 2009 – 2011**
Objectives for the original Task Force included making recommendations on fishery management efforts such as trap limits, fleet size reduction, and season opening date changes. Stakeholders in the original Task Force included commercial and recreational fishermen, crab processors, owners of CPFVs, non-governmental organizations (NGOs), and representatives from California Sea Grant and the Department. The original Task Force held five public meetings between May 2009 and February 2010. A facilitation team composed of neutral consultants interviewed Task Force members to identify critical issues and collect information on fishery data needs. Members shared their views on the most effective methods to manage the

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291 Rapid Assessments, 58.
292 Fishery Management Overview, 2.
293 Cal. Fish & Game § 8276.4 (pursuant to S.B. 1690 (Cal. 2009).
294 Status of the Fisheries, 2-9.
295 Status of the Fisheries, 2-9.
296 Cal. Fish & Game §§ 8276.4, 8276.5.
297 Status of the Fisheries, 2-9.
300 Task Force Proceedings, 7.
fishery. Although the Task Force did use data (e.g., landings data and permit information) to help inform its decisions, as an advisory body its mandate did not include a scientific review. The efforts of the original Task Force resulted in the trap limit program passed by the California legislature in 2011.

**Renewed Task Force: 2012 – 2019**

The renewed Task Force consists of two voting representatives for sport fishing, two voting representatives for crab processing, one voting representative for CPFV owners, two non-voting representatives of NGOs, one non-voting representative of Sea Grant, two non-voting representatives of the Department, and seventeen voting representatives of commercial fishery interests elected by permit holders in their respective ports and production levels. The Task Force also includes a sport fishery workgroup that will seek to identify recreational fishery objectives, brainstorm solutions, and resolve overlap between the sport and commercial sectors. Public meetings are held by the Task Force in various regions along the California coast as needed and a neutral consultant facilitates the meetings.

The renewed Task Force has multiple objectives. Its first task is to review a proposed trap limit program submitted by the Department. It must also review and evaluate management measures and make recommendations to the Joint Committee on Fisheries and Aquaculture, the Department, and the Commission, with final recommendations due no later than January 15, 2017. Management review priorities include trap limit restriction options, current and future sport and commercial fishery efforts, season modifications, essential information needs, and short- and long-term objectives for

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301 Task Force Proceedings, 8.
303 Cal. Fish & Game § 8276.5.
304 Cal. Fish & Game § 8276.4(a).
307 Fisheries Forum Report, 10.
308 Fisheries Forum Report, 10.
309 Cal. Fish & Game § 8276.4(c)(1). In its recommendations, the Task Force will address the need for a permanent advisory committee; the economic impact of the trap limit program including the impact on permit holders of different tiers and on the economies of different ports; the cost of the trap limit program to the Department, including enforcement costs; viability of a buyout program for permit holders at the lowest tier level; refining both recreation and commercial management; and the need for statutory changes to accomplish Task Force objectives. Cal. Fish & Game § 8276.4(c)(2).
improved management.\textsuperscript{310} Recommendations will be forwarded on from the Task Force upon an affirmative vote of at least two-thirds of its members.\textsuperscript{311}

To ensure a smooth transition to the complex trap limit program created by the legislature upon the recommendation of the original Task Force, the renewed Task Force works closely together with the Department and OPC.\textsuperscript{312} The program places permit holders into one of seven tiers based on their California landings during a five-year window period. The highest tier of permit holders is allowed a maximum of 500 traps, and the lowest tier is allowed 175.\textsuperscript{313} Permit holders also require a biennial trap limit permit along with trap tags.\textsuperscript{314} Failure to purchase tags and permits will render the commercial permit invalid, thereby removing latent permits from the fishery.\textsuperscript{315} Although legislation sets the specifics of the program, some flexibility is built into the statute so that the Director of the Department may, in consultation with the Task Force, make modifications.\textsuperscript{316} The State legislature must decide whether to extend the Task Force and the trap limit program before April 1, 2019.\textsuperscript{317}

**Meeting the Goals and Requirements of the MLMA**

The MLMA contains several goals to guide the sustainable management of fisheries. Many of the goals are broad and a great deal of overlap exists between them. The primary goals include: conserve entire ecosystems,\textsuperscript{318} recognize non-consumptive values,\textsuperscript{319} allow only those activities that are sustainable,\textsuperscript{320} maintain, restore, or enhance habitat,\textsuperscript{321} restore depressed fisheries,\textsuperscript{322} minimize bycatch,\textsuperscript{323} minimize adverse effects

\begin{footnotesize}
\textsuperscript{310} Cal. Fish & Game § 8276.4(c)(3).
\textsuperscript{311} Cal. Fish & Game § 8276.4(f).
\textsuperscript{312} Fisheries Forum Report, 3.
\textsuperscript{313} Cal. Fish & Game § 8276.5(a)(1).
\textsuperscript{314} Cal. Fish & Game § 8276.5(a)(3); Status of the Fisheries, 2-9.
\textsuperscript{315} Cal. Fish & Game § 8276.5(a)(3); Status of the Fisheries, 2-9.
\textsuperscript{316} Cal. Fish & Game § 8276.5(a).
\textsuperscript{317} Status of the Fisheries, 2-9.
\textsuperscript{318} Cal. Fish & Game §7050(b)(1).
\textsuperscript{319} Cal. Fish & Game §7050(b)(3).
\textsuperscript{320} Cal. Fish & Game §7050(b)(2).
\textsuperscript{321} Cal. Fish & Game §7055(b).
\textsuperscript{322} Cal. Fish & Game §7055(b).
\end{footnotesize}
on fishing communities,\textsuperscript{324} establish processes for adaptive management,\textsuperscript{325} establish a program for external peer review,\textsuperscript{326} and ensure collaboration and stakeholder involvement.\textsuperscript{327} This review is meant to be preliminary and foundational and therefore is not a comprehensive analysis of every goal and objective found within the MLMA. We focus on the goals listed above because they encapsulate several other specific goals listed in sections 7050 and 7056 of the Act. For example, the best available science requirement is reflected in the goals of restoring depressed fisheries, ensuring adaptive management and sustainability, conserving entire ecosystems, and the goal of establishing a peer review process.

“The MLMA requires that Fishery Management Plans (FMPs) form the primary basis for managing the State’s marine fisheries. An FMP is a planning document based on the best available scientific knowledge and other relevant information, that contains a comprehensive review of the fishery along with clear objectives and measures to ensure its sustainability.”\textsuperscript{328} Despite the lack of a formal FMP under the MLMA, the current management of Dungeness crab successfully achieves several of the goals of the Act. However, the fishery could take certain steps to further achieve the MLMA’s goals. For example, while the inclusion of the Task Force may be a good model for stakeholder engagement, a scientific advisory board could add to the data available to the Task Force and allow for formal peer review. In addition, the limited entry and trap limit programs are intended to produce sustainable fisheries yield, although there are some concerns that these measures could lead to more intensive fishing.\textsuperscript{329}

**Conserve Entire Ecosystems [e.g., Fish and Game Code §7050(b)(1)]**

The MLMA recognizes that the health of fish populations is closely related to the health of their ecosystem. “Maintaining the health of marine ecosystems is key to productive

\textsuperscript{323} Cal. Fish & Game § 7056(d).

\textsuperscript{324} Cal. Fish & Game § 7056(i-j).

\textsuperscript{325} Cal. Fish & Game § 7056(g), (l).

\textsuperscript{326} Cal. Fish & Game § 7062.

\textsuperscript{327} Cal. Fish & Game § 7056(h), (k).


fisheries and non-consumptive uses of marine living resources.” The MLMA broadly requires that entire ecosystems be conserved. More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.” Similar to requiring sustainability, conserving entire ecosystems is an overarching goal that encompasses many of the other goals and objectives of the MLMA.

Impacts of the fishery on the crab’s ecosystem are unclear. The fishery “likely does not cause serious or irreversible harm to key elements of ecosystem structure and function,” but more data is needed to confirm this. One potential concern is that of “ghost fishing,” when lost or abandoned traps continue to fish. The legislature addressed this concern by requiring that traps have a self-destruct device to allow the eventual escape of all crabs from an abandoned trap. More generally, no work has examined the effect of either working or abandoned traps on the benthos, but studies of traps used in other fisheries suggest that traps have a minimal effect on soft sediment communities. Due to the lack of data, more information is needed to evaluate the effects of the Dungeness crab fishery on the ecosystem. One approach may be development of a fishery research protocol to collect information to develop this knowledge base (see Part V(B) below).

**Recognize Non-Consumptive Values [e.g., Fish and Game Code §7050(b)(3)]**
The MLMA recognizes that marine ecosystems provide important benefits to people beyond the consumption of seafood. Important non-consumptive values include “educational, scientific, and recreational uses that do not involve the taking of

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331 Cal. Fish & Game § 7050(b)(1).

332 Cal. Fish & Game § 7084(a).

333 *Rapid Assessments*, 63.

334 *Rapid Assessments*, 64.


336 Cal. Fish & Game § 9011.

337 Rasmuson, 133.

338 *Rapid Assessments*, 63.
California’s marine living resources.” The objectives for management set out in the MLMA encourage the protection of marine resources to ensure their continued availability for non-consumptive uses. Nothing in the current management regulations of Dungeness crab was located relevant to this goal; however, as with the “conserve entire ecosystems” goal, a fishery research protocol could be developed to identify necessary data and reflect these values in management decisions (see Part V(B) below). In making these decisions, it is important not only consider a sustainable fishery but also the fishery’s role in the ecosystem.

**Allow Only Those Activities that Are Sustainable [e.g., Fish and Game Code §7050(b)(2)]**

Sustainability is identified as the primary goal of the MLMA. The MLMA defines sustainability as both “continuous replacement of resources, taking into account fluctuations in abundance and environmental variability,” and “securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.” The MLMA broadly requires that allowable activities and uses of marine resources must be sustainable and lists several goals and objectives to guide management of sustainable fisheries.

The Dungeness crab fisheries along the West Coast are currently considered to be sustainable because of a combination of the crab life cycle and a simple yet effective fishery management system that follows the “3-S principle.” Four of the top five crab seasons have occurred in the past decade. The crabs reach sexual maturity in a relatively short period of time and only larger, older males are removed from the population by the fishery. In addition, research implies that males impregnate

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339 Cal. Fish & Game § 7050(b)(3).
340 Cal. Fish & Game § 7050(b)(3).
341 Cal. Fish & Game § 7056.
342 Cal. Fish & Game § 99.5.
343 Cal. Fish & Game § 7050(b)(2).
344 Status of the Fisheries, 2-8.
345 Fisheries Forum Report, 8.
346 Living Marine Resources, 110; Status of the Fisheries, 2-8.
essentially all mature females. Because of this, the wide fluctuations in catch from year to year appear to be related to ocean conditions rather than unsustainable fishing practices. Management does not utilize reference points and the measures in place regulate only size, sex, season, and effort to a limited extent (through the permitting programs).

As California moves forward with the trap limit program, one step toward determining the sustainability of the fishery would be to assess the success of the program in lessening the effects of derby fishing. The imposition of trap limits may result in intensification of fishing the permitted traps. Some Task Force fishermen have expressed concern that derby fishing will grow worse as fishermen fish their permits harder and latent permits become active. One objective of the current Task Force is to assess this issue and evaluate whether the trap limits maintain the sustainability of the fishery.

Maintain, Restore, or Enhance Habitat [e.g., Fish and Game Code §7055(b)]
The MLMA recognizes that the health of many fish populations is closely related to the health of their habitat. “Healthy habitats are important for maintaining the productivity and diversity of marine ecosystems and viable commercial and recreational fisheries.” The MLMA broadly requires that the habitat of marine wildlife is to be maintained, restored, or enhanced, where appropriate. More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.”

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349 Rapid Assessments, 53.


351 Living Marine Resources, 110.

352 Task Force Proceedings, 15.

353 Task Force Proceedings, 15.


355 Cal. Fish & Game § 7056(b).

356 Cal. Fish & Game § 7084(a).
Most crab fishing occurs in nearshore waters. No work has yet examined the effect of crab traps on the benthos. Studies of traps used in other fisheries suggest that traps have a minimal effect on soft sediment communities but may have significant impacts when deployed on reefs, especially when wind causes the traps to move across the reef. It is important to consider the cumulative impacts of traps that do not remain entirely stable on the seafloor. A fishery research protocol could help to examine these habitat effects. (See more on fishery research protocols under the “Data Gaps” section below). The trap limit program may limit the impact because the number of traps cannot be increased. Although Senator Evans, author of the trap limitation program legislation, did note that the program will “keep unneeded gear out of the water,” there is no indication that this was out of concern for the habitat.

**Restore Depressed Fisheries [e.g., Fish and Game Code §7055(b)]**
The MLMA classifies a fishery as depressed if “a declining population trend has occurred over a period of time appropriate to that fishery,” or if fish populations decline below abundance levels “consistent with maximum sustainable yield.” A fishery may be depressed due to human impacts such as over-fishing or as a result of natural causes such as changes in ocean conditions. Regardless of the cause, the MLMA requires that all state-managed fisheries include the objective of restoring depressed fisheries to sustainable levels. If overfishing is the cause of a depressed fishery, the MLMA further requires that a time-table and process for rebuilding the fishery be included in all FMPs. Crab populations have fluctuated around fairly stable long-term mean for more than 30 years. Because the fishery captures 80-90% of all legal-sized male crabs annually, landings data provide a relatively accurate picture of crab population size. Although numbers vary from year to year, landings data since the 1960s indicate an abundance of legal-sized male crabs and there is no evidence of

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357 Rapid Assessments, 62.
358 Rasmuson, 133.
359 Rasmuson, 133.
360 Rapid Assessments, 62.
362 Cal. Fish & Game §90.7.
363 Cal. Fish & Game §7056(c).
364 Cal. Fish & Game §7086.
365 Living Marine Resources, 110.
366 Status of the Fisheries, 2-8 – 2-9.
overfishing. Researchers have studied dramatic declines in landings in the late 1950s and believe that the shift to warmer waters driven by changes in the Pacific Decadal Oscillation during and following the decline is the most plausible cause, not overfishing. The renewal of the Task Force in 2011 and the implementation of the trap program, meant to “conserve the resource,” show the legislature’s commitment to sustainably manage the resource as it has done in the past. Reference points to define when a stock is “depressed” or “overfished” do not exist. A reference point that identifies when crab stocks are “depressed” would be useful in setting expectations for the public and assisting the Department in ensuring the survival of crab populations.

Minimize Bycatch [e.g., Fish and Game Code §7056(d)]
The MLMA defines bycatch as “fish or other marine life that are taken in a fishery but which are not the target of the fishery . . . includ[ing] discards.” Bycatch is often discarded dead or kept unreported and can be a serious problem, affecting vulnerable marine species. The MLMA requires monitoring of bycatch and discards and reduction of bycatch that is deemed “unacceptable.” Fisheries that use traps produce less bycatch than most fisheries because of release valves and small openings. Bycatch in the Dungeness crab fishery is perceived to be low. Fishermen are not required to keep a logbook to tally bycatch and no studies have been performed. Permit holders are allowed incidental take of octopuses, any fish species, and rock crab species provided that all crabs taken are in season. The National Marine Fisheries Service (NMFS) classified the Dungeness crab fishery as a category II, indicating that incidental mortality or serious injury of marine mammals can occur because humpback and gray

367 Status of the Fishery 2-8; Living Marine Resources, 110.
369 Bill Analysis, 8.
370 Cal. Fish & Game § 90.5.
371 MLMA Guide, 32.
372 Cal. Fish & Game § 7056(d).
373 Rapid Assessments, 60.
374 Rapid Assessments, 60.
375 Rapid Assessments, 60.
376 Cal. Fish & Game § 8284.
377 Cal. Fish & Game § 9011; Status of the Fisheries, 2-2.
whales can become entangled in the traps. These periodic entanglements may pose some risk to endangered, threatened, and protected species. A fishery research protocol could help to examine the effects of traps on bycatch species (see Part V(B) below).

Minimize Adverse Effects on Fishing Communities [e.g., Fish and Game Code §7056(i),(j)]

Because the MLMA is concerned with the management of fisheries, impacts on fishing communities and coastal economies are inevitable. The MLMA requires that managers consider the “long-term interests of people dependent on fishing for food, livelihood, or recreation,” and minimize adverse effects of management on local economies and communities. From 2000-2006, the Dungeness crab fishery in California, Oregon, and Washington had a higher fisherman fatality rate than any other fishery in the United States, including those in Alaska. This is probably because of the derby-style dynamics of the fishery. The trap limit program is an effort to curtail derby fishing but positive results are not assured as fishermen may just fish their permits harder.

Establish Processes for Adaptive Management [e.g., Fish and Game Code §7056(g),(l)]

The MLMA defines adaptive management as a “scientific policy that seeks to improve management of biological resources . . . by viewing program actions as tools for learning.” Even if a chosen management measure fails, it “will provide useful information for future actions.” Management is adaptive when fisheries managers are able to respond to changing environmental and socio-economic conditions, and update regulations accordingly. The MLMA requires that management decisions are “adaptive and are based on the best available scientific information.”

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378 Rapid Assessments, 61.
379 Rapid Assessments, 62.
380 Cal. Fish & Game § 7056(i-j).
382 Commercial Fishing Fatalities.
383 Cal. Fish & Game § 90.1.
384 Cal. Fish & Game § 90.1.
385 Cal. Fish & Game § 7056(l).
386 Cal. Fish & Game § 7056(g)
The legislature’s renewal of the Task Force and the requirement that the Task Force submit an updated set of recommendations suggest a legislative commitment to improving management in an ongoing fashion (see Part III.C.2 above). More specifically, some flexibility is built into the statute creating the trap limit program to allow for adaptive measures. The Director of the Department may, in consultation with the Task Force, make modifications. For example, the statute reads, “[i]n consultation with the Dungeness crab task force, or its appointed representatives, the director shall adopt a program, by March 31, 2013, for Dungeness crab trap limits for all California permits. Unless the director finds that there is consensus in the Dungeness crab industry that modifications to the following requirements are more desirable, with evidence of consensus, including, but not limited to, the record of the Dungeness crab task force, the program shall include all of the following requirements . . . .”387 The Director of the Department must submit a proposed program to the Task Force for review and allow them sixty days to review and recommend any proposed changes.388 The Director or legislature will view a proposed recommendation that receives an affirmative vote of at least fifteen Task Force members as having the consensus of the crab industry.389 The Director may then modify the program after implementation after consultation with the Task Force if such a modification is consistent with the legislature’s requirements.390

**Establish a Program for External Peer Review [e.g., Fish and Game Code §7062]**

External peer review is identified as a tool to ensure that the best available scientific information is used in achieving the goals of the MLMA.391 The MLMA requires that documents such as FMPs and fishery research protocols undergo external peer review, and gives discretion to the Department to submit other management documents for peer review.392 Neither the Legislature nor the Commission is required to submit Dungeness crab management decision documents to peer review.393 However, the Department is required to submit documents such as FMPs and fishery research plans

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387 Cal. Fish & Game § 8276.5(a).
388 Cal. Fish & Game § 8276.5(d)(1).
389 Cal. Fish & Game § 8276.5(c).
390 Cal. Fish & Game § 8276.5(d)(2).
391 Cal. Fish & Game § 7062.
392 Cal. Fish & Game § 7062(a).
393 Cal. Fish & Game § 7062(e).
to be peer reviewed,\textsuperscript{394} and has broad discretion to submit other management documents.\textsuperscript{395} Although the Dungeness crab Task Force’s facilitation team did consult experts to identify fishery data needs, the final recommendations did not go through a formal peer review process.\textsuperscript{396} Task Force members simply reviewed the final recommendations to ensure that the report “accurately reflected their sentiments.”\textsuperscript{397} Because the Task Force is composed mostly of industry participants and not scientists, this review is not an adequate replacement for formal peer review.\textsuperscript{398}

\textbf{Collaboration and Stakeholder Involvement [e.g., Fish and Game Code §7056(h),(k)]}

Collaboration and stakeholder involvement refers to the involvement of interested parties and members of the public throughout the management process.\textsuperscript{399} This involvement can occur through research collaborations or at the public comment stage of regulation development.\textsuperscript{400} The MLMA requires that the “management decision making process is open and seeks advice and assistance of interested parties,” and strongly encourages collaboration with “fishery participants, marine scientists, and other interested parties.”\textsuperscript{401} The bill renewing the Task Force “provides the platform for ongoing work with Crab Fishery stakeholders to craft a bill that will help conserve the resource, meet regulatory requirements of the Department of Fish and Game, keep unneeded gear out of the water, and put a halt to the annual cross border race for crabs that threatens the livelihoods of . . . fishermen.”\textsuperscript{402} The Task Force both holds public meetings and gathers information from its members, who are stakeholders in the fishery (see list of members in Part III(C)(2) above).\textsuperscript{403} The Task Force includes the recommendation of trap limits and other management measures based on some data and extensive involvement of fishermen and other members of the public. The

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\textsuperscript{394} Master Plan, 6-1.
\textsuperscript{395} Cal. Fish & Game § 7062(a).
\textsuperscript{396} Task Force Proceedings, 11.
\textsuperscript{397} Task Force Proceedings, 11.
\textsuperscript{399} Cal. Fish & Game § 7059(a).
\textsuperscript{400} Cal. Fish & Game § 7056(h), (k).
\textsuperscript{401} Cal. Fish & Game § 7056(h), (k).
\textsuperscript{402} Bill Analysis, 8.
\textsuperscript{403} Task Force Proceedings, 7.
\end{flushleft}
involvement of the Task Force ensures that stakeholders are able to have their voices heard and that adverse effects to the fishing community are minimized.

Fishery-Specific Challenges and Opportunities

Adaptive Management
The Dungeness crab fishery is currently healthy and stable due in large part to effective management techniques, but challenges remain for ongoing and adaptive management. Perhaps most significantly, the State legislature must approve of and pass any new management practices for the fishery. This process is burdensome and weakens the managers’ ability to adapt quickly to changes in the fishery. For example, California has trouble updating legislation to update and streamline management in coordination with Oregon and Washington as a part of the Tri-State Committee. Although the legislature did adopt the original Task Force’s recommendation to put the trap limit program in place, all changes are ultimately up to the legislature. If the Department and Commission were able to manage the commercial fishery without the legislature’s approval, as they do with the recreational fishery, fishery management would be more adaptive and could more easily coordinate with Oregon and Washington.

Data Gaps
Lack of data presents another challenge. Although landings data provide a window into the fishery’s health, current population abundance and the occurrence of overfishing are unknown. The Task Force discussed the use of commercial fishery logbooks to improve data collection, but most members rejected this idea. In addition, no clear long-term objectives or research plans exist for the fishery. One approach may be to develop a fishery research protocol to collect information to expand this knowledge base. Essential fisheries information (EFI) is identified in the MLMA as a necessary component of sustainable fisheries management. To accomplish the goal of

404 Rapid Assessments, 53.
405 Rapid Assessments, 64.
406 Rapid Assessments, 58.
407 Rapid Assessments, 64.
408 Rapid Assessments, 56.
410 Rapid Assessments, 53.
411 Cal. Fish & Game § 7060(a).
incorporating and obtaining EFI, fishery research protocols are required elements of all FMPs. Fishery research protocols include a description of past and ongoing monitoring, current EFI, and steps to obtain missing EFI. A fishery research protocol is not required for Dungeness crab because the fishery is not managed under an FMP; however, something as extensive as a full fishery research protocol may be unnecessary to ensure the goals of the MLMA, including “conserve entire ecosystems,” are met for Dungeness crab. The main barrier to such a research program would stem from the capacity and budget instability faced by the Department. Research collaborations could provide an opportunity to undertake more focused and in depth projects while alleviating reliance on government funding.

Peer Review
The Task Force presents an opportunity to change and adapt management techniques over the next seven years. It will learn from the current trap limit program and make new recommendations based on this knowledge to the legislature. The Task Force currently includes just one scientist and its review is not an adequate substitute for a formal peer review. By including more scientists the Task Force and standardizing an approach to peer review within the Task Force, the Department would gain capacity to review management approaches.

Conclusion
Despite no formal stock assessment of the fishery, California’s Dungeness crab fishery is in good health based on historical landings data. Stakeholders involved in the fishery believe that management of the fishery can be improved and are currently attempting to do so through the Task Force. Stakeholders are particularly concerned about the effects of derby fishing on the fish stock and on the safety of the fishermen themselves. But because only the legislature can pass regulations for the commercial fishery, it is difficult to update and improve management techniques. If the Department had the authority to develop regulations for the Commission to adopt, as occurs in Oregon and Washington, management could more easily adapt to changing conditions. Impacts resulting from alternative management decisions (through an FMP or otherwise) could be realized in the following areas: data collection to assess the fish stock, bycatch, and

412 Cal. Fish & Game § 7081; Master Plan, 2-2.
413 Master Plan, 2-2.
414 Cal. Fish & Game § 8276.4(c)(2).
non-consumptive values, scientific peer review of potential management strategies, and assessing and managing the fishery’s effects on the ecosystem. A move away from legislative control of the fishery could allow for more adaptive management moving forward.
Market Squid

Executive Summary
California’s market squid fishery is one of the most important fisheries in the state and in 2011 it was the largest in California in both volume and value. Market squid is managed by the California Fish and Game Commission (Commission) and the California Department of Fish and Wildlife (Department) and monitored at the federal level by the Pacific Fisheries Management Council (PFMC or Council). In 2004, the Market Squid Fishery Management Plan (MSFMP) and its implementing regulations were adopted by the Commission. Minor regulatory changes were made in subsequent years, with the most recent modifications to the commercial fishery effective as of July 2014. This document provides a preliminary and foundational overview of how market squid are managed and discusses how the management of the market squid fishery reflects certain overarching goals of the Marine Life Management Act (MLMA).

Specifically, the MSFMP utilizes (1) fishery control rules; (2) a restricted access program; (3) ecological considerations; and (4) advisory committees to meet its stated goals and objectives.

While market squid was considered a data poor fishery when the MSFMP was adopted in 2004, a number of papers published from 1999-2006 improved the limited understanding of market squid biology. Still, there is no reliable estimate of market


421 MSFMP, 1-62.

422 See infra footnotes 106-109.
squid abundance\textsuperscript{423} and a proxy for MSY is used;\textsuperscript{424} however recent research efforts may aid in determining stock status for harvest of market squid.\textsuperscript{425} While data gaps exist, a monitoring program (port sampling and logbooks) has been in place since before the MSFMP, providing a significant data set of fishery-dependent sampling efforts and catch information.\textsuperscript{426} Opportunities exist to continue to support sustainable management of the fishery.

\textsuperscript{423} MSFMP, 1-58, 2-15.
\textsuperscript{424} MSFMP, 1-62.
\textsuperscript{426} MSFMP, 1-64.
Enabling Authorities and General Regulatory Structure

The market squid fishery is a “state managed fishery and a federally monitored species.” In 2001, the state Legislature delegated the authority to manage market squid to the Commission. As a federally monitored species, market squid are also included in the Coastal Pelagic Species Fishery Management Plan (CPS FMP).

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427 2012 Fisheries Forum Report, 16.

428 Cal. Fish & Game § 8425(a). The Department and Commission “. . . shall adopt a market squid fishery management plan and regulations to protect the squid resource and manage the squid fishery at a level that sustains healthy squid populations, taking into account the level of fishing effort and ecological factors, including, but not limited to, the species’ role in the marine ecosystem and oceanic conditions.” Id.

Brief Snapshot of the Fishery

Who is fishing?
The market squid fishery is comprised of both commercial and recreational sectors. Commercial take is managed through a restricted access program. To participate in the commercial market squid fishery, fishermen must hold one of four permit types: (1) market squid vessel permit (either transferable or non-transferable); (2) market squid brail permit (transferable only); (3) light boat permit (transferable or non-transferable); or (4) experimental permit (non-transferable). A vessel owner may only hold one market squid permit per vessel. No permit is required for incidental commercial landings of less than two tons or “for purposes of live bait only.” The MSFMP established the following capacity goals for each permit type: 55 market squid vessel permits (including 3 experimental, non-transferable permits), 18 market squid brail permits,
permits, and 34 market squid light boat permits.\textsuperscript{437} From 1998-2005, there was only a general squid permit, not separate vessel and brail permits.\textsuperscript{438} In the 2004/2005 fishing season the commercial market squid fleet included 167 squid vessels\textsuperscript{439} and 44 light boat permits. The restricted access program was designed to slowly “reduce the number of [permitted] vessels in order to achieve the capacity goal in a less disruptive manner.”\textsuperscript{440} The Department issued 77 vessel permits, 42 brail permits, 35 light boat permits, and zero experimental permits in 2012.\textsuperscript{441} A sport fishing license is required for any recreational take of squid,\textsuperscript{442} however, no permit is required for recreational take of market squid for live bait purposes.\textsuperscript{443} Data on the number of recreational fishermen and their catch levels are insufficient\textsuperscript{444} and “[r]ecreational landing records are not kept.”\textsuperscript{445}

\textbf{What do they fish?}

The commercial and recreational sectors “target[] spawning squid that are believed to die shortly after spawning.”\textsuperscript{446} The recreational squid fishery supplies live or dead squid as bait for recreational fisheries throughout the state, including rockfish and white seabass.\textsuperscript{447}

\textbf{When do they fish?}

Annual permits are issued or renewed each year and the season runs from April 1 to March 31 the following year.\textsuperscript{448} New permits or permit renewals are available through

\begin{itemize}
  \item \textsuperscript{437} Cal. Code Regs. tit. 14 § 149.1(m)(1)-(3). See also MSFMP, 1-67.
  \item \textsuperscript{438} Personal Communication with Chelsea Protasio, Cal. Dep’t of Fish and Wildlife (August 2014).
  \item \textsuperscript{440} MSFMP, 1-68.
  \item \textsuperscript{441} \textit{Rapid Assessments}, 74.
  \item \textsuperscript{442} Cal. Fish & Game § 7145.
  \item \textsuperscript{443} MSFMP, 1-67; 2-18.
  \item \textsuperscript{444} MSFMP, 1-40.
  \item \textsuperscript{445} \textit{Rapid Assessments}, 75.
  \item \textsuperscript{446} MSFMP, 1-20.
  \item \textsuperscript{447} MSFMP, 1-37.
  \item \textsuperscript{448} Cal. Code Regs. tit. 14 § 149.1(f); MSFMP, 1-1.
\end{itemize}
the Automated Licensing Data System (ALDS) on February 15 for the next permit year. Commercial take is closed during weekends (between noon on Friday and noon on Sunday); take for live bait is exempt from this weekend closure. The squid season is most active in central California during summer months and in southern California during winter months. The recreational sector of the fishery is not subject to any seasonal or hour closures.  

**Where do they fish?**
While information on market squid spawning locations has been limited in the past, recent research details more nuanced information on squid spawning habits, including finding Central and Southern California spawning habitats to be on sandy bottom in shallow (20-70 meters) water in a narrow temperature range of 10-14.4 degrees C. As a result, the fishery shifts from the coastline to further offshore islands from season to season, though they are generally “harvested nearshore on sandy bottom habitats” and even those offshore spawning locations occur less than 300 meters from the islands almost 100% of the time. It remains unknown whether “squid show site fidelity, returning to the same spawning site where they hatched.”

The state commercial fishery is bounded by the “westerly extension of the United States – Republic of Mexico boundary line” in the south and the California – Oregon border to the north. Commercial harvest occurs in all state waters “except where prohibited or restricted, as specified, in state marine protected areas (MPAs)” and the MSFMP regulations. “There are two main fishery areas in California,” referred to as the

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449 Personal Communication with Chelsea Protasio, Cal. Dep’t of Fish and Wildlife (Oct. 2013).
452 Cal. Code Regs. tit. 14 § 29.05(a); and Rapid Assessment, 75.
453 MSFMP, 2-19.
455 MSFMP, 2-19.
456 MSFMP, 1-3.
458 MSFMP, 2-19.
460 MSFMP, 1-3; Cal. Code Regs. tit. 14 § 27. See also Cal. Code Regs. tit. 14 § 29.05(b).
northern and southern fishery regions.\textsuperscript{461} Regardless of the location of spawning ground and where commercial fishermen are fishing, most landings occur in Santa Barbara (at Ventura and Port Hueneme) and in Los Angeles (at San Pedro and Terminal Island).\textsuperscript{462} In the north, the fishery is concentrated in areas around Monterey Bay and Half Moon Bay with the majority of harvest occurring “within a half-mile of the Monterey Bay shoreline” and in the south, the fishery includes “the Channel Islands and coastal areas from Point Conception south to La Jolla.”\textsuperscript{463}

**How do they fish?**
Commercial harvest of market squid is restricted to use of “round haul gear, including purse seine drum seine and lampara nets[,] . . . brail gear, including dip and scoop nets, . . . [and l]ights.”\textsuperscript{464} Seine fishing methods entail the use of “[a]round haul net with a ‘purse’ line to close the bottom of the net.”\textsuperscript{465} Brail methods involve “[a] large dip net sometimes used with the assistance of the vessel’s hydraulics.”\textsuperscript{466} The maximum wattage allowed for lights is 30,000 watts and each vessel must use light shields “orienting the illumination directly downward, or providing for the illumination to be completely below the surface of the water.”\textsuperscript{467} Light boats are not allowed in District 10,\textsuperscript{468} and any lights used to attract squid must come from the “vessel deploying nets for the take, possession, and landing of squid or from the seine skiff of the vessel deploying

\textsuperscript{461} MSFMP, 1-30. These regions are not delineated by regulation.

\textsuperscript{462} MSFMP, 1-30.

\textsuperscript{463} MSFMP, 1-30; and Rapid Assessment, 74.

\textsuperscript{464} Cal. Code Regs. tit. 14 § 149.1(b)(1)-(3).

\textsuperscript{465} MSFMP, 1-33.

\textsuperscript{466} MSFMP, 1-33.

\textsuperscript{467} Cal. Code Regs. tit. 14 § 149(g), (h). When interim measures on lights went into effect on May 30, 2000, the Commission asked the Department to report back as to the effectiveness within one year. In 2001, the Department recommended continuing the wattage and shielding regulation and supported “continued study and exploration in the use of alternative fishing methods, such as underwater lights, which may be less invasive.” Cal. Dep’t of Fish and Wildlife, Status of the Market Squid Fishery with Recommendations for a Conservation and Management Plan - Report to the Legislature: May 1, 2001, http://www.dfg.ca.gov/marine/cpshms/status01.asp (last visited Oct. 29, 2013). In the report, the Department “urges the development of additional gear restrictions such as limitations on mesh or net size based on information collected in field studies, logbooks, or from bycatch or other information available from port sampling efforts.” Id.

Recreational harvest is by hand-held dip nets, hook and line and by hand, as well as with sabiki and other bait rigs.

**How much can they fish?**
The annual commercial catch is limited to 118,000 short tons (st) of market squid. This catch limit is based on the average catch over a 3-year period from 1999-2002. Using current landings trends, the Department estimates when this limit will be reached and publicly announces closure of the fishery. The annual catch limit does apply to incidental take of up to two tons of market squid per trip or per day, but does not apply to take of squid for live bait purposes only. Regulations for the two tons exemption were amended and went into effect as of July 1, 2014. There is no limit for recreational harvest.

**Meeting the Goals and Requirements of the MLMA**
The MLMA contains several goals to guide the sustainable management of fisheries. Many of the goals are broad and a great deal of overlap exists among them. The primary goals include: conserve entire ecosystems, recognize non-consumptive values, allow only those activities that are sustainable, maintain, restore, or enhance habitat, restore depressed fisheries, minimize bycatch, minimize adverse effects

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469 Cal. Fish & Game § 8399.1.
474 MSFMP, 1-62 – 1-63.
476 Cal. Code Regs. tit. 14 § 149(g).
478 Personal Communication with Chelsea Protasio, Cal. Dep’t of Fish and Wildlife (August 2014).
480 Cal. Fish & Game § 7050(b)(1).
481 Cal. Fish & Game § 7050(b)(3).
482 Cal. Fish & Game § 7050(b)(2).
483 Cal. Fish & Game § 7055(b).
484 Cal. Fish & Game § 7055(b).
on fishing communities, establish processes for adaptive management, establish a program for external peer review, and ensure collaboration and stakeholder involvement. This review is meant to be preliminary and foundational and therefore is not a comprehensive analysis of every goal and objective found within the MLMA. This review focuses on the primary goals listed above because they encompass several other specific goals listed in sections 7050 and 7056 of the Act. For example, the MLMA’s best available science requirement is reflected in the goals of conserving entire ecosystems, restoring depressed fisheries, ensuring adaptive management and sustainability, and the goal of establishing a peer review process. In addition to accounting for the goals of the MLMA, the MSFMP has two primary goals: (1) “[t]o manage the market squid resource to ensure long term resource conservation and sustainability;” and (2) “[t]o develop a framework for management that will be responsive to environmental and socioeconomic changes.” The MSFMP states nine priority objectives to meet these goals. The MSFMP bases it management to meet these goals and objectives (and the goals and objectives of the MLMA and the CPS FMP) on (1) fishery control rules; (2) a restricted access program; (3) ecological considerations; and (4) administrative items. The following discussion is organized according to goals identified in the MLMA and each of the MSFMP objectives are sorted and detailed relative to each of the applicable MLMA goals.

Conserve entire ecosystems [e.g., Fish and Game Code §7050(b)(1)]
The MLMA recognizes that the health of fish populations is closely related to the health of their ecosystem. “Maintaining the health of marine ecosystems is key to productive fisheries and non–consumptive uses of marine living resources.” The MLMA broadly requires that entire ecosystems be conserved. Conserving entire ecosystems is an

485 Cal. Fish & Game § 7056(d).
486 Cal. Fish & Game § 7056(i-j).
487 Cal. Fish & Game § 7056(g).
488 Cal. Fish & Game § 7062.
489 Cal. Fish & Game § 7056(h), (k).
490 MSFMP, 1-5.
491 MSFMP, 1-5.
492 MSFMP, 1-57.
494 Cal. Fish & Game § 7050(b)(1).
overarching goal that encompasses many of the other goals and objectives of the MLMA. The MSFMP supports this goal through its objectives to “[m]aintain an adequate forage reserve for marine mammals, fish and seabirds”495 and “[s]upport and promote increased understanding of market squid natural history, population dynamics, and its ecosystem’s role to improve management.”496

Adopted in November of 2012, the Commission’s Forage Fish Policy also contains some guiding principles for managing forage species for the benefit of the ecosystem.497 Among other things, the Forage Species Policy calls upon the Commission to manage forage species with precautionary goals based on the best available science and to identify and incorporate essential fisheries information (EFI).498 Market squid management documents do not reference this relatively new Forage Species Policy specifically, but some aspects of market squid management recognize and minimize adverse effects of the fishery on squid predators, including (1) the restricted access program establishing a vessel-based capacity goal; (2) weekend closures; (3) closures in the Gulf of the Farallones and MPAs to protect predators and provide them with prey; and (4) light shield restrictions499 to protect seabird populations. Regarding the restricted access program, permits are not required for live bait or incidental take of two tons or less,500 so the impacts of these harvests on the forage population are unknown. Regarding habitat, “MPAs and ecological reserves [] function as forage reserves for the many species that consume market squid.”501 While the preferred project alternative under the MSFMP would have designated additional ecological reserves for market squid, the reserves were not adopted as a part of the regulatory implementation of the MSFMP. See below under the “Maintain, restore or enhance habitat” goal for more on MPAs and reserves.

The Forage Policy also requires managers to “[i]dentify and progressively incorporate [EFI] needed for ecosystem-based management of forage species, including physical

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495 MSFMP, 1-5.
496 MSFMP, 1-5.
497 Forage Policy.
498 Forage Policy.
499 Lights themselves have also changed since the inception of the regulations, with fishermen now using green halogens and LEDs. Personal Communication with Dianna Porzio, Cal. Dep’t of Fish and Wildlife (Oct. 2013).
501 MSFMP, 1-74.
factors, oceanographic conditions, the effects of fishing on forage species’ dependent predators, the availability of alternative prey, spatio-temporal foraging hotspots for predators, and existing management, including marine protected areas.”

Squid monitoring programs (port sampling and logbooks) are an example of a management measure in the MSFMP consistent with this goal. Fisheries independent research has also been conducted to describe predator-prey interactions to more fully understand the role of market squid as a forage species.

The MSFMP was adopted well before the Commission’s Forage Species Policy; and given its newness, exploring what forage species management “consistency” might look like, and how forage species might be managed jointly, is an opportunity. Presently, many of the regulations in place to implement the MSFMP appear consistent with the Forage Species Policy and efforts to “encourage cooperation and collaboration” of forage species are emerging along the west coast, such as with the Pacific Fishery Management Council’s Ecosystem Plan effort.

Recognize non-consumptive values [e.g., Fish and Game Code §7050(b)(3)]
The MLMA recognizes that marine ecosystems provide important benefits to people beyond the consumption of resources. Important non-consumptive values include “educational, scientific, and recreational uses that do not involve the taking of California’s marine living resources.” The objectives for management set out in the MLMA encourage the protection of marine resources to ensure their continued availability for non-consumptive uses.

The recognition and inclusion of non-consumptive values into fisheries management is a major challenge generally, and particularly in terms of allocating marine resources equitably among fishing sectors, non-consumptive users, and ecosystem needs. Market squid’s role as a forage species,

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502 Forage Policy.


504 The Forage Policy references the importance of facilitating “consistency in the management of forage species.” Forage Policy. By “consistency,” the Commission might be referencing consistency across those forage species managed in the state and in coordination with the federal council. In other words, how might sardine, herring, market squid, and other species be cooperatively managed based on their shared status as forage species?

505 Regarding a DFW reviewer question on market squid landing numbers for Mexico and Canada, COS does not have this information at this time.


507 Cal. Fish & Game § 7050(b)(3).

508 Cal. Fish & Game § 7050(b)(3).
and therefore its contribution to and interactions within the ecosystem, may be considered an important non-consumptive value that would support educational, scientific, and other non-consumptive uses. For example, species interactions like whales foraging for squid may contribute to increased whale watching in nearshore environments and result in positive socioeconomic impacts from tourism.

Weekend closures provide an example of a management measure under the MSFMP that addresses non-consumptive recreational values of the fishery by helping to “alleviate conflict with other interest groups (e.g., divers, recreational fishermen, commercial passenger fishing vessels, etc.).” The light shield requirements also reflect non-consumptive values by protecting coastal communities and seabird populations.

**Allow only those activities that are sustainable [e.g., Fish and Game Code §7050(b)(2)]**

Sustainability is identified as the primary goal of the MLMA. The MLMA defines sustainability as both “continuous replacement of resources, taking into account fluctuations in abundance and environmental variability,” and “securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.” The MLMA broadly requires that allowable activities and uses of marine resources must be sustainable and lists several goals and objectives to guide management of sustainable fisheries. The MSFMP supports this overarching sustainability goal with the objective that management of the fishery “[p]rovide for the sustainable use of the market squid resource by commercial and recreational fisheries for the optimum long-term benefits of present and future generations.” The MSFMP identifies several approaches to achieving this goal and specifically states that “[i]n the absence of a biomass estimate for market squid, a limited entry program, in conjunction with a seasonal catch limit, monitoring the fishery through the egg escapement method and weekend closures should collectively provide for a sustainable squid resource and fishery.”

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509 MSFMP, 1-64.
510 MSFMP, 1-65.
511 Cal. Fish & Game § 7056.
512 Cal. Fish & Game § 99.5.
513 Cal. Fish & Game § 7050(b)(2).
514 MSFMP, 1-5.
515 MSFMP, 1-66.
Squid Fishery” includes a detailed description of these management measures, discussed in turn below and referenced under other MLMA goals sections that follow.

**Limited Entry Program**

When the MSFMP was adopted, the market squid fishery was identified as “capable of harvesting more squid than is available under current or likely future biomass conditions.” In response, the MSFMP developed a Restricted Access Program with capacity goals—pursuant to the Commission’s Restricted Access Policy—in part to “contribute to sustainable fisheries management by providing a means to match the level of effort in a fishery to the health of the fishery resource and by giving fishery participants a greater stake in maintaining sustainability.” The MSFMP capacity goals intend to establish a “moderately productive and specialized fleet.” While current permit numbers are less than pre-MSFMP numbers, they are still over the capacity goal set forth in the regulations as the process of attrition within the fishery takes time. The non-transferable permits for the commercial market squid fishery will continue to reduce the capacity of the fishery over time because the non-transferable market squid vessel permits, brail permits, and light boat permits all become null and void upon the death of the original permit holder.

**Egg Escapement as a Proxy MSY and Annual Catch Limits**

Information for calculating an acceptable level of harvest in the market squid fishery is available, including biomass, reproductive potential and productivity, and age

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516 MSFMP, 1-67.

517 The Commission’s purposes for Restricted Access programs are to “(1) promote sustainable fisheries; (2) provide for an orderly fishery; (3) promote conservation among fishery participants; and (4) maintain the long-term economic viability of fisheries.” Cal. Fish and Game Comm’n, Miscellaneous Policies, Restricted Access Commercial Fisheries [hereinafter Restricted Access Policy] http://www.fgc.ca.gov/policy/p4misc.aspx (last visited Oct. 29, 2013).

518 MSFMP, 1-65 – 1-66 quoting Restricted Access Policy.

519 MSFMP, 1-67.

520 Cal. Code Regs. tit. 14 § 149.1(c)(2).


composition,\textsuperscript{523} as well as other biological\textsuperscript{524} and economic parameters.\textsuperscript{525} The MLMA encourages using MSY as a standard for determining whether there is overfishing in a fishery and new ways to calculate MSY using different types of fisheries data, including catch data, continue to emerge.\textsuperscript{526} For market squid, an egg escapement method (set at an escapement level of 30\%) is used as a proxy for MSY.\textsuperscript{527} The MSFMP states that the use of the egg escapement method “should be considered a temporary solution while other fishery-independent methods\textsuperscript{528} are pursued to assess biomass and to collect essential fishery information.”\textsuperscript{529} A new analytical approach to computing absolute abundance of the spawning population of market squid has been recently developed, presenting a new opportunity for market squid management.\textsuperscript{530}

The annual catch limit of 118,000 st for market squid is based on a 3-year average of historical catch from 1999-2000 to 2002-2003\textsuperscript{531} and assumes the stock is above the average spawning biomass.\textsuperscript{532} The MSFMP states that based on guidance from NOAA Fisheries (Restrepo et al. 1998), a recent average catch from a time period where “there


\textsuperscript{525} MSFMP, 1-81.

\textsuperscript{526} Steven Martell & Rainer Froese et al., A Simple Method for Estimating MSY from Catch and Resilience, 14 Fish and Fisheries 504–514 (2012).

\textsuperscript{527} MSFMP, 1-61.

\textsuperscript{528} Department staff notes that funds are needed for acoustic surveys. Personal Communication with Briana Brady, Cal. Dep’t of Fish and Wildlife (Oct. 2013).

\textsuperscript{529} 2006 Status of the Fisheries, 1-10.


\textsuperscript{531} MSFMP, 1-61 – 1-62.

\textsuperscript{532} MSFMP, 1-62.
is no qualitative or quantitative evidence of declining abundance” may be used to develop a proxy for MSY. For market squid this historical catch average is based on a three-year span with annual catches exceeding 100,000 tons. The MSFMP states the 118,000 st limit is an appropriate annual catch limit because (1) squid can support such landings due to a semi-annual lifespan and the presence of several cohorts throughout the year; and (2) the “ability of the market squid fishery to support landings of greater than 100,000 tons in the 1999-2000 season with repeat landings of the same magnitude in the following two seasons suggests that the stock is robust enough to withstand this level of landings.” When the annual catch limit is met before the season’s end, as it has for the last four seasons, measures are taken to close down the fishery. In compliance with the Section 3.2.6 “Live Bait Fishery and Incidental Catch of Market Squid” of MSFMP, the Commission also adopted provisions to allow for market squid to be landed commercially after the catch limit has been reached so long as the squid will be used for live bait purposes only. Prior to regulatory changes effective in July 2014, incidental catches of up to two tons per trip were also allowed to exceed the annual catch limit. “It was never the intent, nor is it compatible with the management goals of the MSFMP to have a two ton directed fishery occurring after the catch limit has been reached.” However, there is no definition of the term “incidental,” making compliance and enforcement difficult. These amended rules are intended to “clarify that the commercial fishery is closed once the catch limit is reached, and specifies that the incidental take allowance of two tons must be landed or possessed with other species.”

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534 MSFMP, 1-62 – 1-63. The two years preceding the chosen range both had landings of under 12,000 tons due to El Nino events, and the year immediately following the chosen range had landings of under 50,000 tons. MSFMP at 1-63. Outside of the three-year span selected, catch had only exceeded 50,000 tons four times and 100,000 tons one other time. MSFMP, 1-32.

535 MSFMP, 1-62.

536 MSFMP, 1-62.


538 Personal Communication with Laura Ryley, Cal. Dep’t of Fish and Wildlife (August 2014).

539 MSFMP, 1-65.


Monitoring
The MSFMP has an objective to “ensure effective monitoring of the market squid population and its fisheries.” The market squid fishery is monitored both by fishery dependent and fishery independent sampling efforts. First, a port sampling program implemented in October 1998 allows the Department to determine characteristics of harvested squid, shifts in the fishery, and to estimate egg escapement. Data collected under the port sampling program include species identification, size, weight, sex, age from statoliths, maturity through gonad and mantle tissue collection, and fecundity. Second, the logbook program implemented in May 2000 requires written logbooks to be kept by all individuals who possess a market squid permit. Valuable catch information other than landing data are gathered from fishing vessels and lightboats providing exact fishing locations and allowing an estimate of fishery effort. Finally, landing receipts are required for all commercial fishermen to fill out when catch is sold by fishermen and provide the primary source of information about the amount, value, and location of catch, and the gear used.

542 MSFMP, 1-5.
543 MSFMP, 1-81 – 1-84.
544 A guide to port sampling, laboratory sampling procedures, and databases for the market squid fishery. 2010. CDFW CPSHMS Project.
545 MSFMP, 1-81.
546 MSFMP, 1-82.
547 Cal. Code Regs. tit. 14 § 149(e).
548 “Exact” locations are logged depending on the level of accuracy of the vessel activity data. Some records only record latitude and longitude to the minute level, not the second level. When this is the case, the location can be off by as much as approximately 1.5 kilometers. Personal communication, Laura Ryley, Cal. Dep’t of Fish and Wildlife (Oct. 2013). Logbook data for light and brail vessels only require “general location, to the nearest geographic landmark.” Personal Communication with Chelsea Protasio, Cal. Dep’t of Fish and Wildlife (Oct. 2013). Given this, it would be interesting to explore what percentage of boats are outliers (i.e., those who don’t include seconds on their latitude/longitude coordinates) to begin to reveal patterns of this reporting. Personal Communication with Dianna Porzio, Cal. Dep’t of Fish and Wildlife (Oct. 2013).
549 MSFMP, 1-81; MSFMP, 1-84.
550 Cal. Fish & Game § 8043.
551 MSFMP, 1-81; Cal. Fish & Game § 8043(b)(1).
Regarding fishery independent research, the Department has sponsored several research projects beginning in 1998 that have provided information on paralarval and market squid distribution when not in spawning grounds, characterization of spawning habitat, and reproductive potential. The Department research program was funded by permit fees and coordinated for comparability, and research focused on increasing the sample size of female squid to refine the egg escapement model and locating and characterizing squid spawning beds. Since the MSFMP, several additional fishery independent studies on market squid have been conducted including the Department’s cooperative research programs with the California Wetfish Producers Association, the University of California at Santa Barbara, and the Scripps Institute of Oceanography.

**Weekend closures**
Weekend closures were in existence pre-MSFMP and have continued subsequent to its adoption. They allow for two days of uninterrupted spawning and thus, spread escapement throughout the year instead of during one concentrated time.

**Maintain, restore or enhance habitat [e.g., Fish and Game Code §7055(b)]**
The MLMA recognizes that the health of many fish populations is closely related to the health of their habitat. “Healthy habitats are important for maintaining the productivity

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552 MSFMP, 1-82.
553 MSFMP, 1-82.
554 MSFMP, 1-84.
560 MSFMP, 1-64.
and diversity of marine ecosystems and viable commercial and recreational fisheries.”  

The MLMA broadly requires that the habitat of marine wildlife is to be maintained, restored, or enhanced, where appropriate.  

More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.”  

The MSFMP directs the Department to “[i]dentify, protect, and restore critical market squid habitat.”  

Market squid Essential Fish Habitat (EFH) is generally defined as the entire EEZ from the U.S. – Canada and U.S. – Mexico borders above the thermocline (50-79 degrees F).  

The MSFMP contemplates maintaining, restoring or enhancing market squid habitat through the description of harvest replenishment areas that would “protect spawning habitat, function as forage reserves, offer protection against bycatch and fishery interactions, and provide areas of uninterrupted spawning for market squid.”  

Although similar to MPAs in practice, the MSFMP states that “[h]arvest replenishment areas differ from MPAs in that they would only be managed for the commercial market squid fishery.”  

The MSFMP’s Environmental Document assessed several Options for Squid Harvest Replenishment/General Habitat Closure Areas, some of which were quite extensive and would make “half of the state a squid harvest replenishment area.”  

Ultimately, the implementing regulations did not set aside harvest replenishment areas.  

However, fishing is not allowed in 12 MPAs at the northern

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562 Cal. Fish & Game § 7056(b).
563 Cal. Fish & Game § 7084(a).
564 MSFMP, 1-5.
565 MSFMP, 1-29. See also Rapid Assessments, 84. A detailed description of the market squid EFH as defined by the Coastal Pelagic Species FMP is located in Appendix D: Description and Identification of Essential Fish Habitat for the Coastal Pelagic Species Fishery Management Plan, available at http://www.pcouncil.org/wp-content/uploads/I4a_ATT2_APDX_D_EFH_NOV2010BB.pdf. In 2010, the Coastal Pelagic Species Management Team conducted a five-year review of the Coastal Pelagic Species Essential Fish Habitat, in which they examined all available updated information and determined that no change to the EFH definition was warranted. Coastal Pelagic Species Management Team, Report to the Pacific Fisheries Management Council: Essential Fish Habitat Periodic Review of Coastal Pelagic Species (Nov. 2010) available at http://www.pcouncil.org/wp-content/uploads/I4a_ATT1_CPSMT_EFH_NOV2010BB.pdf.
566 MSFMP, 1-73.
567 MSFMP, 2-27.
568 MSFMP, 2-28.
569 MSFMP, 3-7.
Channel Islands established in 2002 and no roundhaul nets may be used in state-designated ecological reserves.\(^{570}\) Also, of the 147 California MPAs currently in place in 2012, 124 prohibit take of squid, only 13 allow take of squid, and 10 prohibit take with potential exceptions to squid.\(^{571}\) So long as the areas closed to fishing are also areas that contain squid habitat, as is the case with the northern Channel Islands MPAs, these restrictions can “act as general habitat area closures for they offer protection against bycatch and fishery interactions and function as forage reserves.”\(^{572}\)

In terms of adverse habitat impacts from the market squid fishery on habitat, “the only opportunity for damage to benthos or essential fish habitat . . . is from lost gear.”\(^{573}\) However, there is also a slight potential for the fishery to damage “spawning grounds because market squid attach their egg cases to the bottom substrate at spawning sites that include shallow, nearshore areas"\(^{574}\) when market squid are spawning in these nearshore areas, and fishing pressure is high.

**Restore depressed fisheries [e.g., Fish and Game Code §7055(b)]**

The MLMA classifies a fishery as depressed if “a declining population trend has occurred over a period of time appropriate to that fishery,” or if fish populations decline below abundance levels “consistent with maximum sustainable yield.”\(^{575}\) A fishery may be depressed due to human impacts such as overfishing or as a result of natural causes such as changes in ocean conditions. Regardless of the cause, the MLMA requires that all state managed fisheries include the objective of restoring depressed fisheries to sustainable levels.\(^{576}\) If overfishing is the cause of a depressed fishery, the MLMA further requires a timetable and process for rebuilding the fishery be included in all FMPs.\(^{577}\)

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\(^{570}\) MSFMP, 1-73 – 1-74.

\(^{571}\) Personal Communication with Anna Holder, Cal. Dep’t of Fish and Wildlife (Oct. 2013).

\(^{572}\) MSFMP, 2-27.

\(^{573}\) Rapid Assessments, 84.

\(^{574}\) Rapid Assessments, 84.

\(^{575}\) Cal. Fish & Game § 90.7 (“‘Depressed,’ with regard to a marine fishery, means the condition of a fishery for which the best available scientific information, and other relevant information that the commission or department possesses or receives, indicates a declining population trend has occurred over a period of time appropriate to that fishery. With regard to fisheries for which management is based on maximum sustainable yield, or in which a natural mortality rate is available, ‘depressed’ means the condition of a fishery that exhibits declining fish population abundance levels below those consistent with maximum sustainable yield.”)

\(^{576}\) Cal. Fish & Game § 7056(c).

\(^{577}\) Cal. Fish & Game § 7086.
Although “[o]verfished” is defined at §97.5 of the Fish and Game Code, “because no biomass estimate exists for market squid, it is not possible to define an overfished condition for this species.” The MSFMP further defines “overfished” to be “a condition that may exist when either the egg escapement threshold is not met, or catches of squid exceed any specified allowable level.” “Overfishing” as defined at §98 of the Fish and Game Code and in the MSFMP also “may mean that harvests of squid are occurring at times when either the egg escapement threshold is not being met, or catches are exceeding specified allowable levels. These catches may not be sustainable.” Similar to the MSFMP, the amended federal Coastal Pelagic Species FMP sets the allowable biological catch based on a 30% egg escapement target and sets the overfishing limit as two consecutive years below this target. Market squid is not considered overfished, nor is it currently undergoing overfishing. See discussion above under the ‘Allow only those activities that are sustainable’ goal for more on how the market squid fishery is managed to avoid becoming a depressed fishery.

Minimize bycatch [e.g., Fish and Game Code §7056(d)]
The MLMA defines bycatch as “fish or other marine life that are taken in a fishery but which are not the target of the fishery . . . includ[ing] discards.” Bycatch is often discarded dead or kept unreported and can be a serious problem, affecting vulnerable marine species. The MLMA requires monitoring of bycatch and discards and reduction of bycatch that is deemed “unacceptable.” To achieve this goal, the MSFMP articulates the following objective: “[e]nsure proper utilization, the avoidance of bycatch in the market squid fishery, and the avoidance of wastage of market squid in other fisheries.” The MSFMP definition of “bycatch” closely mirrors the MLMA’s and

578 MSFMP, 1-63.
579 Cal. Code Regs. tit. 14 § 53.01(o).
580 Cal. Code Regs. tit. 14 § 53.01(p).
582 Cal. Fish & Game § 90.5. The NOAA Fisheries definition of bycatch does not include discards: “Animals caught by fishing that were not the intended target of the fishing activity. Such unwanted catch is often wasted.” National Marine Fisheries Service, Protected Resources Glossary, http://www.nmfs.noaa.gov/pr/glossary.htm.
583 MLA Guide, 32.
584 Cal. Fish & Game § 7056(d).
585 MSFMP, 1-5.
refers to both retained species that are caught and landed along with the target species and discards. The MSFMP defines “discards” as “[f]ish that are taken in a fishery but are not retained because they are of an undesirable species, size, sex, or quality, or because they are required by law to be released.”

Overall, “[b]ycatch is minimal in the commercial squid fishery, although it cannot be avoided entirely.” Fishing with roundhaul gear targets specific schools of market squid so there is a low rate of incidental take. Other coastal pelagic species including Pacific mackerel, Pacific sardines, northern anchovies, and jack mackerel are the most common incidental take associated with the market squid fishery but “[n]one of these species [] are considered overfished or otherwise jeopardized by the market squid fishery.” Additionally, these species are all federally managed and monitored under the CPS FMP. These coastal pelagic species tend to be retained by market squid fishermen and because sorting occurs at the dock, not on the boat, the “presence or absence of incidental catch has been documented through [the Department’s] port sampling program.” Incidental catch increases in shallower waters where the nets may have contact with the bottom. Although less data are available regarding bycatch within the brail fleet, it contributes a small portion of total squid landings and “it is

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587 MSFMP, 1-107.

588 MSFMP, 1-40.

589 Rapid Assessments, 79.


591 Rapid Assessments, 80.

592 Rapid Assessments, 81.

593 Rapid Assessments, 79.


595 MSFMP, 1-41.
unlikely that the brail fishery poses a risk of serious or irreversible harm to bycatch species.”

Contrary to the commercially valuable incidental catch that is retained by market squid fishermen, some bycatch is released alive. Round haul gear infrequently catches benthic species including “stingrays, bat rays, brittle stars, and croaker” that can be released alive. Larger species can be released at sea using a dip net or by lowering the cork line, so actual numbers of incidental catch are unknown. Incidental take of squid egg capsules is also a concern because it “may affect the stock itself.” Between 1998 and 2003 the Department’s port sampling program found that “3.2% of sampled landings contained squid egg cases,” overall, while 8.3% of landings in Monterey contained squid egg cases. In 2011, 8.4% of sampled landings contained squid egg cases.

Minimize adverse effects on fishing communities [e.g., Fish and Game Code §7056(i),(j)]

Because regulations enacted pursuant to the MLMA place restrictions and requirements on fisheries, impacts on fishing communities and coastal economies are inevitable. The MLMA requires that managers consider the “long-term interests of people dependent on fishing for food, livelihood, or recreation,” and minimize adverse effects of management on local economies and communities. Relevant to this goal, the MSFMP requires the Department to “[m]inimize the adverse impacts of management on small-scale fisheries, coastal communities, and local economics.” The MSFMP directly addresses impacts on the fishing community through the use of advisory committees. See more on market squid advisory committees in the “Collaboration and stakeholder involvement” section below. The MSFMP’s restricted access program (see above under “Allow only those activities that are sustainable” goal) also addresses impacts on the fishing community. Finally, gear restrictions adopted by the MSFMP were not

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596 Rapid Assessments, 81.
597 Rapid Assessments, 80.
598 Rapid Assessments, 80.
599 Rapid Assessments, 79.
600 MSFMP, 1-40.
601 Rapid Assessments, 79.
602 Cal. Fish & Game § 7056(i-j).
603 MSFMP, 1-6.
significant so the fishery did not incur costly gear switching requirements upon implementation of the Plan.\textsuperscript{605}

The MSFMP also recognizes the importance of understanding the social and economic facts of the fishery (i.e., employment, expenditures, market demand, and revenue).\textsuperscript{606} A 2001 study on the socio-economic organization of the market squid fishery provided “social scientific information . . . to evaluate and consider potential outcomes of management options for the squid fishery.”\textsuperscript{607} The MSFMP contains a significant amount of descriptive information on market squid landings per port, ex-vessel revenues, and the demographic and social aspects of the communities associated with the fishery, which may help managers make balanced decisions regarding any impacts their decisions may have on these communities.\textsuperscript{608} Additionally, a variety of available resources on employment, expenditures and revenues are listed in the MSFMP\textsuperscript{609} and understanding the social and economic dimensions of the fishery is identified as an important goal in the MSFMP;\textsuperscript{610} however, no detailed approach to analysis is provided.

Management should be adaptive [e.g., Fish and Game Code §7056(g),(l)]

The MLMA defines adaptive management as a “scientific policy that seeks to improve management of biological resources . . . by viewing program actions as tools for learning.”\textsuperscript{611} Even if a chosen management measure fails, it “will provide useful information for future actions.”\textsuperscript{612} Management is adaptive when fisheries managers are able to respond to changing environmental and socio-economic conditions, and update regulations accordingly.\textsuperscript{613} The MLMA requires that management decisions are

california/170.html (“. . . brail-boat (scoop net) squid fishermen say they’re losing out to seiners under the quota system adopted by the state’s fish and game commission in 2004.”).

\textsuperscript{605} MSFMP, 1-65.
\textsuperscript{606} MSFMP, 1-84.
\textsuperscript{608} MSFMP, 1-48 – 1-53.
\textsuperscript{609} MSFMP, 1-84.
\textsuperscript{610} MSFMP, 1-87.
\textsuperscript{611} Cal. Fish & Game § 90.1.
\textsuperscript{612} Cal. Fish & Game § 90.1.
\textsuperscript{613} Cal. Fish & Game § 7056(l).
“adaptive and are based on the best available scientific information.” The MSFMP echoes this goal, requiring the Department to “[u]se adaptive management to provide for necessary changes and modifications of management measures in a timely and efficient manner” and “[e]nsure enforcement of regulations.” Management of market squid relies on a hierarchical framework for adjustments—some require FMP amendment, while others may only need an in-season adjustment. Adaptive management is key to managing the market squid fishery as information on the biology of the squid, and estimates of squid abundance, become increasingly available. An area of particular attention is how environmental forcing (e.g., El Niño/La Niña cycles) affects stocks of market squid population dynamics, particularly in the face of climate change.

**Peer review [e.g., Fish and Game Code §7062]**
External peer review is identified as a tool to ensure that the best available scientific information is used in achieving the goals of the MLMA. The MLMA requires that documents such as FMPs and fishery research protocols undergo external peer review, and gives discretion to the Department to submit other management documents for peer review. The Department relied on a peer review panel that received all pertinent comments from the Department, fishery participants and other interested parties when developing the MSFMP.

**Collaboration & stakeholder involvement [e.g., Fish and Game Code §7056(h),(k)]**
Collaboration and stakeholder involvement refers to the involvement of interested parties and members of the public throughout the management process. This involvement can occur through research collaborations or at the public comment stage.

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614 Cal. Fish & Game § 7056(g).
615 MSFMP, 1-5.
616 MSFMP, 1-5.
617 MSFMP, 1-9.
619 Cal. Fish & Game § 7062.
620 Cal. Fish & Game § 7062(a).
621 MSFMP, 1-10.
622 Cal. Fish & Game § 7059(a).
of regulation development. The MLMA requires that the “management decision making process is open and seeks advice and assistance of interested parties,” and strongly encourages collaboration with “fishery participants, marine scientists, and other interested parties.” The Department established two advisory committees to examine the market squid fishery, directly addressing the need to involve interested parties in development of the MSFMP. The Squid Fishery Advisory Committee (SFAC) “included fishery participants, environmentalists, and scientists and advised the Department on proposed management strategies and changes to the fishery.” The Squid Research Scientific Committee (SRSC) included “national and international university, agency, and private industry scientists . . . [that] made recommendations on squid research protocols and methods as well as management strategies.” The Commission ultimately adopted a limited entry program that combined elements supported by members of the advisory committees, other squid fishing industry participants, conservation groups, and a group of processors and fishermen. The Department also held several public meetings during FMP development (between 2001 and 2004), and provided a variety of opportunities for public comment on the preliminary and draft versions of the FMP before its final adoption. Since the MSFMP adoption, whenever a regulatory action comes before the Commission regarding market squid, stakeholders are engaged through the public comment process. This occurred in several meetings between November 2013 and July 2014, when the Commission discussed the Department’s intent to amend the two ton permit exemption in the market squid regulations. In addition, the Department has worked closely with the California Wetfish Producer’s Association to develop a “cooperative industry-agency” research program for market squid. This collaboration continues to prove

623 Cal. Fish & Game § 7056(h), (k).
624 Cal. Fish & Game § 7056(h), (k).
625 Cal. Code Regs. tit. 14 § 53.02(c); MSFMP, 1-6.
626 MSFMP, 1-6.
627 MSFMP, 1-6.
628 MSFMP, 1-68 – 1-69.
629 MSFMP, 1-6. All public comments and Department responses are catalogued in Section 4 of the FMP. MSFMP, 4-1 – 4-143.
630 See, e.g., May 2012 FGC Meeting Video.
631 Personal Communication with Laura Ryley, Cal. Dep’t of Fish and Wildlife (August 2014).
632 Memorandum of understanding between California Wetfish Producers Association and California Department of Fish and Game, Marine Region, Coastal Pelagic Species/Highly Migratory Species Project Regarding Collaborative Market Squid Research.
invaluable to the agency and the industry by addressing key research questions on market squid abundance.633

Fishery-Specific Challenges and Opportunities

Data Gaps
Traditional assessment methods used to determine biomass are challenging to apply to market squid because of its short life span.634 As of the adoption of the MSFMP, there was no reliable estimate of market squid abundance,635 but a new analytical approach to computing absolute abundance of the spawning population is now available, and management decisions may need to be updated in response, particularly to verify whether the current MSY egg escapement proxy promotes sustainability.636 Information regarding the ecological interactions of market squid, including its role as a forage species in the ecosystem is also available,637 but limited, and little current information exists on the socioeconomic dimensions of the squid fishery, and how such information might need to be incorporated into regulatory decisions.638 Finally, little is known about the number of recreational fishermen and their catch levels.639 The California Recreational Fisheries Survey (CRFS) would be a useful source for such data, but the program does not collect catch and effort information on market squid.640

Funding for Implementation
Baseline costs for maintaining existing Department programs that deal directly with “market squid research, monitoring, enforcement and license sales exceeds $964,000,” in 2005 dollars.641 Annual fees for market squid permits are used to “1) cover the cost of

634 MSFMP, 1-2 ~ 1-3.
635 MSFMP, 1-58; 1-83.
638 MSFMP, 1-87.
639 Rapid Assessments, 75.
640 Personal Communication with Edward Hibsch, Pacific States Marine Fisheries Commission (September 2014).
641 MSFMP, 1-70 – 1-71.
squid research and management programs, and 2) provide adequate monitoring and implementation of a limited entry program.”642 Any change in those permit fees directly impacts Department sponsored research.643

Peer Review
Peer review of management documents is noted in the MLMA regulations as an essential aspect of successful management.644 While the Department and Commission are not required to submit market squid management documents for peer review, the Department has broad peer review discretion.645 Exploring additional peer review opportunities of new management measures may be a valuable tool given the increasingly available scientific understanding of the market squid resource.

Conclusion
As one of the most important fisheries in terms of volume and revenue, the market squid fishery continues to thrive with 116,900 st landed in the 2013-2014 season.646 The management components of the market squid fishery positively reflect many of the MLMA’s goals including its limited access program, gear restrictions, and weekend closures. Although considered a data-poor fishery in both the MSFMP647 and the Managing Data Poor Fisheries Workshop,648 there have been several years of additional research on the species since the MSFMP was adopted in 2004. It nonetheless continues to pose management challenges in the face of uncertainty around estimates of abundance and how current harvest levels impact the market squid’s role as a forage species. Some proposed regulatory changes may allow management to be more precautionary in the face of this uncertainty.

642 MSFMP, 1-70.
643 MSFMP, 1-82.
644 Cal. Fish & Game § 7062(a).
645 Cal. Fish & Game § 7062(a).
647 MSFMP, 1-62.
Nearshore

Executive Summary
Management of the nearshore fishery is complex. From increasing coastal human populations and changes in the commercial and recreational fisheries to fluctuations in oceanographic conditions over at least the past 100 years, nearshore fisheries have been under pressure from a suite of sources. Increased capacity of recreational and commercial fishing and environmental changes have led to localized and broader reductions in many nearshore stocks. Due to the significant decline of some vulnerable shelf species within the west coast groundfish fishery in the late 1990’s, there was concern about the unknown status of nearshore stocks. A concerted effort focused on conservative harvest measures was adopted to avert a similar scenario for nearshore fisheries. The rapid growth of the commercial fishery also generated alarm about the health of these fish stocks and was a key driver behind California’s enactment in 1998 of the Marine Life Management Act (MLMA; effective January 1, 1999) that requires the state to develop fishery management plans, including the Nearshore Fishery Management Plan (NFMP, Nearshore FMP). Also, one of the statutes under the MLMA, referred to as the Nearshore Fisheries Management Act (NFMA), gave the California Fish and Game Commission (Commission) authority to adopt regulations to manage nearshore stocks and fisheries. The NFMA initially defined 9 species groups (10 species) as nearshore fish stocks; this list was expanded in 2002 to include a total of 19 nearshore species. Today, “Nearshore fish stocks” refers to any of the following: black rockfish (Sebastes melanops), black-and-yellow rockfish (Sebastes chrysomelas), blue rockfish (Sebastes mystinus), brown rockfish (Sebastes auriculatus), cabezon (Scorpaenichthys marmoratus), calico rockfish (Sebastes dallii), California scorpionfish (sculpin) (Scorpaena guttata), California sheephead (Semicossyphus pulcher), China rockfish (Sebastes nebulosus), copper rockfish (Sebastes caurinus), gopher rockfish (Sebastes carnatus), grass rockfish (Sebastes rastrelliger), greenlings of the genus Hexagrammos, kelp rockfish (Sebastes atrovirens), monkeyface prickleback (Cebidichthys violaceus), olive rockfish (Sebastes serranoides), quillback rockfish (Sebastes maliger), and treefish (Sebastes serriceps).

651 California Nearshore Fisheries Management Act, Cal. Fish & Game §8587.1.
In addition, the Commission approved policies in 1999 regarding restricted access to commercial fisheries. Under the NFMA authority, the Commission enacted several regulations for the nearshore fishery prior to the adoption of the NFMP. These included establishing a nearshore fishery permit system and specifying size limits for nearshore fish species. The NFMP was approved by the Commission in 2002 along with a set of regulations including definitions of fishery control rules and total allowable catch (TAC) and a mechanism to close the fishery if a sector allocation or TAC is reached, among others. Since then, many adjustments and interjurisdictional actions have taken place to develop regulations through major efforts by the California Department of Fish and Wildlife (Department). In 2006, an update on implementation, identifying progress, challenges, and remaining actions for the NFMP was completed. The majority of NFMP species are managed jointly by the Department and NOAA Fisheries/Pacific Fishery Management Council (PFMC). While inherently more complicated under joint management, the Department uses the NFMP framework to guide management at both the state and federal levels. The Department also collaborates with the PFMC on responsibilities including stock assessments, contributing substantial resources to managing the fishery.

This review provides a close examination of specifically how the NFMP addresses the MLMA’s overarching goals of ensuring the conservation, restoration, and sustainable use of California’s marine living resources. The NFMP aims to meet its requirements, goals, and objectives by employing five management approaches: Fishery Control Rules, Allocation, Regional Management, Marine Protected Areas (MPAs), and Restricted Access Programs. A review of the goals and objectives of the NFMP, as described in this document, indicate that the NFMP maps heavily onto the goals of the MLMA. A preliminary investigation into how these measures operate in the nearshore fishery reveals challenges to full implementation and potential opportunities to overcome them. We highlight a few major obstacles, such as insufficient data collection and stalled regional management, which stem primarily from capacity limitations. However, we emphasize that this review was not intended to provide a full assessment of implementation of the NFMP or regulatory history of the nearshore fishery. A comprehensive evaluation of implementation would shed more light on management under the NFMP and is a critical next step in the process of evaluating the MLMA in practice.

653 Cal. Code Regs. tit. 14 §52.01(g).
654 Personal communication with Barnes, Tom. Marine Program Manager, Cal. Dep’t of Fish and Wildlife. October 2013.
655 Cal. Dep’t of Fish & Game, Update on NFMP Implementation 1-16 (2006) (hereinafter Update on NFMP Implementation).
656 NFMP Section 1, 3-101.
Enabling Authorities and General Regulatory Structure

The regulatory authority for the nearshore fishery has changed over the past three decades. Prior to the adoption of the federal Pacific Coast Groundfish Fishery Management Plan, California managed its nearshore species through a regulatory process that included the Department along with either the California State Legislature (for the commercial sector) or the Commission (for the recreational sector). With implementation of the federal groundfish plan in 1982, nearshore groundfish species came under the management authority of PFMC and NOAA Fisheries. (This federal groundfish plan aimed to streamline policies, reduce jurisdictional difficulties, and lower state-by-state management variability for fisheries crossing state boundaries.) The jointly managed species included 13 nearshore rockfish, California scorpionfish, cabezon, and kelp greenling. Department staff assisted in the development of management actions and regulations for these species through their participation on the Council and the Council’s advisory teams. However, much of the specific management for these species in the 1980s and 1990s occurred at the state level since federal

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management categorized species very broadly (“Other Rockfish” for the nearshore rockfish and California scorpionfish; “Other Fish” for cabezon and kelp greenling).

In 1999, management at the state level changed with the enactment of the Nearshore Fisheries Management Act (NFMA). The NFMA gave authority to the Commission to regulate both the commercial and recreational sectors of nine nearshore species groups (10 species): five shallow nearshore rockfish (black-and-yellow, China, kelp, grass, and gopher rockfish), California scorpionfish, cabezon, California sheephead, and two greenlings (kelp and rock greenling). Authorization of the Commission to regulate these species for all sectors, allowed for a more uniform and effective management process. In addition, the NFMA gave the Commission authority to add other nearshore species to this list. Accordingly, in 2002, the FGC added nine more species: eight deeper nearshore rockfishes (black, blue, brown, calico, copper, olive, quillback, and treefish) and the monkeyface prickleback.

During this time frame (1999-2002), the Department provided guidance to the Commission on potential harvest limits and sector allocation options for California sheephead, cabezon, and greenlings (kelp and rock greenling combined). At the end of 2000, the Commission adopted interim total allowable catch and sector allocations for 2001, and then took action in the summer and fall of 2001 to close commercial fisheries based upon these catch allocations. In 2001 and 2002, the Commission revised the interim recreational and commercial harvest amounts, which included reallocating fish between sectors, while taking emergency actions to prevent exceeding the new harvest limits. The 2002 adopted harvest limits remained in place through 2003.

Following the requirements of the MLMA, the Department developed the NFMP, which the Commission adopted in 2002 along with regulations to implement the NFMP. This NFMP covered all 19 of the nearshore finfish species regulated by the Commission through the NFMA. During early plan implementation, and in conjunction with concurrent federal actions, the Department recommended revised state and/or federal harvest limits for plan species beginning in 2003.

The Council began to split up the rockfish along depth gradients (nearshore, shelf, and slope) and manage the nearshore rockfish under a “Nearshore Rockfish” category in 2000, developing harvest limits and management measures for this group through the Council process. For the federal management areas off of California, composition of this group consisted of the 13 NFMP nearshore rockfish and California scorpionfish (14 jointly-managed species). Starting with the Council’s 2003 regulatory cycle, Department representatives to the Council proposed harvest limits and management measures for this group based upon the NFMP framework (e.g., harvest control rules). Unlike the
nearshore rockfish, management of cabezon and kelp greenling at the federal level in 2003 continued under “Other Fish.” Because no federal harvest limits were developed for these two species, the Commission in 2003 adopted revised state harvest limits and associated state management measures for cabezon and for kelp and rock greenling combined, many of which were also incorporated into federal regulations (exceptions include state trip limits658). These regulatory actions were considered to be consistent with federal policies because the NFMP harvest control rules were built upon the same principles (Restrepo and Powers, 1999) as those within the federal groundfish plan.

Currently, the Department continues to provide management proposals based upon the NFMP for the nearshore rockfish group, cabezon, and kelp greenling during the Council’s regulatory cycle and these proposals are modified if needed through a collaborative process that includes the Department, NOAA Fisheries staff, and the public. Generally, if the state’s proposed measures are either consistent with or more conservative than federal policies, NOAA Fisheries does not consider making changes to them. Regulations for this nearshore rockfish group, cabezon, and kelp greenling then are adopted through both the federal and Commission processes. Although federal harvest limits are set for cabezon, this species along with the kelp and rock greenlings (combined), California sheephead, and monkeyface prickleback, continues to be actively managed at the state level.

To simplify the management structure, the NFMP describes a long-term plan to seek sole management of the Council managed species through a transfer of management authority from NOAA Fisheries to the state.659 If transferred, the state would obtain full responsibility for management including stock assessments, setting catch and trip limits, monitoring and biological data collection, assessing bycatch, and opening and closing fisheries, as well as continued coordination with Oregon, Washington, and the Council. However, a formal process to transfer management authority for the 16 groundfish species to the state is on hold due to substantial capacity limitations of both the Department and the Council,660 as well as the current ability to achieve most NFMP objectives through the federal process.661 The benefit of the current joint arrangement is that the Council/NOAA Fisheries conducts much of the stock assessment work, provides bycatch observers, and operates groundfish sampling programs (although their efforts directed at nearshore fisheries specifically are limited). The joint state-

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659 NFMP Section 3, 17-18.
660 Update on NFMP Implementation, 9.
federal management for nearshore fish stocks thus represents a balancing act between capacity limitations and a unified management structure.

**Brief Snapshot of the Fishery**

**Who is fishing?**

Several actions were taken to begin limiting the rapidly expanding commercial live fishery prior to the completion of the NFMP, which were continued or revised after plan completion. The first was the Pacific Coast Groundfish Fishery Management Plan, implemented in 1982 to manage approximately 90 groundfish species off Washington, Oregon, and California. A federally imposed limited entry Groundfish Restricted Access Program followed in 1994, which reduced the number of commercial groundfish vessels. Also notable is that finfish trap permits were required in southern California waters in 1995, and were extended statewide in 1998.

In 2000, under the authority of the NFMA, the Commission established regulations for a nearshore fishery permit (NFP) and imposed a moratorium on new permits. In 2001, the Commission set size limits for the commercial species listed within the NFMA statute and added a regulation specifying that only the 10 nearshore stocks designated within the NFMA required a NFP. Access was further limited by the Commission in 2001 for fishermen holding NFPS; regulations (effective March 2002) required fishermen renewing their permits in 2002-2003 to possess a valid 2001-2002 NFP and to have landed at least 100 lbs. of nearshore species from 1994-2000. Further regulatory actions taken by the Commission regarding the NFP and other nearshore permits are provided below. Department staff provided a list of these and other regulatory actions from 1982-2013 detailing management changes in the nearshore fishery.

The NFMP takes an approach to restricted access for its commercial fishery based upon the Fish and Game Commission’s restricted access policy, including using permitting programs, capacity goals, gear restrictions, trip limits, and time and area closures. Three permit types limit participation in the nearshore fishery, each with different criteria regarding geographic designations and transferability.

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663 NFMP Section 1, 3-138.
665 NFMP Section 1, 3-102; Fish & Game Commission, Policies, Restricted Access, http://www.fgc.ca.gov/policy/p4misc.aspx#RESTRICT (last visited 9/30/2013).
666 NFMP Section 1, 3-102; Fish & Game Commission, Policies, Restricted Access, http://www.fgc.ca.gov/policy/p4misc.aspx#RESTRICT (last visited 9/30/2013).
1. As noted above, the current NFP program began in 2001. The 10 species initially designated by the NFMA, and commonly referred to as the shallow nearshore species group, includes: black-and-yellow, China, gopher, grass, and kelp rockfishes, kelp and rock greenling, California scorpionfish, California sheephead, and cabezon.\textsuperscript{667} The monkeyface prickleback, although a shallow water species, is not covered by the NFP.\textsuperscript{668} (The monkeyface prickleback was included in regulations that established a control date for the purpose of developing and implementing a gear endorsement program for the other nearshore species, but at this time, no gear endorsement program has been established for any of these species.)\textsuperscript{669} Currently, the NFP program limits participation in the following ways: permits are only valid in the specified regional management area,\textsuperscript{670} only one permit is issued per person, and permits cannot be changed to another management area.\textsuperscript{671} There is flexibility however, in that most permits are transferable\textsuperscript{672} and new entrants are allowed if they purchase two permits from the same region and retire one.\textsuperscript{673} A statewide capacity goal of 61 NFPs was set with resource sustainability in mind.\textsuperscript{674} In 2003, a total of 224 NFPs was issued based on individuals that met the strict qualifying criteria.\textsuperscript{675} In 2011, that number decreased to 164 permits of which only 108 were actively used.\textsuperscript{676} (Active is defined as “permittees whose annual landings of permit species exceeded 100 pounds.”)\textsuperscript{677}

2. Deeper Nearshore Permit. A deeper nearshore fishery permit (DNFP) was first required in 2003 for the commercial take of the following eight deeper nearshore species: black rockfish, blue rockfish, brown rockfish, calico rockfish, copper rockfish, olive rockfish, quillback rockfish and treefish.\textsuperscript{678} DNFPs are applicable statewide and non-transferable.\textsuperscript{679} When the program began, 292 permits were issued. In 2011, that number decreased to 199 permits of which only 63 were considered active.

\textsuperscript{667} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report, p.13 (2012).
\textsuperscript{668} Personal communication with Aseltine-Neilson, Debbie. Senior Environmental Scientist Specialist. Cal. Dep’t of Fish and Wildlife. January 2014. California.
\textsuperscript{669} Cal. Code Regs. tit. 14 §150.4.
\textsuperscript{670} Cal. Code Regs. tit. 14 §150(a).
\textsuperscript{671} Cal. Code Regs. tit. 14 §150(b).
\textsuperscript{672} Cal. Code Regs. tit. 14 §150(d).
\textsuperscript{673} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report, p.15 (2012).
\textsuperscript{674} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report, p.15 (2012).
\textsuperscript{675} Personal communication with Wilson-Vandenberg, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.
\textsuperscript{676} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report, p.15 (2012).
\textsuperscript{677} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report, p.15 (2012).
\textsuperscript{678} Cal. Code Regs. tit. 14 §150.02(a)(b).
\textsuperscript{679} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report, p.15 (2012).
3. Bycatch Permit. A nearshore fishery bycatch permit (NFBP) also was first established in regulations in 2003. The NFBP may only be issued to a valid nearshore permit holder and is required for anyone using trawl or entangling nets (gill and trammel nets) to take shallow nearshore species. Bycatch permits are non-transferable, become null and void upon the death of the permit holder, and are regionally specific. Nearshore fishery bycatch permit holders are also limited to 25 pounds in the South-Central Coast Region, 50 pounds in the South Coast Region, zero pounds per trip in the North Coast and North Central regions, and are subject to all pertinent state and federal cumulative trip limits.

Unlike the commercial sector, permits are not required for participation in the recreational nearshore fishery, which occurs both as shore and boat-based fishing, though sport-fishing licenses are mandatory.

What do they fish for?
“Nearshore fisheries” refers to the commercial or recreational taking, possession, or landing of any species of nearshore fish stocks. These 19 nearshore species were selected by the Department based on an assessment of 124 species that occur in coastal waters shallower than 40 fm (240 feet) depth using a set of criteria (including life history traits, habitat needs, landings trends, etc.) designed to identify the species most in need of management. Landings in the commercial fishery have tapered off since peaking in the 1990s, although the live-fish component remains high, comprising 85 percent of all nearshore species landed in 2011.

The nearshore permit program lists minimum size limits for commercial retention for the 10 species of nearshore fishes originally described in the NFMP. Individuals below the regulatory size limit must be discarded immediately.
Where and when do they fish?
The nearshore fishery is managed spatially and temporally through regional management areas and a system of time and area closures, which can include depth restrictions. “Nearshore waters” are defined as ocean waters extending from the shore to 20 fathoms and including around offshore rocks and islands. However, minimizing bycatch of overfished shelf species often dictates the depths where, and the months when, nearshore species can be fished. Also along much of the coast, nearshore species also occur in deeper water, necessitating nearshore regulations in waters deeper than 20 fathoms.

The NFMP recognized the significant geographical differences in the coast wide nearshore fishery and proposed regional management tailored to the specific conditions of regions along the coast. Four nearshore fishery regional management areas currently exist off California. The designation of four, rather than the originally preferred three areas (largely based on biogeography), was based on recommendations from the public regarding “regional differences in the nearshore fisheries and species distributions in the northern and southern areas of central California.” The regional areas are defined as follows: 1) North Coast Region, between the CA-OR border and Cape Mendocino, 2) North-Central Coast Region, from Cape Mendocino to Point Año Nuevo, 3) South-Central Coast Region, from Point Año Nuevo to Point Conception, and 4) South Coast Region, from Point Conception to the Mexico border. This approach aligns the South Coast regional management area with a distinct biogeographic feature at Point Conception (the coastline changes from west to south-facing). It also addresses differences in the nearshore fishery along the central California coast (such as the prevalence of cabezon in landings from the southern part of the central California coast) by dividing the central coast into two management areas. Point Año Nuevo is the preferred boundary due to kelp bed species composition, since kelp beds north are more likely to contain bull kelp, and few fishermen from the Monterey port complex fish north of Point Año Nuevo. The northern boundary at Cape Mendocino also aligns with a significant biogeographic feature. The full regional management approach, as envisioned in the NFMP, would encompass developing and implementing
a catch monitoring system, harvest limits and allocations, enforcement mechanisms, constituent involvement processes, and a restricted access program for each region, among other activities. Due to Department budget and staffing constraints, the regional management system has not yet been fully implemented. However, this regional management approach is unique among FMPs in California and has the potential to better meet geographical fishery needs and appropriate management goals of the fishery. A follow-up to this review should include a full examination of the status of regional management in the nearshore fishery.

Spatial management approaches in the nearshore fishery include state and federally managed areas with different regulations. No take and limited take MPAs are an example of such closures as they protect entire habitats and communities, and are intended to have a substantial role in the NFMP through implementation of the MLPA. Time-area closures are another tool applied to the nearshore fishery (which have changed over time in name, placement, and regulations). At the federal level, these are broadly referred to as Groundfish Conservation Areas (GCAs), and primarily include the trawl and non-trawl Rockfish Conservation Areas (RCAs) and the Cowcod Conservation Areas (CCAs). The RCAs may change spatially and seasonally throughout the year, and were implemented in 2003 to allow overfished rockfish species to rebuild. RCAs are closed to commercial groundfish trawl and non-trawl gears with fishing restricted by region, season, and depth. CCAs limit recreational and commercial bottom-fishing to minimize interaction with cowcod, which was severely overfished in Southern California and has been under a rebuilding plan since 2001. Geographic, depth, and seasonal constraints are associated with CCAs, of which there are two, a large area south of Pt. Conception and a smaller area west of San Diego. The CCAs are the only spatial closure with an exception for nearshore access; fishing is allowed within a 20-fm depth restriction and with limitations on which species may be kept. This is significant because in 2013 for the first time, shelf rockfish

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702 NFMP Section 1, 3-128.
703 Update on NFMP Implementation, 7.
704 NFMP Section 1, 3-128.
710 Southwest Fisheries Science Center, Fisheries Resources Division, Cowcod Research, http://swfsc.noaa.gov/textblock.aspx?Division=FRD&ParentMenuID=190&id=1290
can be taken in addition to the nearshore species. For the recreational fishery within California, the time-area closures are specific to designated management areas, which have, since 2005, been referred to as Groundfish Management Areas (GMAs). The boundaries were originally based on the NFMP regional management designations. Within each GMA, specific months and depths (areas bounded by depth contours) are closed to groundfish fishing. Currently five GMAs are in place that close recreational fisheries seasonally for federal groundfish, including the 16 NFMP species, two of the state-managed NFMP species (California sheephead and rock greenling), and other state-managed species that are caught along with the 18 NFMP species (e.g., ocean whitefish). The current GMAs are: 1) Northern, 2) Mendocino 3) San Francisco, 4) Central, and 5) Southern. GMA boundaries and seasons may change from year to year, depending on the Council’s biennial management review process.

**How do they fish?**

The vast majority of nearshore finfish are taken by line and trap gear. Commercial nearshore fishery permit holders have regional permits that only allow the use of hook-and-line and dip nets, and an additional trap endorsement can be tied to a permit for use of trap gear. The commercial fleet also has a total hook limit of 150 per vessel or 15 hooks per line. Recreational fishing gear is restricted to no more than two hooks and one line, where a hook is a single hook, or a double or treble hook with multiple points connected to a single shank. Recreational divers can only fish with spear and by hand.

**How much can they fish?**

Initially, NFMP species were managed conservatively (e.g., catch limits based on 50% of historic landings) due to a lack of stock assessments. However, several nearshore stocks have been formally assessed by NOAA Fisheries, the Department, or Department sponsored contractors at least once in recent years and harvest measures are now applied accordingly (e.g., these stocks have total allowable catch levels (TACs) based on estimates of actual stock size). As of February 2012, stocks of “cabezon, California scorpionfish, California sheephead, kelp greenling, black, blue and gopher rockfishes

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715 NFMP Section 2, 3-91.
716 Cal. Code Regs. tit. 14 §150.03.
717 Update on NFMP Implementation, 6.
718 Cal. Code Regs. tit. 14 §150.17
have been assessed; results from all of these assessments except kelp greenling and California sheephead have been accepted for use in management.” The Department recently re-evaluated the state’s control rules for kelp greenling and cabezon, increasing the TACs to conform to new federal harvest limits for both species. Increases in federal limits were based on a new stock assessment for cabezon and improved methods to establish limits for kelp greenling, a data-limited species. New data moderate assessments for China, copper and brown rockfishes are currently being used to update TACs for 2015-2016. Remaining data poor stocks are still managed using NMFS data poor assessment protocols such as 1) the precautionary Restrepo method of setting TACs at 50% of recent landings, and 2) productivity-susceptibility analysis (PSA) that identifies species most in need of further assessment and ranks assessment data by quality.

TAC levels are calculated bi-annually by species or species group (e.g., nearshore rockfish), using the best available science, and are allocated between the commercial and recreational sectors. “Until the state has management authority for one or more of the GFMP species in the NFMP, the TAC of a species or species group will not exceed the amount specified in the Federal Register for that species or species group.” As so many co-occur and are fished and managed together, the nearshore rockfish have a grouped TAC, though the Department keeps track of nearshore rockfish stocks by species. In the event a TAC for a species or species group is exceeded or expected to do so, the Department may impose a regulatory change on the relevant sector. It is rare for both recreational and commercial sectors to surpass their allocation limits (i.e., for TAC levels to be exceeded). The history of TACs being met or exceeded in the nearshore fishery is a key element that was not a goal of this research, but would be a valuable metric in a full assessment of this FMP.

Building upon the allocation policy adopted by the Commission in December 2000, allocations of TACs for nearshore fish stocks between the commercial and recreational

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726 NFMP Section 1, 3-102.
727 Cal. Code Regs. tit. 14 §52.09(a).
729 Cal. Code Regs. tit. 14 §52.09(b).
731 NFMP Section 1, 3-102.
sectors are based on historical fishery information “applied regionally, with constituent involvement, and based on a careful review of recreational and commercial landings information . . .”\textsuperscript{732} Since regional management is not fully in place yet, “allocation of state managed nearshore fish stocks [is] based on the . . . ratio of recreational to commercial take for a species during the periods 1983 through 1989, and 1993 through 1999.”\textsuperscript{733} In 2004, the California Recreational Fisheries Survey (CRFS) Program began, which systematically collects sport-fishing data to provide accurate estimates of finfish catch and effort data.\textsuperscript{734} Prior to the CRFS, recreational data were not available at a spatial resolution sufficient for calculating regional allocations and catch limits based solely on past landings.\textsuperscript{735} Currently, allocation of the nearshore stocks is overall 80/20 recreational to commercial, so the recreational sector catches most of the fish.\textsuperscript{736}

Allocations and landings are regulated differently for commercial and recreational fishing sectors. The Department limits recreational landings using seasons, depths and bag limits.\textsuperscript{737} Sport fishers are only allowed to keep ten individuals within the Rockfish, Cabezon, and Greenling complex (RCG complex is defined as all species of rockfishes, cabezon and greenlings).\textsuperscript{738} In order to reduce bycatch and wastage, no size limit regulations exist for nearshore rockfish sport fishing, although there are size limits on cabezon, sheephead and greenlings.\textsuperscript{739} As commercial vessels usually fish in shallower depths, fish have greater post-release survival improving the efficacy of implemented size limits.\textsuperscript{740} Commercial fishers are regulated via cumulative two-month trip limits, which are set conservatively to minimize the bycatch of overfished groundfish species (which often means that healthy stocks are under-harvested as a result).\textsuperscript{741}

\textsuperscript{732} Cal. Code Regs. tit. 14 §52.05(c).
\textsuperscript{733} Cal. Code Regs. tit. 14 §52.05(d).
\textsuperscript{735} Personal communication with Aseltine-Neilson, Debbie. Senior Environmental Scientist Specialist. Cal. Dep’t of Fish and Wildlife. January 2014. California.
\textsuperscript{737} Personal communication with Wilson-Vandenberg, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.
Meeting the Goals and Requirements of the MLMA

The MLMA contains several goals to guide the sustainable management of fisheries. Many of the goals are broad and a great deal of overlap exists between them. The primary goals include: conserve entire ecosystems, recognize non-consumptive values, allow only those activities that are sustainable, maintain, restore, or enhance habitat, restore depressed fisheries, minimize bycatch, minimize adverse effects on fishing communities, establish processes for adaptive management, establish a program for external peer review, and ensure collaboration and stakeholder involvement. This review is meant to be preliminary and foundational and therefore is not a comprehensive analysis of every goal and objective found within the MLMA. We focus on the goals listed above because they encapsulate several of the specific goals listed in sections 7050 and 7056 of the Act. For example, the best available science requirement is reflected in the goals of restoring depressed fisheries, ensuring adaptive management and sustainability, conserving entire ecosystems, and the goal of establishing a peer review process.

“The MLMA requires that Fishery Management Plans (FMPs) form the primary basis for managing the state’s marine fisheries. An FMP is a planning document based on the best available scientific knowledge and other relevant information, that contains a comprehensive review of the fishery along with clear objectives and measures to ensure its sustainability.” The NFMP employs a combination of five management approaches: Fishery Control Rules, Allocation, Regional Management, Marine Protected Areas (MPAs), and Restricted Access, to be used separately or combined, over time and over geographic regions, to meet the respective goals of the NFMP and the MLMA. Also, “a fishery management measure may be selected [by the Commission and applied by the Department] instead of, or in addition to, measures included in the adopted NFMP where specified in statute or regulation.” The NFMP has five primary goals: (1) “ensure long-term resource conservation and sustainability;” (2) “employ

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742 Cal. Fish & Game §7050(b)(1).  
743 Cal. Fish & Game §7050(b)(2).  
744 Cal. Fish & Game §7050(b)(3).  
745 Cal. Fish & Game §7055(b).  
746 Cal. Fish & Game §7055(b).  
747 Cal. Fish & Game §7056(d).  
748 Cal. Fish & Game §7056(i-j).  
749 Cal. Fish & Game §7056(g),(l).  
750 Cal. Fish & Game §7062.  
751 Cal. Fish & Game §7056(h),(k).  
753 NFMP Section 1, 3-101.  
754 NFMP Section 2, 2-11.  
755 Cal. Code Regs. tit. 14 §52.03(b).
science-based decision-making;” (3) “increase constituent involvement in management;” (4) “balance and enhance socio-economic benefits;” and (5) “identify implementation costs and sources of funding.” Many of these goals and their objectives specifically address the goals of the MLMA, and are noted as such in the following sections.

**Conserve entire ecosystems [e.g., Fish and Game Code §7050(b)(1)]**
The MLMA recognizes that the health of fish populations is closely related to the health of their ecosystem. “Maintaining the health of marine ecosystems is key to productive fisheries and non–consumptive uses of marine living resources.” The MLMA broadly requires that entire ecosystems be conserved. Similar to requiring sustainability, conserving entire ecosystems is an overarching goal that encompasses many of the other goals and objectives of the MLMA. The first objective under the first primary goal of the NFMP is to: “[c]onserve the health and diversity of marine ecosystems and marine living resources” and includes the following list of more specific objectives: “(1a) [u]se an ecosystem approach to management of the nearshore fishery, considering species diversity, species interactions, food webs, and community structure; (1b) [i]dentify other species in the ecosystem that may affect, or be affected by, changes in the abundance of nearshore fish; (1c) [i]dentify man-made or environmental influences on the nearshore ecosystem; [and] (1d) [e]stablish marine reserves and other types of marine protected areas to protect and restore marine ecosystems and to provide for non-consumptive uses.” Pursuant to these goals and objectives, both the MLMA and the NFMP require a management shift from focusing on individual populations to the sustainability and resilience of the entire nearshore ecosystem, differentiating among regions that vary biogeographically. The NFMP is notably one of only two multi-species management plans at the state level, representing a step towards ecosystem-level management (The Abalone Recovery and Management Plan is the other).

Stage III management of the NFMP fishery control rule is specifically intended to meet the MLMA standard of “conserve entire ecosystems.” It is detailed in the NFMP as a “data rich” scenario and identified as the integration of ecosystem level knowledge into practical management. As sufficient EFI data become available, they are incorporated

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756 NFMP Section 1, 6-13.
758 Cal. Fish & Game §7050(b)(1).
759 NFMP Section 1, 1-6 – 1-7.
760 NFMP Section 1, 1-6 – 1-7.
761 NFMP Section 1, 3-106.
763 NFMP Section 1, 3-115.
into management models to increase or decrease individual species TACs as a standard practice.\textsuperscript{764} This represents an important integration of ecosystem conservation in the NFMP.

Several recent implementation actions on incorporating MPAs into management reflect the “conserve entire ecosystems” goal. The NFMP refers to these unfished areas as “reference reserves.” “MPAs are . . . key to the goal of moving toward an ecosystem-based management approach by providing a better understanding of the role of Plan species in the ecosystem.”\textsuperscript{765} In 2011, the Department held a workshop with managers and scientists on integrating MPAs into fisheries management. The Department is using workshop findings to identify gaps in understanding MPA effects on fisheries, inform decisions related to management actions, and improve their ability to incorporate MPAs into the broader context of fishery science.\textsuperscript{766} Due to economic and capacity limitations needed for long-term monitoring and existing limitations on the science, MPAs are not currently utilized as reference areas to inform management.\textsuperscript{767} However, research efforts are underway on the central coast, which are to be incorporated into upcoming assessments.\textsuperscript{768} Another important program is the State Wildlife Action Plan (SWAP), an ongoing effort since 2005 to examine the health and habitats of “species of greatest conservation need” and promote conservation actions while it is feasible to do so.\textsuperscript{769} California’s SWAP includes goals, strategies, and objectives for several key ecosystems that are important for the nearshore species. The Department also began to determine the amount of appropriate habitat for Plan species in and around existing MPAs, beginning with the South Region and southern California species,\textsuperscript{770} however this effort has not been completed.\textsuperscript{771} The NFMP criteria for MPAs for the 19 nearshore species were also included as design principles in the MLPA Master Plan Framework adopted by the Commission (August 2005).\textsuperscript{772} Also notable is the Department’s contribution to the Council’s Pacific Coast Fishery Ecosystem Plan,\textsuperscript{773} which is highly relevant to

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\textsuperscript{765} Update on NFMP Implementation, 7.
\textsuperscript{766} Proceedings of the Marine Protected Areas and Fisheries Integration Workshop, p.2.
\textsuperscript{767} Personal communication with Wilson-Vandenberg, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.
\textsuperscript{770} Update on NFMP Implementation, 7.
\textsuperscript{772} Update on NFMP Implementation, 7.
\textsuperscript{773} Pacific Fishery Management Council. 2013. Pacific Coast Fishery Ecosystem Plan for the U.S. Portion
management of the nearshore fisheries. The Council is currently undertaking an
initiative to protect unmanaged forage species, some of which are prey for NFMP
species. The Department has been involved in this effort as well as a similar effort by
the Commission to develop a Forage Fish Policy that stands to benefit the plan
species. 774

To foster improvements in the management of individual fisheries, the MLMA requires
that FMPs include a research protocol that identifies critical information gaps and the
steps needed to close those gaps. 775 The protocol set forth in the NFMP details the need
for additional information regarding the ecological interactions of the nearshore species
stating, “[e]cological interactions of the 19 NFMP species have not been studied in a
coordinated manner or using standard methods. As a result, little is known about
regional impacts of oceanographic events or human disturbances on the physiological,
energetic, and behavioral aspects of these 19 NFMP species or associated species.” 776
The NFMP also recognizes the need for a standardized methodology to collect and
analyze information on ecological interactions (including understanding the
distribution of habitats of the 19 nearshore species). 777 Although not ecosystem role
specific, progress has been made on acquiring and applying essential fishery
information via collaborative research on abundance, growth rates, ageing, and other
life history traits of NFMP species. 778 Since 2006, the science on ecosystem-based
management and key EFI for NFMP species continues to improve, although
Department contributions to this effort have been limited by available resources. 779

Recognize non-consumptive values [e.g., Fish and Game Code §7050(b)(3)]
The MLMA recognizes that marine ecosystems provide important benefits to people
beyond the consumption of seafood. Important non-consumptive values include
“educational, scientific, and recreational uses that do not involve the taking of
California’s marine living resources.” 780 The objectives for management set out in the
MLMA encourage the protection of marine resources to ensure their continued
availability for non-consumptive uses. 781 The recognition and inclusion of non-
consumptive values into fisheries management is a major challenge generally. One of the most difficult elements of fishery management is allocating marine resources equitably among fishing sectors, non-consumptive users, and ecosystem needs. Relevant to this MLMA goal is the NFMP’s objective to “[r]ecognize the importance of non-consumptive uses of California’s marine resources” under the primary goal to balance and enhance socioeconomic benefits. Inclusion of such uses is required in the NFMP when considering allocation changes: “non-consumptive uses” are to be factored in by the Commission among seven other elements, when changing NFMP allocations.

The NFMP further acknowledges examples of such values, noting that several nearshore species are important to skin divers and scuba divers for “their intrinsic value and observational interest.” The NFMP also intends for MPAs to “ensure that the MLMA’s objectives for . . . recognition of non-consumptive uses . . . are met.” Specifically, an MPA network that functions as intended for management of the nearshore fishery and ecosystem will accomplish the following: improve the recreational and educational opportunities associated with protected nearshore ecosystems, and protect marine natural heritage including the aesthetic and non-consumptive values of California’s marine wildlife.

Allow only those activities that are sustainable [e.g., Fish and Game Code §7050(b)(2)]

Sustainability is identified as the primary goal of the MLMA. The MLMA defines sustainability as both “continuous replacement of resources, taking into account fluctuations in abundance and environmental variability,” and “securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.” The MLMA broadly requires that allowable activities and uses of marine resources must be sustainable and lists several goals and objectives to guide management of sustainable fisheries. The objectives relevant to the sustainability goal identified in the NFMP include to: 1) allow and encourage only sustainable activities and uses of

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782 NFMP Section 1, 1-5.
783 NFMP Section 1, 1-11.
784 Cal. Code Regs. tit. 14 §52.05(b).
785 NFMP Section 1, 1-1.
786 NFMP Section 1, 3-101-102.
787 NFMP Section 1, 3-109-110.
788 Cal. Fish & Game §7056.
789 Cal. Fish & Game §99.5.
790 Cal. Fish & Game §7050(b)(2).
nearshore marine living resources, 2) ensure that the nearshore fishery is conducted in a manner such that long-term health of the resource is not sacrificed in favor of short-term benefits, 3) ensure a fishery managed on the basis of maximum sustainable yield (MSY) shall have optimum yield (OY) as its objective, and 4) promote total fishing capacity that is matched to sustainable harvest levels.  

Management under the NFMP employs fishery control rules, novel stock assessment techniques, MPAs, and research programs to meet sustainability goals, as described below. Fishery Control Rules involve the methods used to determine allowable annual fishing mortality, and are the primary mechanisms to achieve sustainable use, prevent overfishing, and rebuild depressed stocks, which are described in MLMA as the primary conservation standards for fisheries management. The NFMP also recommends allowable fishing depths, cumulative two-month trip limits, size restrictions for certain species, permit and gear restrictions, and season adjustments as measures for achieving sustainability goals.

Due to the lack of information on stock status for most NFMP species prior to 2004-2005, many were managed conservatively based on historic landings. As of early 2012, stock assessments were completed for seven NFMP species (California scorpionfish, California sheephead, cabezon, kelp greenling, black, blue, and gopher rockfishes) and results from all but two (California sheephead and kelp greenling) have been implemented into management. Data moderate assessments have recently been completed for kelp greenling and China, brown and copper rockfish. These assessments, while not as extensive as full stock assessments, use novel modeling methods when information is limited that provide insight into stock status. Six NFMP

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791 NFMP Section 1, 1-7.
792 NFMP Section 2, 2-11.
793 NFMP Section 2, 2-11.
797 The SWFSC Fisheries Ecology Division hosted a Pacific Coast Groundfish Stock Assessment Review (STAR) Panel for data-moderate assessments, April 22-26, 2013. The Panel considered eleven models (eight species, some with regional breaks) for rockfish and flatfish along the Pacific Coast, using two different modeling approaches: Extended Depletion-Based Stock Reduction Analysis, XDB-SRA, developed by E.J. Dick and Alec MacCall (SWFSC), and Extended Simple Stock Synthesis, exSSS, developed by Jason Cope and Chantel Wetzel (NWFSC). The Panel recommended approval of the majority of the proposed assessments under one or the other of the modeling frameworks to the Scientific and Statistical Committee of the Pacific Fishery Management Council for full consideration. This represents a major step forward in the development of methods for assessing stock status of West Coast groundfish using these novel methods that are less data-intensive.
stocks remain to be assessed and are managed at a catch limit equal to fifty percent of recent total landings as prescribed by the NFMP control rules.\textsuperscript{798}

These NFMP harvest control rules are built upon the same principles (Restrepo and Powers, 1999) as those within the federal groundfish management plan, and therefore are consistent with the more precautionary approach taken by the Council in setting harvest limits for federal groundfish (that include greater consideration of uncertainty around stock status). However, it is important to note that in one case, the NFMP control rules are more conservative than those under the Council. For assessed species, the level at which the stock status is determined to be “precautionary” (as opposed to “healthy”) follows a 60-20 control rule under the NFMP. Consequently, harvest limits set for species at an assessed stock level less than 60\% of estimated unfished biomass will be more conservative than if they were set using the Council’s 40-10 control rule.

MPAs are an additional tool that can assist managers in ensuring the sustainability of the nearshore fishery through the protection of essential habitat and collection of EFI. In separate legislation subsequent to the MLMA, the Marine Life Protection Act (MLPA) instituted a coast wide MPA network to better protect “the state’s marine life, habitats, and ecosystems,”\textsuperscript{799} over the course of 1999-2012. The inclusion of NFMP criteria for MPAs, specific to the 19 nearshore species, aids the design and creation of MPAs consistent with the goals of the MLMA and NFMP.\textsuperscript{800} The NFMP stated that an MPA network that serves the purposes of the nearshore fishery and ecosystem will accomplish the following: 1) integrate MPAs into traditional fisheries management, 2) maximize rebuilding of depressed stocks to achieve sustainable yield, and 3) ensure that stock biomass can be maintained.\textsuperscript{801} These MPAs were designed based on a collaborative public process, but an assessment of how well this network achieves the intended function under the NFMP is a critical next step.

Many recent and ongoing activities to “ensure nearshore fishery resources are sustainable over the long term” were noted in the 2006 update.\textsuperscript{802} These include capacity reductions, data collection, adaptive management, and consistent engagement of stakeholders in management discussions. Different capacity reduction methods include a full restricted access (RA) program limiting the total nearshore fishery permits and a rule allowing new entrants to the fishery, on the condition that they purchase two

\begin{footnotesize}
\begin{enumerate}
\item 2007 Assessment of Blue Rockfish (\textit{Sebastes mystinus}) in California, p.5.
\item NFMP Section 1, 3-101-102.
\item NFMP Section 1, 3-109-110.
\item Update on NFMP Implementation, 1.
\end{enumerate}
\end{footnotesize}
permits from the same region and retire one.\textsuperscript{803} A deeper nearshore species permit program was also implemented which further limited participation and applies statewide for eight deeper nearshore species.\textsuperscript{804} A concerted effort towards data collection has resulted in more available data on abundance and life history traits for most of the NFMP species in both the recreational and commercial fisheries. Since 2001, catch limits have been used to regulate in-season landings and close fishing activities accordingly, allowing for more responsive, sustainable management actions.\textsuperscript{805}

To date, fishery-independent research using scuba and remotely operated vehicles (ROVs) has taken place inside and outside MPAs with the goal of improving assessment techniques, identifying baselines, and understanding the effects of the established MPAs. This research included an effort in 2004 by the Cooperative Research and Assessment of Nearshore Ecosystems (CRANE) program, which included statewide private, academic, and agency partners.\textsuperscript{806,807} The MPA Monitoring Enterprise is another independent research effort to assess the performance of MPAs in California and has been in effect since 2007.\textsuperscript{808} However, that research is focused on MPAs and their future management rather than fisheries management, resulting in limited use for nearshore species management.\textsuperscript{809} As a greater understanding of nearshore stocks and MPA effects is achieved, management measures and catch limits can be refined and based on estimates of actual stock size relative to target goals, such as an unfished state.\textsuperscript{810}

Fishery-dependent research and monitoring has been conducted in the recreational and commercial sectors since the 1980’s. Starting in 1979, the NOAA Marine Recreational Fisheries Statistics Survey (MRFSS) provided catch and effort information for commercial passenger fishing vessels (CPFVs), private and rental boats, beach and bank anglers, and anglers fishing from man-made structures.\textsuperscript{811} Periodically, MRFSS also collected socioeconomic data from these fishers.\textsuperscript{812} In the 1980-90s, on board survey programs of CPFVs also collected catch composition, amount, size, and bycatch data.\textsuperscript{813}

\begin{thebibliography}{813}
\bibitem{803} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report, 15 (2012).
\bibitem{804} Cal. Leg. Fisheries Forum, Dep’t of Fish & Game Annual Marine Fisheries Report 15 (2012).
\bibitem{805} Update on NFMP Implementation, 5.
\bibitem{806} Update on NFMP Implementation, 3.
\bibitem{809} Personal communication with Wilson-Vandenberg, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.
\bibitem{810} Update on NFMP Implementation, 2.
\bibitem{811} NFMP Section 1, 4-155-156.
\bibitem{812} Personal communication with Aseltine-Neilson, Debbie. Senior Environmental Scientist Specialist. Cal. Dep’t of Fish and Wildlife. January 2014. California.
\bibitem{813} NFMP Section 1, 4-155-156.
\end{thebibliography}
Commercial fishery sampling dates back to 1917 although adequate biological information on nearshore finfish was not collected until 1991. Since 2004, three key improvements were made in fishery dependent monitoring efforts: a new California Recreational Fisheries Survey (CRFS) program was implemented, commercial dockside sampling was recommenced in southern California, and a collaborative nearshore commercial logbook program was tested. The CRFS program is notable in that it provides finer spatial resolution of catch and effort estimates (increasing the number of regional estimates within California from two to six) based upon sampling methodologies that have been improved over those used by MRFSS. In addition, an increase in sampling results in higher accuracy of estimates. Commercial bycatch data comes from the West Coast Groundfish Observer Program (WCGOP) that has been in effect since 2001.

Maintain, restore or enhance habitat [e.g., Fish and Game Code §7055(b)]

The MLMA recognizes that the health of many fish populations is closely related to the health of their habitat. “Healthy habitats are important for maintaining the productivity and diversity of marine ecosystems and viable commercial and recreational fisheries.” The MLMA broadly requires that the habitat of marine wildlife is to be maintained, restored, or enhanced, where appropriate. More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.” The fifth objective under the first primary goal of the NFMP is to “[m]aintain the health of marine nearshore fishery habitat, and to the extent feasible, restore or enhance that habitat where appropriate.” It also includes the following list of more specific objectives: 1) identify key habitats for nearshore fish species, assess habitat status, and identify measures to enhance habitats where appropriate; 2) identify and minimize fishing activities that adversely impact habitats when possible; 3) promote fishing activities that minimize adverse habitat impacts; and 4) protect nearshore fishery habitats through designation of marine protected areas.

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814 NFMP Section 1, 4-152 -153.
815 Update on NFMP Implementation, 3.
817 Update on NFMP Implementation, 3.
819 Cal. Fish & Game §7056(b).
820 Cal. Fish & Game §7084(a).
821 NFMP Section 1, 1-8.
822 NFMP Section 1, 1-8.
The 19 species managed under the NFMP occupy diverse habitats primarily within rocky reef or kelp environments. “Critical Habitat” is defined for each species in Chapter 2 of the NFMP. The Environmental Document (ED) accompanying the NFMP identifies the effects of the fishery on habitat and the main threats to essential habitat for nearshore species. It extensively describes the biophysical resources within the nearshore zone, providing a baseline for determining potential impacts of nearshore fishing activities. The most significant anthropogenic stressors include ghost fishing via lost fishing gear, pollutants and trash from operation and maintenance of fishing vessels, and physical disturbance of substrate and benthic flora and fauna from gear and anchor interactions. The only allowable gears in the nearshore fishery are hook and line, traps, and dip nets, all of which cause relatively little habitat damage. Of particular significance, the ED identifies Pacific Coast groundfish essential fish habitat (EFH) as encompassing the entire nearshore fishing grounds, therefore it applies to the 16 jointly managed species. To minimize fishing activities that destroy habitat, the Department provided input to the PFMC to contribute to EFH designations. As MPAs are part of the NFMP management portfolio, an assessment of the amount of each nearshore species’ habitat that is protected is a recognized need but has not been accomplished to date.

**Restore depressed fisheries [e.g., Fish and Game Code §7055(b)]**

The MLMA classifies a fishery as depressed if “a declining population trend has occurred over a period of time appropriate to that fishery,” or if fish populations decline below abundance levels “consistent with maximum sustainable yield.” A fishery may be depressed due to human impacts such as over-fishing or as a result of natural causes such as changes in ocean conditions. Regardless of the cause, the MLMA requires that all state managed fisheries include the objective of restoring depressed fisheries to sustainable levels. If overfishing is the cause of a depressed fishery, the MLMA further requires that a time-table and process for rebuilding the fishery be included in all FMPs. Objective three under the first primary goal of the NFMP is to “[r]ebuild depressed nearshore fisheries to the highest sustainable yields consistent

823 NFMP Section 1, 2-17.
824 NFMP Section 1, 2-18 – 2-52.
825 NFMP Section 2, 31.
826 NFMP Section 2, 3-90-91.
827 NFMP Section 2, 4-121.
828 Update on NFMP Implementation, Appendix 1, 14.
829 NFMP Section 2, 52.
830 Update on NFMP Implementation, Appendix 1, 14.
831 Cal. Fish & Game §90.7.
832 Cal. Fish & Game §7056(c).
833 Cal. Fish & Game §7086.
with environmental and habitat conditions.” This objective contains several sub-objectives including the following two specific sub-objectives: 1) specify criteria for identifying when the fishery is likely to become overfished or is overfished, and identify reference points to trigger management actions to prevent overfishing and to rebuild stocks; 2) establish MPAs to help restore depressed fish populations. Significantly, none of the nearshore stocks have been identified as depressed so there has been no need to trigger actions for rebuilding.

Many nearshore fishery species are vulnerable to overfishing and localized depletion due to their residential nature and because most of them are long-lived, late maturing, and slow growing. In the NFMP, a stock is considered “overfished” at or below the threshold of 30% of the estimated unfished biomass, a more conservative definition than the GFMP level of 25%. Rebuilding plans are not included in the NFMP to address overfished species; in fact they are only included in the GFMP when a species is determined to be overfished. Restoration of depressed stocks is accomplished through the application of the conservative NFMP 60-20 harvest control rule, which acts as a rebuilding plan for species that become overfished.

“Overfishing” is defined as “a rate of taking that the best available scientific information . . . indicates is not sustainable or that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.” In the NFMP, it is defined as the total catch of a nearshore fish population that exceeds the Total Allowable Catch (TAC) in any year or season. When the TAC for a NFMP species or species group is exceeded or expected to be exceeded, the Department may close the fishery. In-season monitoring allows the Department to determine whether it needs to close the fishery. In 2009 and 2010, the Department closed the commercial greenling fishery early, consistent with the previous seven years.


834 NFMP Section 1, 1-7.
835 NFMP Section 1, 1-7-8.
838 Cal. Code Regs. tit. 14 §52.01(i).
841 Cal. Fish & Game §98.
842 Cal. Code Regs. tit. 14 §52.01(j).
843 Cal. Code Regs. tit. 14 §52.09(b).
Minimize bycatch [e.g., Fish and Game Code §7056(d)]

The MLMA defines bycatch as “fish or other marine life that are taken in a fishery but which are not the target of the fishery . . . includ[ing] discards.” Bycatch may be kept for sale, or is often discarded dead or kept unreported and can be a serious problem, particularly for vulnerable marine species. The MLMA requires monitoring of bycatch and discards and reduction of bycatch that is deemed “unacceptable.” The fourth objective under the first primary goal of the NFMP is to “[l]imit bycatch of nearshore species, and all species taken by nearshore fisheries, to acceptable types and amounts, as determined for the fishery, and minimize the mortality of bycatch that is discarded.” The NFMP indicates that this objective can be accomplished by developing and implementing collaborative monitoring programs to assess bycatch levels in all sectors of the fishery, and implementing strategic incentives such as preferences in harvest areas or harvest guidelines. For example, while not formally implemented as a fishery management action, there is a voluntary effort in the recreational fishery to expand the use of descending devices to release fish and reduce discard mortality, which could, in effect, extend the fishing season. An additional sub-objective under the first primary goal is to include bycatch estimates in determining total catches by different sectors of the fishery. Collaborative monitoring efforts that collect bycatch data are underway, and are described in the section “j. Collaboration & stakeholder involvement.” It is worth noting that impacts of fishing under the NFMP on threatened/endangered and non-listed species are expected to be “less than significant.” Also the NFMP contains feedback loops, which are intended to prompt management changes when impacts to non-listed species become apparent.

Nearshore fishery bycatch data has been collected from the recreational and commercial sectors through multiple sampling and survey techniques. In the 1980-90s, the CPFV on board survey programs collected catch composition, amount, size, and bycatch data. The NOAA MRFSS provided similar information as well as socioeconomic data. Since 2004, three key improvements were made in bycatch data gathering: the CRFS program,

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845 Cal. Fish & Game §90.5.
847 Cal. Fish & Game §7056(d).
848 NFMP Section 1, 1-8.
849 NFMP Section 1, 1-8.
851 NFMP Section 1, 1-7.
852 NFMP Section 2, 125, 129.
853 NFMP Section 2, 129-130.
854 NFMP Section 1, 4-155-156.
855 NFMP Section 1, 4-155-156.
the commercial dockside sampling program expanded back into southern California, and a collaborative pilot nearshore commercial logbook program. Commercial bycatch data comes from the West Coast Groundfish Observer Program (WCGOP) that has been in effect since 2001. In addition, cooperative research between the Department and the PFMC on discard mortality rates for groundfish is beginning to be incorporated into total catch estimates. Through these mechanisms, the Department and NOAA account for incidental take and discard mortality in the commercial and recreational fisheries. Bycatch estimates are then factored into calculations for setting TACs as called for in the NFMP. The specifics of how bycatch data are to be incorporated into management are not detailed in the NFMP, which limits guidance but may also provide flexibility.

The NFMP measures that are in place to regulate bycatch include bycatch limits, gear restrictions, and time or area closures. First, direct limitations on bycatch ensure that bycatch does not reach unacceptable levels. However, in areas of co-occurrence of target and overfished bycatch species, low bycatch limits can limit fishing opportunities for healthy fish stocks. Second, limiting fishers to hook-and-line and trap gear reduces the potential for bycatch. Third, Groundfish Management Areas (GMAs), Rockfish Conservation Areas (RCAs) and Cowcod Conservation Areas (CCAs) are in place to reduce bycatch through time/area closures. Finally, bycatch is listed as a category of EFI that is necessary to accurately gauge total mortality, which is based on landings, natural mortality, and discard mortality. The Department conducted extensive barometric research in conjunction with other state and federal partners to identify discard mortality rates for nearshore species, a necessary component for setting harvest limits. Accurate discard rates can only be determined from at-sea observers, and are part of the WCGOP sampling protocol, which is the only active source for such data for commercial Pacific groundfish fisheries. Department staff currently are not able to

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856 Update on NFMP Implementation, 3.
857 Update on NFMP Implementation, 3.
861 NFMP Section 1, 3-148.
864 NFMP Section 1, 4-163.
865 NFMP Section 1, 4-162.
866 West Coast Groundfish Observer Program (WCGOP), http://www.psmfc.org/program/west-coast-groundfish-observer-program-wcgop.
access WCGOP data because of confidentiality issues. The CRFS survey protocol collects recreational fishery bycatch data. The Nearshore Fishery Bycatch Permit Program also addresses bycatch directly by preventing the targeting of nearshore stocks by trawl fishing, while allowing minimal take to reduce wastage (detailed above in the “who is fishing” section).

Minimize adverse effects on fishing communities [e.g., Fish and Game Code §7056(i), (j)]
Because the MLMA is concerned with the management of fisheries, impacts on fishing communities and coastal economies are inevitable. The MLMA requires that managers consider the “long-term interests of people dependent on fishing for food, livelihood, or recreation,” and minimize adverse effects of management on local economies and communities. The fourth primary goal of the NFMP is to balance and enhance socioeconomic benefits. “California’s fisheries are a public trust resource and as such are managed for the public benefit, including food production, commerce and trade, subsistence, cultural values, recreation, maintenance of healthy ecosystems, and scientific research. None of these purposes are mutually exclusive and achieving as many as possible is desirable and consistent with resource conservation.”

It is not always possible to preemptively minimize negative effects on fishing communities. West coast groundfish fishermen were hit hard with the failure of the shelf groundfish fishery from California to Washington in the late 1990’s. Landings declined by more than 50% between 1980 and 2000 and with subsequent reductions in seasons, depths and areas, many fishers and harbor businesses experienced hardship as a result. The management challenges that emerged from this significant decline centered on minimizing the economic and social impacts while rebuilding the

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870 Cal. Fish & Game §7056(i-j).
871 NFMP Section 1, 1-11.
872 NFMP Section 1, 1-11.
873 NFMP Section 1, 3-121.
overfished stocks, and took the form of trawl permit buy-backs, a fixed-gear permit stacking program, and implementation of the coast-wide groundfish observer program, and limited entry among other actions.\footnote{Miller, S.D., M.E. Clark, J.D. Hastie, and O.S. Hamel. Our Living Oceans, 6th Edition, Pacific Coast Groundfish Fisheries, NMFS Northwest Fisheries Science Center, p.212, http://spo.nmfs.noaa.gov/olo6thedition/26--Unit%2015.pdf.}

One advantage of joint management of NFMP species is the benefit of full National Environmental Policy Act (NEPA) analyses of proposed regulatory measures. All of the federal regulation development (annual/biennial) includes evaluation of the socio-economic impacts on communities of changes to recreational or commercial measures, to which the Department contributes.\footnote{Personal communication with Wilson-Vandenberg, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.}

Management should be adaptive [e.g., Fish and Game Code §7056(g), (l)]
The MLMA defines adaptive management as a “scientific policy that seeks to improve management of biological resources . . . by viewing program actions as tools for learning.”\footnote{Cal. Fish & Game §90.1.} Even if a chosen management measure fails, it “will provide useful information for future actions.”\footnote{Cal. Fish & Game §90.1.} Management is adaptive when fisheries managers are able to respond to changing environmental and socio-economic conditions, and update regulations accordingly.\footnote{Cal. Fish & Game §7056(l).} The MLMA requires that management decisions are “adaptive and are based on the best available scientific information.”\footnote{Cal. Fish & Game §7056(g).} The first objective under the second primary goal of the NFMP is to: “[e]ncourage fishery management decisions that are adaptive and based on the best available information and that do not substantially delay the management process.”\footnote{NFMP Section 1, 1-9.} To meet those criteria, management measures must be designed with monitoring and evaluation in mind to detect the positive or negative effects of such measures.\footnote{NFMP Section 1, 1-13.}

One way in which the Department applies adaptive management in the recreational and commercial nearshore sectors involves responding to catch monitoring data.\footnote{Personal communication with Wilson-Vandenberg, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.} If catch levels approach or exceed TACs, in-season or year-end regulatory changes are implemented accordingly. Similarly, if bycatch of overfished species is expected to exceed allowable levels, actions are taken to minimize or prevent any overage. Many state and federal fisheries bodies utilize this form of adaptive management, where
established mechanisms allow management to respond and react quickly to certain situations. There is an entire field of study on the theory and practice of adaptive management, which describes adaptive management as a more systematic approach to management. Under this interpretation, the steps in the management process are linked by a series of feedback loops to improve our understanding of natural systems and our ability to manage those systems, over time. Applying adaptive management in this more comprehensive fashion requires more resources, funding, and institutional support than is realistically achievable for most managers. However, there may be value in examining some aspects of this more intensive adaptive management cycle. Using existing management frameworks, a more active adaptive management approach may help managers to link key process components (goals and objectives, models and hypotheses, monitoring, evaluating and assessing, iterating and responding), and facilitate achievement of management goals.884

The NFMP establishes a hierarchical framework within which management adjustments can be made in a timely manner. Four types of actions exist within the NFMP framework: an FMP Amendment, Full Rulemaking Action, Notice Action, and Prescribed Action. “Depending upon the scale and significance of needed changes, the FMP itself may need to be amended or an in-season decision made by the Department—for action such as closing a fishery once a quota has been reached, for instance—may be appropriate. The former action requires much greater analysis and public review than does the latter.”885 The NFMP also establishes a process for regular review of the fishery and a process for constituent involvement when determining the need for adjustments.886 This periodic review is intended to determine the effectiveness of nearshore regulations in accomplishing the NFMP’s goals and objectives and whether any “resource conservation, social, or economic issues exist that require a management response.”887 A report on the status of implementation was completed in 2006, which outlined progress, needed actions and challenges up to that point,888 and a full review of the NFMP implementation is currently underway at the Department.889

885 NFMP Section 1, 1-13.
886 NFMP Section 1, 1-13.
887 NFMP Section 1, 1-16.
888 Update on NFMP Implementation, 1-16.
Establish an external program for peer review [e.g., Fish and Game Code §7062]

External peer review is identified as a tool to ensure that the best available scientific information is used in achieving the goals of the MLMA.\textsuperscript{890} The MLMA requires that documents such as FMPs and fishery research protocols undergo external peer review, and gives discretion to the Department to submit other management documents for peer review.\textsuperscript{891} An objective under the second primary goal of the NFMP is: “[u]tilize the program for external peer review of the scientific basis of marine living resources management documents developed under the MLMA.”\textsuperscript{892} External peer review has been an important part of the NFMP development and the nearshore fishery stock assessments, all of which have undergone external peer review.\textsuperscript{893} In addition, any proposed collaborative work is developed in conjunction with fishery scientists, and the published scientific work has been peer reviewed.\textsuperscript{894}

Collaboration & stakeholder involvement [e.g., Fish and Game Code §7056(h),(k)]

Collaboration and stakeholder involvement refers to the involvement of interested parties and members of the public throughout the management process.\textsuperscript{895} This involvement can occur through research collaborations or at the public comment stage of regulation development.\textsuperscript{896} The MLMA requires that the “management decision making process is open and seeks advice and assistance of interested parties,” and strongly encourages collaboration with “fishery participants, marine scientists, and other interested parties.”\textsuperscript{897}

Collaboration and stakeholder involvement have been part of the NFMP process since the beginning. In the initial scoping work for preparation of the NFMP, small group meetings were held in 13 communities along the California coast. Meetings focused on “gaining an understanding of constituents’ expectations for the process of developing the NFMP and suggestions for the best ways to involve constituents in that process.”\textsuperscript{898} Constituents included fishery participants, marine scientists, and other interested community members.\textsuperscript{899} Also, early in the development process the Department created

\textsuperscript{890} Cal. Fish & Game §7062.
\textsuperscript{891} Cal. Fish & Game §7062(a).
\textsuperscript{892} Cal. Fish & Game §7062; NFMP Section 1, 1-9.
\textsuperscript{893} Personal communication, Tom Barnes, October 2, 2013.
\textsuperscript{894} Personal communication with Wilson-Vandenber, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.
\textsuperscript{895} Cal. Fish & Game §7059(a).
\textsuperscript{896} Cal. Fish & Game §7056(h),(k).
\textsuperscript{897} Cal. Fish & Game §7056(h),(k).
\textsuperscript{898} NFMP Section 2, 1-6.
\textsuperscript{899} NFMP Section 2, 1-6.
a Nearshore FMP Advisory Committee composed of 20 stakeholders representing the recreational and commercial fishing sectors, environmental community, and academia to provide guidance on development and issues to be addressed in the FMP. The goals and objectives listed in the adopted NFMP reflect extensive consultation with constituents through public meetings, input from the NFMP Advisory Committee, and one meeting of the MLMA Evaluation Advisory Committee. Due to consistently low attendance, public meetings occur less frequently now than in the early phase of the NFMP. The Department also considered “written comments by the peer review panel, constituent written comments, and comments submitted via its web page.” Finally, constituents are to be involved in the fishery review process and are engaged by the Department in the development of state and federal regulations for NFMP species. For the latter, members of the public can participate in the Council’s Groundfish Advisory Panel (GAP) process, as well as provide testimony at Council meetings. At the state level, the Department was actively involved with constituents when, for example, commercial trip limits were developed or revised and the public has provided comment during Commission discussions on proposed actions.

The joint management by the Department and the Council includes ongoing, active collaboration in implementation of the NFMP in multiple ways. Stock assessments are a prime example in which the Department fully participates in the federal process, including conducting assessments, supplying information for assessments, providing representation on the stock assessment review (STAR) panel and offering guidance generally for nearshore species assessments. Monitoring is another significant area of shared responsibility. The Department conducts monthly catch monitoring of the recreational and commercial sectors as well as weekly tracking of bycatch species, while the Pacific States Marine Fisheries Commission (PSMFC) samples the commercial groundfish landings, including nearshore species, and then supplies the Department with that information for tracking purposes.

900 NFMP Section 3, 24.
901 NFMP Section 1, 1-5.
903 NFMP Section 1, 1-5.
904 NFMP Section 1, 1-13.
905 Personal communication, Deb Wilson-Vandenberg, October 4, 2013.
Several recent implementation actions including constituent involvement have occurred in recent years. Although the Regional Advisory Committees called for in the NFMP\textsuperscript{909} have not been created yet due to resource constraints, continued efforts “to more formally involve constituents in the management process have been developed so managers are better able to address constituent needs in planning management actions.”\textsuperscript{910} These include: 1) establishment of a statewide Groundfish Task Force comprised of recreational, commercial, and environmental members (this group is not currently active), 2) development of a mailing list of interested parties who receive notice of proposed regulation changes, relevant press releases, and the Marine Management Newsletter, 3) creation of four recreational and four commercial regional focus groups whose input was used for the 2007-2008 regulation development process, 4) enhanced online information on groundfish issues to improve information access, 5) regional conference calls with constituents on proposed regulation changes,\textsuperscript{911} and 6) public meetings with constituents, sometimes in conjunction with Council meetings in California, during regulation development.\textsuperscript{912} In addition, four collaborative research projects have been initiated: the CRANE cooperative sampling effort to provide information for managing California’s nearshore rocky reef fish and invertebrate populations (no longer active);\textsuperscript{913} the CRFS program, a shared effort between the Department and the Pacific States Marine Fisheries Commission;\textsuperscript{914} a volunteer nearshore fishery pilot logbook program, tested as a joint effort among the Department, NOAA Fisheries and the PSMFC;\textsuperscript{915} and MPA research, as part of the MLPA baseline monitoring being conducted through partnerships with multiple research organizations such as the Ocean Science Trust, the Partnership for Interdisciplinary Studies of Coastal Oceans as well as citizen-science groups engaged in data collection.\textsuperscript{916} Further, the Department collaborates with a variety of state and federal agency and academic partners on projects such as: reconstructing historic catch for assessments; evaluating assessment methodologies and incorporating MPAs into fishery management; collecting biological and life history information on plan species; developing long term hook and line studies for indices of abundance; evaluating the effects of ten years of

\textsuperscript{909} NFMP Section 1, 3-127.
\textsuperscript{910} Update on NFMP Implementation, 8.
\textsuperscript{911} Update on NFMP Implementation, 8.
\textsuperscript{912} Personal communication with Wilson-Vandenberg, Deb. Senior Environmental Scientist. Cal. Dep’t of Fish and Wildlife. December 2013. California.
RCAs; and evaluating the utility of various non-lethal survey methodologies to assess abundance.917

Fishery-Specific Challenges and Opportunities

Matching the fishery to available resources
The alignment of fishing capacity with available resources is a key characteristic of fisheries that are economically and ecologically sustainable.918 A large part of achieving that balance in the nearshore fishery involves restricting fishing access, which has been taking place gradually. However, nearshore fishery participation is still above the capacity goal and some fishers have indicated that due to low catch limits the fishery is not economically sustainable.919 Another issue is that nearshore fishery permits are region-based while trip and TAC limits may be statewide or regional (though not in alignment with NFMP regions).920 Deeper nearshore permits have a different management structure including state-wide, non-transferable permits. “Managing this coastwise fishery is further complicated by significant regional differences in biological and socio-economic factors.”921 An opportunity to understand these regional differences may be available with the implementation of the regional collection of socio-economic and ecological information through the baseline monitoring program established for the California MLPA process.922 In addition, the establishment and engagement of the Regional Advisory Committees to address overcapacity could be a positive step towards resolving these issues. However, in order to fully match management with available stocks, assessments that determine region-level biomass are needed which are currently not available on that scale.923

Data Gaps
Limitations on the quality, timeliness and/or precision of available information are additional barriers hindering the potential of the NFMP.924 Monitoring and assessment of nearshore fish stocks and the fisheries themselves are not adequate for optimizing ecological and economic performance of the nearshore fishery. Reaching that goal

918 NFMP Section 1, 3-136.
919 Update on NFMP Implementation, 6.
921 NFMP Section 1, 1-5.
924 Update on NFMP Implementation, 1.
would at least entail completing stock assessments for all 19 species. Methods for novel “data moderate” assessments present an opportunity to meet that goal as they require less time and could replace traditional, resource intensive stock assessments. As these techniques are beginning to pass peer review rigor, they are starting to be applied. Relatively little systematic information exists to fully evaluate nearshore fish populations. While extensive research has been conducted on several species, many information gaps remain and there is no program currently adequate for the systematic assessment, of nearshore fish stocks. Since the NFMP was created, efforts to assess and conservatively manage nearshore fish species have expanded, particularly in the recreational fishery. A systematic program to fully evaluate the nearshore complex is still lacking in the commercial fishery. The explanation for this is simple: collecting EFI is expensive and time-intensive. A related data issue is that although stock assessments have been completed for 10 species, they are conducted on a much larger scale than is appropriate for regional management measures due to data limitations and thus have limited utility for that application. Finally, obtaining biological sample data from commercially landed catch is very challenging. This could be addressed with a mandatory sampling requirement. One opportunity that could potentially bridge research and data gaps is more collaborative partnerships with science and research organizations, if carefully designed with clear goals and responsibilities for all parties. For example, designing baseline and longer-term data collection within MPA monitoring research to meet fishery management needs could contribute to nearshore stock and habitat assessment efforts with the appropriate focus and emphasis. However, a challenge of implementing this is the lack of funding available for longer-term monitoring within the MPAs. Also, a Logbook Pilot Program for California’s Nearshore Groundfish Fishery was tested in 2005, which yielded promising results for a future voluntary logbook program to address the need for better data on catch, effort

927 NFMP Section 2, 1-8.
929 Update on NFMP Implementation, 4-5.
and economic data.\textsuperscript{933} If put into practice broadly, such a program could fill a major gap in commercial catch, bycatch and effort data needs.

Similarly, the NFMP recognizes that data on non-consumptive values are difficult to collect and apply to fisheries management decisions. Although general socio-economic data are often available, that information is typically not adequate for in-depth analyses. Determining allocation of nearshore fishery resources among competing users (including non-extractive users) for example, requires analyses of resource demand by each user-group.\textsuperscript{934} To date, this kind of information has not been collected in any “deliberate, objective, and systematic manner in California”\textsuperscript{935} but represents an opportunity to further align the NFMP with MLMA goals.

Finally, the regional management measure was a significant step, but truly minimizing negative effects on fishing communities requires a greater understanding of the socio-economic dimensions of the nearshore fishery than we currently have.\textsuperscript{936} Gaining that knowledge requires resource-demanding surveys of the primary user groups (commercial fishermen and processors, recreational fishermen, end-users of commercial products, and non-extractive users).\textsuperscript{937}

**Adaptive Management**

Although there has been an update on the NFMP’s implementation, a review of the NFMP has not been completed since its adoption in 2002. A periodic review of nearshore fishery management according to the FMP and the MLMA would provide an opportunity to evaluate impacts of Department actions, determine the effectiveness of regulations and ensure that decisions are based on the best available scientific information. This evaluation process can identify issues that may require a management response and allow for course corrections and regulatory updates. The Department does apply adaptive management through in-season monitoring which provides a basis for adjusting regulations as needed to avoid exceeding TAC numbers. The Department and the Council also use a biennial process to evaluate the fishery and make appropriate adjustments adaptively.\textsuperscript{938} However, a more systematic adaptive management strategy based on the key components described in section “h. Management should be adaptive,” could contribute to more effective outcomes in the

\textsuperscript{934} NFMP Section 1, 4-174.
\textsuperscript{935} NFMP Section 1, 4-174.
\textsuperscript{936} NFMP Section 1, 4-173-174.
\textsuperscript{937} NFMP Section 1, 4-173-174.
nearshore fishery. A successful example of this form of adaptive management is in place for red knots (a migratory shorebird species) and horseshoe crabs in Delaware Bay. Through broad stakeholder participation in a linked, step-wise process, a sustainable crab harvest strategy was developed while stopover habitat was protected for a declining population of migrating red knots.\textsuperscript{939}

**Challenges to Implementation**

The primary purpose of this review was to examine how the NFMP aligns with the overarching MLMA goals of ensuring the conservation, restoration, and sustainable use of California’s marine living resources. In order to provide a clearer picture of performance of the Nearshore FMP since its inception in 2002, a preliminary assessment of management under the NFMP, in terms of implementation, became a secondary goal. This process identified many successes, such as significant fleet capacity reduction and efforts to move towards Stage III Management, and also several challenges facing the Department, such as insufficient data collection and stalled regional management, which stem primarily from capacity limitations. In fact a lack of adequate funding and consequent understaffing of the Department have primarily hampered progress on full NFMP implementation.\textsuperscript{940} The stalled regional management measure is a prime example of a resultant implementation challenge.\textsuperscript{941} Because the regulatory and monitoring workload would need to increase fourfold for full implementation, insufficient resources are the fundamental reason why the regional system is not yet in place. Inadequate data for regional stock assessments\textsuperscript{942} and establishing fair and equitable regional catch limits and allocations is another related challenge,\textsuperscript{943} as doing so would greatly increase the regulatory and monitoring workload. Further, the complexity of the restricted access program and commercial permitting, in conjunction with the mismatch between permits and catch limits (TACs or trip limits), all contribute to a less than straightforward commercial fishery.\textsuperscript{944} However it is essential to note that implementation of the NFMP was not fully evaluated so the complete picture of successes, challenges, and opportunities remains to be recognized.

\textsuperscript{940} Update on NFMP Implementation, 1.
\textsuperscript{941} Update on NFMP Implementation, 7.
\textsuperscript{943} Update on NFMP Implementation, 7.
Conclusion

The NFMP represents a significant achievement in the management of California state fisheries. The Plan’s comprehensive goals and objectives generally reflect the MLMA’s broad purpose of reframing fisheries management in California. Limited essential fishery information (biological and socioeconomic) coupled with a balancing act of regulatory authority presents major management challenges for the nearshore fishery. Tools such as the restricted access program, precautionary 60-20 control rule, and limits on recreational fishing are in place and beginning to improve the health of nearshore stocks. Other tools that could further the goals of the NFMP and MLMA are not sufficiently operational, including regional management, adaptive management, and implementation of the ecosystem-based Stage III management provision. The difficulty in implementing these tools emanates primarily from capacity limitations for the first two, while limited science limits the third. Potential opportunities exist to meet some of these challenges, from leveraging existing collaborative partnerships and developing new ones, to adopting successful measures and innovative ideas from federal or other state fisheries management.
Executive Summary

California’s commercial herring fishery occurs mainly in San Francisco Bay for roe-herring, herring-egg-on-kelp, and fresh fish. Management of the commercial herring fishery falls under the authority of California’s Fish and Game Commission (Commission), which bases regulations on recommendations from the Department of Fish and Wildlife (Department). Management is adaptive and regulatory quotas are updated annually to reflect recent population assessments done by the Department. Additionally, any conflicts and issues among stakeholders are addressed quickly during the annual review and update of regulations. Several unique management concepts have been implemented in the herring fishery, such as a limited entry permit system and permit lotteries, quota allocation by gear type, the platoon system, gear conversion programs, and transferability of permits.

This document provides a preliminary and foundational overview of how herring are managed. It specifically discusses how the management of the herring fishery reflects certain overarching goals of the Marine Life Management Act (MLMA). Despite the lack of a formal FMP, herring management successfully accomplishes many of the goals of the MLMA. Management measures such as quotas, gear restrictions, temporal and areal closures, and annual review of regulations help to minimize adverse effects on the marine ecosystem, ensure that the herring fishery is sustainable, and consider the interests of members of the public reliant on the herring resource. The positive achievements of the chosen management measures could be strengthened by the

947 2013 FSED, 2-1.
948 2013 FSED, 2-2.
enhancement of essential fisheries information through both fisheries independent and fisheries dependent research on herring’s role in the marine ecosystem.

**Enabling Authorities and General Regulatory Structure**

The Department and Commission are responsible for developing and implementing separate regulations for the recreational and commercial herring fishery. Minimal recreational fishing for Pacific herring occurs, and regulations specific to the recreational take of herring, found in California’s Ocean Sport Fishing Regulations, are equally limited.\(^{950}\) The commercial herring fishery is managed pursuant to a legislative mandate found in the Fish and Game Code (FGC).\(^{951}\) The State legislature initially set quotas for the first three years of the fishery, but ultimately delegated authority to the Commission to set regulations in the California Code of Regulations in 1975.\(^{952}\)

For the past fifteen years, commercial herring regulations have been subject to frequent review by the Department and Commission and are updated annually.\(^{953}\) The annual review process includes the development of a Supplemental Environmental Document by the Department, public notice and comment, and adoption or rejection of the proposed regulatory changes by the Commission. The Department develops and presents a Draft Supplemental Environmental Document and its management recommendations to the Director’s Herring Advisory Committee (DHAC), a group of 26 representatives from the herring fishery,\(^{954}\) the public and other interested parties. The Department may modify the recommendations based on comments received.\(^{955}\) The recommendations are then presented at a public hearing and again modified as necessary.\(^{956}\) Once the Supplemental Environmental Document is completed, the

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\(^{950}\) *Rapid Assessments for Selected California Fisheries*, 97. California Ocean Science Trust. Oakland, California, USA. August 2013 [hereinafter *Rapid Assessments*].

\(^{951}\) Cal. Fish & Game §§ 8550-8559.

\(^{952}\) *Herring Evolution*, 21-23; FED, 3-43; “FGC Section 8553 delegates authority from the Legislature to the Commission, whose members are appointed by the Governor, to regulate the commercial harvest and possession of herring. The remaining FGC sections related to herring provide for a limited entry fishery and require periodic review of regulations and policies.” 2013 FSED, 1-6.

\(^{953}\) 2013 FSED, S-1.

\(^{954}\) 2013 FSED, 1-4.

\(^{955}\) FED, 3-43; 2013 FSED, 1-4.

\(^{956}\) FED, 3-43.
recommendations and regulatory package are presented to the Commission who approves or rejects the proposed regulatory changes.957

Several different policies guide the fishery’s annual review process and management decisions. These include management goals from the Marine Life Management Act (MLMA),958 the State policy for conservation of aquatic resources,959 and project goals for maintaining healthy herring stocks that have been identified by the Department.960

**Brief Snapshot of the Fishery**

**Who is fishing?**
San Francisco Bay’s commercial herring fishery is a limited entry fishery.961 A maximum capacity of 240 permits is split between three platoons,962 a grouping system that allows a larger number of permittees to participate without causing congestion in the fishery.963 One permit type, December Herring (DH), is a remnant of a now closed experimental fishing season,964 members of which are now split evenly and incorporated into the Odd and Even platoons.965 Two other permit types, Odd and Even permits, are distributed an equal share of the total annual quota and alternate fishing weeks.966 A final permit type, converted roundhaul (CH) permit, was given to fishermen who voluntarily converted their gear from roundhaul to gill net prior to October 2, 1998.967 A CH permit-holder is authorized to fish in two of the three previously mentioned fishing platoons.968

957 FED, 3-43 – 3-44.
958 Cal. Fish & Game § 7050(b).
959 Cal. Fish & Game § 1700.
960 2013 FSED, 2-1. The original Environmental Document from 1998 had a similar, but shorter and more general, list of project objectives. FED, at 2-1. The evolution of the project objectives is evident in the annual Supplemental Environmental Documents released in most of the subsequent years.
964 *Herring Evolution*, 40.
Special permits for Department sponsored research can also be granted in addition to the regular capacity.\textsuperscript{969} In 2012-2013, 102 permits were assigned to the Even Platoon and 95 permits were assigned to the Odd Platoon.\textsuperscript{970} The total of 198 permits was well below the maximum capacity of 240. For a fisherman to participate in the HEOK fishery, they must first be a prior HEOK permittee or hold a regular herring fishery permit and convert the permit into the HEOK fishery.\textsuperscript{971} In 2012-2013, 10 HEOK permits were renewed.\textsuperscript{972} To participate in the recreational fishery for herring, any person over the age of 16 must have a sport fishing license to take herring or herring eggs.\textsuperscript{973} However, no license is needed for angling from a public pier in ocean or bay waters.\textsuperscript{974}

\textsuperscript{968} Cal. Code Regs. tit. 14 § 163(b)(2).


\textsuperscript{971} Cal. Code Regs. tit. 14 § 164 (f).


What do they fish?
The herring fishery has historically targeted three distinct products: sac-roe (gravid herring), fresh fish, and herring-egg-on-kelp (HEOK) (harvesting of giant kelp that has herring eggs laid on it).975

When do they fish?
Commercial herring fishing seasons coincide with herring spawning activity and begin at 5:00 p.m. on January 1 and end at noon on March 15.976 The end of the commercial herring fishing season may close early if the quota is reached before this date.977 If one platoon fishes their respective quota prior to the end of the season, the other platoon

975 FED, S-2.
may begin fishing if approval is given by the Department.\textsuperscript{978} Herring fishing in San Francisco Bay is prohibited on weekends to reduce conflicts with recreational use of the bay.\textsuperscript{979} The season for the HEOK fishery runs from December 1 through March 31.\textsuperscript{980} The recreational fishery is not subject to possession limits but effort typically coincides with winter spawning events due to herring proximity to nearshore access points so potential take is limited.\textsuperscript{981}

**Where do they fish?**

Commercial herring fishing has historically occurred in many locations off the California coast. Until 2010, the fresh fish fishery occurred in San Francisco Bay and in ocean waters.\textsuperscript{982} Currently, fishing in ocean waters is only allowed near Crescent City.\textsuperscript{983} Despite the historical presence of the sac-roe fishery in Tomales Bay, Humboldt Bay, and Crescent City, no commercial fishing activity has taken place in these areas for over five years.\textsuperscript{984} In fact, fishing effort in Crescent City and Humboldt Bay has been so modest that permit and quota limits have not changed since 1978 and 1982 respectively.\textsuperscript{985} The fresh fish and sac-roe fisheries of San Francisco Bay were recently combined and accommodate the only commercial herring fishing effort currently occurring in California waters.\textsuperscript{986}

In San Francisco Bay, regulations limit fishermen from setting nets within 300 feet of certain recreation areas, such as beaches and piers, or above the lower low water mark of certain geographic closures.\textsuperscript{987} The HEOK fishery is limited to the same areas as San

\textsuperscript{978} Cal. CodeRegs. tit. 14 § 163(h)(7).
\textsuperscript{979} Cal. CodeRegs. tit. 14 § 163(h)(5); FED, 3-50, 4-26.
\textsuperscript{980} Cal. CodeRegs. tit. 14 § 164(b).
\textsuperscript{983} Cal. CodeRegs. tit. 14 § 163(f)(1). Despite the prohibition on targeted fishing, incidental take of less than 10% herring by weight is allowed in the coastal pelagic, market squid, and other fisheries. Cal. Code
\textsuperscript{984} Cal. CodeRegs. tit. 14 § 163(h)(6).
\textsuperscript{986} 2013 FSED, 2-12.
\textsuperscript{987} Herring Evolution, 24, 28.
\textsuperscript{988} 2013 FSED, S-2; 2013 FGC Meeting Video.
Francisco Bay’s gill net herring fishery, unless written approval to use other areas is granted by the owners or controlling agency.988

**How do they fish?**

Until very recently, California’s Code of Regulations contained separate regulations on seasons, permitting, quotas, gear, etc. for each herring fishing method.989 While regulations concerning the HEOK fishery remain distinct, the Commission recently approved new regulatory language that combines the fresh fish and sac-roe fisheries and will eliminate any regulatory distinction between them.990

The commercial herring fishery has strict regulations on gear type to minimize impacts on habitat, congestion, bycatch, and overfishing. Today, set gill nets are the only acceptable gear type for use in the herring commercial fishery. Set gill nets must be clearly marked with buoys, lights, vessel number, and flags/markers and anchored to minimize disturbance of benthic communities and to reduce congestion and conflicts with recreational uses.991 Regulations also contain mesh size limits, designed to minimize the catch of two- and three-year-old herring, many of which are first time spawners.992

An independent set of gear regulations applies to the HEOK fishery.993 The HEOK fishery involves harvesting of giant kelp that has been artificially suspended from rafts or lines.994 This is known as the “open pound” method.995 Rafts and lines have size and length limitations and a maximum of two rafts or lines may be used for each permit.996 An HEOK permittee may test for spawning activity by using no more than ten sets of

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989 See generally Cal. Code Regs. tit. 14 §§ 163-164. Annual changes to the seasons and quotas for the fresh fish and sac-roe fishery were incorporated into § 163 which also contains permitting, gear, and monitoring regulations. Regulations for the HEOK fishery are found in § 164.

990 2013 FSED, S-2; 2013 FGC Meeting Video.


993 Cal. Code Regs. tit. 14 § 164


995 FED, 4-14.

test kelp per permit. Permittees must notify the Department where and when HEO
suspensions and harvesting will take place and are subject to limits on when harvesting
and landing may occur. Recreational fishers may use dip nets, Hawaiian throw nets,
spearfishing gear, slurp guns, or bow and arrow fishing tackle. Other general gear
restrictions from the California sport fishing regulations may apply.

**How much can they fish? (e.g., what are the regulatory limits on total catch?)**

Commercial annual fishing quotas are established by the Commission and apply to
both the herring and HEOK fishery in San Francisco Bay. To guide the Commission, the
Department makes quota recommendations based on annual assessments using
fisheries independent data. Quotas have historically been less than 20% of the
previous year’s spawning biomass estimate but since 2010, quotas have been a more
precautionary 5%. For example, the recently approved quota for the 2013-2014 season
is 3,737 tons, 4.7% of the biomass estimate of 79,500 tons. Allocation of the quota to
each fishing platoon will be in proportion to the number of permits assigned to each.
This quota is also the basis for allocation to the HEOK fishery. If a herring fishery
permit holder decides to transfer to the HEOK fishery, the permittee’s share of the total
herring quota is transferred to the HEOK fishery and converted from whole fish weight
to tons of egg-on-kelp product using a mathematical conversion. In 2012-2013, the
HEOK fishery landed 39.3 of a 40.5 ton quota. Recreational take of herring as fresh
fish is not subject to limits but no more than 25 pounds wet weight may be taken of

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999 CA Ocean Fishing Regulations §§ 28.80, 28.90, 28.91, 28.95. While all these gears type are allowed, the
only types typically used are throw nets or dip nets. Personal Communication with Bartling, Ryan.
1000 CA Ocean Fishing Regulations § 28.65.
1001 Rapid Assessments, 98.
1002 2013 FSED, 2-9.
1003 2013 FSED, 2-4. This proposal was unanimously passed at the August 2013 meeting of the Fish and
Game Commission. See 2013 FGC Meeting Video.
1005 Herring Evolution, 33; 2013 FSED, 2-11.
1006 Personal Communication with Bartling, Ryan. Environmental Scientist. Cal. Dep’t of Fish and
1007 CA Ocean Fishing Regulations § 27.60(b).
herring eggs on plants. Data relating to the number of active recreational fishermen targeting herring or the amount of recreational catch is currently unavailable.

Meeting the Goals and Requirements of the MLMA
The MLMA contains several goals to guide the sustainable management of fisheries. Many of the goals are broad and a great deal of overlap exists between them. The primary goals include: conserve entire ecosystems, recognize non-consumptive values, allow only those activities that are sustainable, maintain, restore, or enhance habitat, restore depressed fisheries, minimize bycatch, minimize adverse effects on fishing communities, establish processes for adaptive management, establish a program for external peer review, and ensure collaboration and stakeholder involvement. This review is meant to be preliminary and foundational and therefore is not a comprehensive analysis of every goal and objective found within the MLMA. We focus on the listed above goals because they encapsulate several other specific goals listed in sections 7050 and 7056 of the Act. For example, the best available science requirement is reflected in the goals of restoring depressed fisheries, ensuring adaptive management and sustainability, conserving entire ecosystems, and the goal of establishing a peer review process.

“The MLMA requires that Fishery Management Plans (FMPs) form the primary basis for managing the State’s marine fisheries. An FMP is a planning document based on the best available scientific knowledge and other relevant information, that contains a comprehensive review of the fishery along with clear objectives and measures to ensure

\[1008 \text{ CA Ocean Fishing Regulations § 28.60(a).} \]
\[1009 \text{ Cal. Fish & Game § 7050(b)(1).} \]
\[1010 \text{ Cal. Fish & Game § 7050(b)(3).} \]
\[1011 \text{ Cal. Fish & Game § 7050(b)(2).} \]
\[1012 \text{ Cal. Fish & Game § 7055(b).} \]
\[1013 \text{ Cal. Fish & Game § 7055(b).} \]
\[1014 \text{ Cal. Fish & Game § 7056(d).} \]
\[1015 \text{ Cal. Fish & Game § 7056(i-j).} \]
\[1016 \text{ Cal. Fish & Game § 7056(g). (l).} \]
\[1017 \text{ Cal. Fish & Game § 7062.} \]
\[1018 \text{ Cal. Fish & Game § 7056(h). (k).} \]
its sustainability.” Despite the lack of a formal FMP under the MLMA for Pacific herring, the current management of the fishery successfully achieves many of the aforementioned goals, and takes significant steps towards accomplishing all of them.

Conserve entire ecosystems [e.g., Fish and Game Code §7050(b)(1)]
The MLMA recognizes that the health of fish populations is closely related to the health of their ecosystem. “Maintaining the health of marine ecosystems is key to productive fisheries and non-consumptive uses of marine living resources.” The MLMA broadly requires that entire ecosystems be conserved. More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.” Similar to requiring sustainability, conserving entire ecosystems is an overarching goal that encompasses many of the other goals and objectives of the MLMA.

Because conserving entire ecosystems is an overarching goal, virtually all management measures currently in effect to regulate the herring fishery are geared towards conserving entire ecosystems. Fishing quotas, temporal and areal closures, gear restrictions, and a robust annual review process all have positive effects on marine ecosystems by protecting herring’s role as a forage species, minimizing bycatch and negative impacts on habitat, and ensuring the overall sustainability of the herring fishery. More information on the management measures employed to regulate the herring fishery is provided below.

As a forage species, herring support ecosystems and the non-consumptive values of recreation and tourism enjoyed by a variety of users. Charismatic species such as marine mammals, other commercially and recreationally targeted fish, and birds use herring as a food source. Fishing quotas based on spawning biomass estimates is identified as a tool to protect the value of herring as a forage species. In addition,


1021 Cal. Fish & Game § 7050(b)(1).

1022 Cal. Fish & Game § 7084(a).

1023 2013 FSED, 3-12.

1024 FED, 4-22.
regulation of gill net mesh size ensures that young herring are able to spawn each year because mesh size is size selective and indirectly effects the ages and species of fish caught by the net.\textsuperscript{1025} Long-term studies have been conducted to determine the ideal mesh size to minimize catch of juvenile herring, maximizing the opportunities for herring to reproduce before being removed from the ecosystem.\textsuperscript{1026} Finally, area closures in biologically sensitive areas serve to protect herring spawning habitat and herring predators from fishing interactions.\textsuperscript{1027} Effects of the commercial herring fishery on forage predators are found to be minimal,\textsuperscript{1028} but further studies on predator-prey relationships are needed to fully understand the impact of the herring fishery.\textsuperscript{1029}

Adopted in November of 2012, the Commission’s Forage Fish Policy contains some guiding principles for managing forage species for the benefit of the ecosystem.\textsuperscript{1030} Among other things, the Forage Fish Policy calls upon the Commission to manage forage species with precautionary goals based on the best available science and to identify and incorporate essential fisheries information (EFI).\textsuperscript{1031} More recently the Department documented herring as an important mid-trophic species, and described a corresponding policy to protect the species through precautionary and informed management recommendations.\textsuperscript{1032}

\textbf{Recognize non-consumptive values [e.g., Fish and Game Code §7050(b)(3)]}

The MLMA recognizes that marine ecosystems provide important benefits to people beyond the consumption of seafood. Important non-consumptive values include “educational, scientific, and recreational uses that do not involve the taking of


\textsuperscript{1027} Herring Evolution, 34-35.

\textsuperscript{1028} FED, 4-19 – 4-25.

\textsuperscript{1029} FED, 4-19 – 4-22.


\textsuperscript{1031} Forage Policy.

California’s marine living resources.”\textsuperscript{1033} The objectives for management set out in the MLMA encourage the protection of marine resources to ensure their continued availability for non-consumptive uses.\textsuperscript{1034}

Temporal and areal closures are used to reduce conflicts with other non-consumptive uses of the San Francisco Bay, such as pleasure boating. Recreational non-consumptive uses of the bay are protected by weekend closures of the herring fishery and prohibitions of herring fishing within 300 feet of certain recreational areas and channel entrances.\textsuperscript{1035} Other area closures are designed to keep herring fishermen away from sensitive military installations or to eliminate the noise of fishing operations near certain residential areas.\textsuperscript{1036}

\textbf{Allow only those activities that are sustainable [e.g., Fish and Game Code §7050(b)(2)]}

Sustainability is identified as the primary goal of the MLMA.\textsuperscript{1037} The MLMA defines sustainability as both “continuous replacement of resources, taking into account fluctuations in abundance and environmental variability,” and “securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.”\textsuperscript{1038} The MLMA broadly requires that allowable activities and uses of marine resources must be sustainable and lists several goals and objectives to guide management of sustainable fisheries.\textsuperscript{1039}

The most essential measure used to ensure that the herring fishery is managed sustainably is the use of biomass estimates to set annual quotas at a precautionary level. Each year, the Department evaluates the herring population of San Francisco Bay through fisheries independent stock assessment techniques such as spawn escapement surveys, hydroacoustic surveys, and cohort analyses.\textsuperscript{1040} These studies are designed to

\begin{itemize}
\item \textsuperscript{1033} Cal. Fish & Game § 7050(b)(3).
\item \textsuperscript{1034} Cal. Fish & Game § 7050(b)(3).
\item \textsuperscript{1035} FED, 4-26; Herring Evolution, 34.
\item \textsuperscript{1036} Herring Evolution, 34.
\item \textsuperscript{1037} Cal. Fish & Game § 7056.
\item \textsuperscript{1038} Cal. Fish & Game § 99.5.
\item \textsuperscript{1039} Cal. Fish & Game § 7050(b)(2).
\item \textsuperscript{1040} FED, 4-16.
\end{itemize}
estimate spawning stock biomass and age class structure for the purpose of setting precautionary fishing quotas.1041 The fishery has been regulated cautiously by setting quotas at less than 20% of the estimated biomass.1042 In 2003, a peer review of the Department’s assessment techniques found that hydroacoustic assessment surveys tended to overestimate the spawning biomass and that 20% quotas may not be sustainable in light of the uncertainties of the herring population status.1043 As a result, the Department no longer uses hydroacoustic data in estimating spawning biomass and subsequent recommended quotas have been between 0% and 10% of the estimated biomass.1044 Since 2010, the Department has recommended precautionary quotas at less than 5% of the previous year’s spawning biomass.1045 Setting precautionary exploitation rates based on the best available science helps to “ensure adequate protection of the herring resource while taking into account accidental overages and other management uncertainties” including environmental variability.1046 This method also protects the non-consumptive value of herring as a forage species1047 and is consistent with the Commission’s Forage Fish Policy.1048

Although the biomass assessments have been largely successful in ensuring sustainability of the fishery, potential for improvement exists with the current methodology. For example, the 1998 Final Environmental Document (FED) notes that the mathematical model used may not accurately predict the potential for overfishing if the assumed natural mortality rate is incorrect.1049 Additionally, herring stocks are

1041 FED, 3-33.
1043 Peer Review, 2.
1045 Rapid Assessment, 98; 2013 FSED, 2-9.
1046 2013 FSED, 2-9.
1047 FED, 4-22; 2013 FSED, 2-9.
1048 Forage Policy.
1049 FED, S-8.
known for instability under fishing pressure. When stock evaluation is minimal (spawning biomass assessments are not currently done for Tomales, Humboldt, Crescent City) the potential for collapse is greater. Although the fisheries in Tomales Bay, Humboldt Bay, and Crescent City are not currently active, periodic stock assessments of these populations are still necessary to ensure sustainability unless a zero quota for these areas is approved. Accurately assessing the Pacific herring stock structure is especially important because certain factors—such as whether populations from different bays comingle in ocean waters—are unknown.

Maintain, restore or enhance habitat [e.g., Fish and Game Code §7055(b)]
The MLMA recognizes that the health of many fish populations is closely related to the health of their habitat. “Healthy habitats are important for maintaining the productivity and diversity of marine ecosystems and viable commercial and recreational fisheries.” The MLMA broadly requires that the habitat of marine wildlife is to be maintained, restored, or enhanced, where appropriate. More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.”

Gear restrictions in the herring fishery serve to maintain, restore, or enhance habitats, a goal closely tied with conserving entire ecosystems. In the context of herring management, gear restrictions take the form of prohibited gear types, marking and labeling requirements, and size and length limitations on nets, rafts, and lines. The practice of anchoring gill nets minimizes dragging and the accompanying benthic disturbance. Likewise, HEOK regulations require that all rafts be attached to

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1050 FED, 4-16.
1051 FED, 4-16.
1052 FED, 4-17.
1053 FED, 3-4, 3-5, 4-17.
1055 Cal. Fish & Game § 7056(b).
1056 Cal. Fish & Game § 7084(a).
permanent structures in certain biologically sensitive areas, and that all lines be attached to permanent structures at all times and have floats or corks over the entire length. These requirements reduce any impact that the HEOK fishery would have on the habitat if they had to be anchored or could scrape the bottom.

The ability to conserve habitats and ecosystems would be strengthened if habitat impacts of certain activities associated with the commercial herring fishery were studied further. Studies on habitat impacts would be undertaken if a fishery research protocol were implemented. (See more on fishery research protocols under the “fishery research protocol” management opportunity below.).

**Restore depressed fisheries [e.g., Fish and Game Code §7055(b)]**
The MLMA classifies a fishery as depressed if “a declining population trend has occurred over a period of time appropriate to that fishery,” or if fish populations decline below abundance levels “consistent with maximum sustainable yield.” A fishery may be depressed due to human impacts such as over-fishing or as a result of natural causes such as changes in ocean conditions. Regardless of the cause, the MLMA requires that all state-managed fisheries include the objective of restoring depressed fisheries to sustainable levels.

The annual review process and update of fishing quotas based on best available science has been used to restore depressed herring stocks. When estimated stock biomass hit a low in 2009, the Department recommended a zero ton quota and the Commission voted to close the fishery for that season and have limited quotas to 5% in recent years. As of 2013, the estimated biomass has increased to above average levels and the fishery appears to be restored to levels consistent with historic biomass estimates. Unfortunately, the dramatic decrease in biomass in 2009 remains unexplained but may be the result of low recruitment, oceanographic conditions, or impacts related to

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1060 FED, 4-15.
1061 Cal. Fish & Game § 90.7.
1062 Cal. Fish & Game § 7056(c).
1064 2013 FSED, 2-8.
1065 2009 FSED, 3-3 – 3-8.
1066 2009 FSED, 3-3 – 3-8.
the 2007 Cosco Busan oil spill. Estimates of total stock biomass and increased knowledge of natural mortality are needed to further understanding of how to restore depressed herring stocks. (See more on fishing quotas under the “allow only those activities that are sustainable” goal above and more on the annual review of herring management under the “management should be adaptive” goal below.).

Although herring management operates under precautionary quotas and zero quotas have been implemented in the past, reference points to define when a stock is “depressed” or “overfished” do not exist. A reference point that identifies when herring stocks are “depressed” would be useful in setting expectations for the public and assisting the Department in ensuring the survival of the herring population. (See more on reference points under the “reference points and indicators” management opportunity.).

Minimize bycatch [e.g., Fish and Game Code §7056(d)]
The MLMA defines bycatch as “fish or other marine life that are taken in a fishery but which are not the target of the fishery . . . includ[ing] discards.” Bycatch is often discarded dead or kept unreported and can be a serious problem, affecting vulnerable marine species. The MLMA requires monitoring of bycatch and discards and reduction of bycatch that is deemed “unacceptable.”

The MLMA goal of minimizing bycatch—intimately related to both ensuring sustainability and conserving entire ecosystems—is accomplished by gear restrictions in the herring fishery. In the context of herring management, gear restrictions can take the form of prohibited gear types, marking and labeling requirements, size and length

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1067 2009 FSED, 2-11. In past SEDs, the Department mentioned the Cosco Busan oil spill as a potential cause of the stock crash. A study conducted by a Natural Resources Damage Assessment (NRDA) team was referenced in several recent Supplemental Environmental Documents but the report was not identified or cited, and the team’s findings are not explained. 2013 FSED, 3-13. One NRDA report on the topic found that the effects of the oil spill varied widely depending on the location of the egg deposition and the depth of egg deposition. Matthew Zafonte, Cosco Busan Oil Spill NRDA: Herring Injury Quantification 4-6 (Aug. 25, 2011) available at nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=63469. Department staff has indicated that they do not consider the spill as a primary contributor to the population decline. The spill did have negative effects on spawning habitat but likely did not impact adult herring since a majority of the adult spawning population had yet to enter the bay at the time of the spill. Personal Communication with Bartling, Ryan. Environmental Scientist. Cal. Dep’t of Fish and Wildlife. November 2013. California.

1068 Cal. Fish & Game § 90.5

1069 MLMA Guide, 32.

1070 Cal. Fish & Game § 7056(d).
limitations on nets, rafts, and lines, and the use of the open pound method in the HEOK fishery. First, the use of round haul gear in the herring fishery was phased out over the course of the 1990’s and beginning in 1998 was completely prohibited. The prohibition was meant to reduce congestion in the fishery, mortality associated with the “wrap and release” technique, and bycatch of threatened and sport species such as salmon, striped bass, and sturgeon. Next, regulation of gill net mesh size has proven to be an effective way of minimizing bycatch because mesh size is size selective and indirectly affects the species of fish caught by the net. Acceptable mesh sizes are limited by regulation, and long-term studies have been conducted to determine the ideal mesh size to minimize incidental catch of juvenile herring and non-target species. Department studies using similar gill net mesh sizes to commercial nets have demonstrated that incidental catch constitutes less than 0.5% of the total catch in the fishery, and regulations prohibit the possession of sturgeon, halibut, salmon, or striped bass on any vessel fishing for herring. Equally important has been the Department’s response to the issue of ghost nets. Ghost nets are those nets lost during fishing that continue to trap fish for days, months, or potentially even years into the future. Data on the impact of ghost nets has been sparse but ghost nets have been recovered with marketable quantities of herring and with sturgeon. Regulations addressing this problem specify that only one gill net per permit with a maximum of two nets and two permits are allowed per vessel, that nets must be tended, and that each net must

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1072 For the “wrap and release” technique, fisherman would wrap a school and if a sample indicated that they were not “ripe” they would be released. However due to the “pursing” of the seine it would cause significant mortality which could not be accounted for in estimating annual catch. Personal Communication with Bartling, Ryan. Environmental Scientist. Cal. Dep’t of Fish and Wildlife. November 2013. California.
1073 Herring Evolution, 35.
1074 2009 FSED, 2-10.
1076 FED, 4-13 – 4-15.
1077 FED, 4-14.
1078 FED, 4-14.
be marked with a permit number and flag buoy.\textsuperscript{1081} The possibility that nets will be lost has been lowered by reducing the total amount of gear in the water and by enabling accountability of the permit holder if a lost net is found.\textsuperscript{1082} Finally, permit attrition and allowing transfer of herring permittees to the HEOK fishery, the Commission is enabling the use of the “open pound” method, which results in no bycatch because the rafts and lines are unenclosed and designed to allow free-swimming fish to spawn on suspended kelp.\textsuperscript{1083}

Minimize adverse effects on fishing communities [e.g., Fish and Game Code §7056(i),(j)]

Because the MLMA is concerned with the management of fisheries, impacts on fishing communities and coastal economies are inevitable. The MLMA requires that managers consider the “long-term interests of people dependent on fishing for food, livelihood, or recreation,” and minimize adverse effects of management on local economies and communities.\textsuperscript{1084}

The annual review of herring management and regulations by the Department and Commission has been successful in minimizing adverse effects on fishing communities. “In addition to annual changes in quotas, management recommendations to improve or provide for the efficient harvest and orderly conduct of the herring fisheries are solicited from interested fishermen, individuals at public meetings, and DHAC.”\textsuperscript{1085} Fishermen have had the opportunity to be extensively involved in the annual review process and many changes to regulations suggested by fishermen have been implemented. (See more on collaboration and involvement by fishermen under the “management should be adaptive” and “collaboration & stakeholder involvement” goals below.).

Management should be adaptive [e.g., Fish and Game Code §7056(g), (l)]

The MLMA defines adaptive management as a “scientific policy that seeks to improve management of biological resources . . . by viewing program actions as tools for learning.”\textsuperscript{1086} Even if a chosen management measure fails, it “will provide useful


\textsuperscript{1083} FED, 4-14.

\textsuperscript{1084} Cal. Fish & Game § 7056(i-j).

\textsuperscript{1085} 2013 FSED, 2-10.

\textsuperscript{1086} Cal. Fish & Game § 90.1.
information for future actions.” Management is adaptive when fisheries managers are able to respond to changing environmental and socio-economic conditions, and update regulations accordingly. The MLMA requires that management decisions are “adaptive and are based on the best available scientific information.”

The annual review of herring management makes the commercial herring fishery one of the most adaptive and closely managed fisheries in California, and providing an effective framework to deliver a more sustainable fishery. Through the annual review process, quotas are updated annually based on the most recent biomass assessments, ensuring sustainability of a fluctuating resource. “In addition to annual changes in quotas, management recommendations to improve or provide for the efficient harvest and orderly conduct of the herring fisheries are solicited from interested fishermen, individuals at public meetings, and DHAC.” For example, the Department’s recommendation to combine the sac-roe and fresh fish fisheries into the same permit system was based on the comments of several fishermen, conservationists, and other members of the public and received unanimous support. This streamlining of the regulations will reduce the administrative and enforcement burden on the Department, improve the economic value of the fishery, and demonstrates the adaptation of management to the growing market for locally sourced fresh fish.

Establish an external program for peer review [e.g., Fish and Game Code §7062]
External peer review is identified as a tool to ensure that the best available scientific information is used in achieving the goals of the MLMA. The MLMA requires that documents such as FMPs and fishery research protocols undergo external peer review, and gives discretion to the Department to submit other management documents for peer review.

1087 Cal. Fish & Game § 90.1.
1088 Cal. Fish & Game § 7056(l).
1089 Cal. Fish & Game § 7056(g)
1090 2013 FSED, 2-8.
1091 2013 FSED, 2-10.
1092 2013 FSED, 7-13; 2013 FGC Meeting Video.
1093 2013 FSED, 7-13; 2013 FGC Meeting Video.
1094 Cal. Fish & Game § 7062.
1095 Cal. Fish & Game § 7062(a).
Peer review of management documents is noted in the MLMA as an important aspect of successful management.\textsuperscript{1096} Neither the Department nor Commission is required to submit herring management documents, such as Supplemental Environmental Documents, to peer review.\textsuperscript{1097} However, the MLMA gives the Department broad discretion to submit any management documents for peer review.\textsuperscript{1098} In the context of herring management, a peer review of the Department’s stock status estimation methods was requested in 2003.\textsuperscript{1099} The peer review identified the strengths and weaknesses in the Department’s annual stock estimates and has been influential in the process of setting quotas.\textsuperscript{1100} The peer review found that hydroacoustic assessment surveys tended to overestimate the spawning biomass and that 20% quotas were too aggressive in light of the uncertainties of herring’s life cycle.\textsuperscript{1101} As a result, the Department no longer uses hydroacoustic data in estimating spawning biomass and subsequent recommended quotas have been between 0% and 10% of the estimated biomass.\textsuperscript{1102}

**Collaboration & stakeholder involvement [e.g., Fish and Game Code §7056(h),(k)]**

Collaboration and stakeholder involvement refers to the involvement of interested parties and members of the public throughout the management process.\textsuperscript{1103} This involvement can occur through research collaborations or at the public comment stage of regulation development.\textsuperscript{1104} The MLMA requires that the “management decision making process is open and seeks advice and assistance of interested parties,” and

\textsuperscript{1096} Cal. Fish & Game § 7062(a).
\textsuperscript{1097} Cal. Fish & Game § 7062(e).
\textsuperscript{1098} Cal. Fish & Game § 7062(a).
\textsuperscript{1099} Peer Review, 1.
\textsuperscript{1100} Peer Review, 1; 2013 FSED, 2-8.
\textsuperscript{1101} Peer Review, 2.
\textsuperscript{1103} Cal. Fish & Game § 7059(a).
\textsuperscript{1104} Cal. Fish & Game § 7056(h), (k).
strongly encourages collaboration with “fishery participants, marine scientists, and other interested parties.”

The involvement of the DHAC and public throughout the course of the annual review process ensures that stakeholders are able to have their voices heard and prime examples can be found in a variety of regulatory changes over the past decade. The Commission has been so effective at incorporating stakeholder comments and minimizing adverse effects on fishing communities that fishermen did not attend the most recent Commission meeting in August 2013, when decisions relating to the 2013-14 season were made. At the meeting, Commissioner Kellogg commented that so much harmony and confidence exists between fishermen and regulators that fishermen do not feel the need to attend in order to have their voices heard. Perhaps the most important example of harmony occurred after the biomass stock crashed prior to the 2009 fishing season. A zero quota was recommended by the Department for the 2009 season to allow the stocks a year of uninterrupted spawning. Comments received by the Commission from both conservationists and from the DHAC, a group of fishermen, supported the zero quota. In the face of crashing stocks and a potential catastrophe, the cooperation and agreement displayed during annual reviews of the herring fishery demonstrated the extent of collaboration, cooperation, and stakeholder involvement that has been achieved in herring management.

Opportunities and Challenges

Standardizing peer review
Peer review of management documents is noted in the MLMA as an important aspect of successful management. Neither the Department nor Commission is required to

1105 Cal. Fish & Game § 7056(h), (k).

1106 For instance, permit qualifications were originally based on a point system developed in 77-78 season. Herring Evolution, 27. The removal of the point system was requested by fishermen and simplified regulations without sacrificing management ability. Cal. Fish and Game Comm’n, 2005 Initial Statement of Reasons for Regulatory Action 4 (Sept. 2, 2005) available at http://www.fgc.ca.gov/regulations/2005/163_1isor2.pdf.

1107 2013 FGC Meeting Video.

1108 2013 FGC Meeting Video.

1109 2009 FSED, S-2.


1111 Cal. Fish & Game § 7062(a).
submit herring management documents, such as Supplemental Environmental Documents, to peer review. However, the Department has broad discretion to submit any other management documents for peer review. In the context of herring management, a peer review has been requested once, in 2003. The peer review identified the strengths and weaknesses in the Department’s annual stock estimates and has been influential in the process of setting quotas. Frequent change in the science of stock assessment techniques for herring is unlikely, but an optional periodic peer review of stock assessment techniques may be a valuable tool for the Department. This tool would provide the Department—which may lack the capacity to incorporate advancements in stock assessment techniques—with the opportunity to seek help from third parties.

Data gaps: developing a fishery research protocol
EFI is identified in the MLMA as a necessary component of sustainable fisheries management. Additionally, the Forage Fish Policy calls upon the Commission to identify and incorporate EFI including physical factors, oceanographic conditions, the effects of fishing on forage species’ dependent predators, the availability of alternative prey, and spatio-temporal foraging hotspots for predators. To accomplish the goal of incorporating and obtaining EFI, fishery research protocols are required elements of all FMPs. Fishery research protocols include a description of past and ongoing monitoring, current EFI, and steps to obtain missing EFI. Something as extensive as a full fishery research protocol would likely be unnecessary to ensure the goals of the MLMA are met for herring, which is not managed under an FMP. Despite this, the Department has recognized that EFI on herring is lacking and gaps have been identified in the following areas: life history, non-spawning phase, behavior and ecological

1112 Cal. Fish & Game § 7062(e).
1113 Cal. Fish & Game § 7062(a).
1114 Peer Review, 1.
1115 Peer Review, 1; 2013 FSED, 2-8.
1116 Cal. Fish & Game § 7060(a).
1117 Forage Policy.
1118 Master Plan, 2-2.
1119 Master Plan, 2-2.
1120 FED, 3-4, 3-5, 4-17.
relationships in offshore feeding areas, natural mortality, importance as a forage species, and habitat impacts. Additional research and collaboration on some of the more important issues, such as natural mortality and herring’s importance as a forage species, would likely strengthen the various management measures used by the Commission to ensure sustainability, conserve entire ecosystems, and meet other significant goals of the MLMA. The main barrier to such a research program for herring would stem from the capacity and budget instability faced by the Department. Research collaborations could provide an opportunity to undertake more focused and in depth projects while alleviating reliance on government funding.

Conclusion
The regulatory decisions that dictate the management of California’s commercial Pacific herring fishery reflect many goals of the MLMA. The management is adaptive to fluctuating stocks and changing public sentiment and the fishery is managed to ensure biological and economic sustainability. In line with California’s recent forage fish policy, management is based on best available science and is precautionary. Improvement of herring’s already effective management could be accomplished through the establishment of a more comprehensive monitoring program. Research would likely focus on Pacific herring’s role in the ecosystem, life history, response to environmental fluctuations, and bycatch and habitat impacts of the fishery.


1123 FED, 3-15, 5-2. El Nino events may have a pronounced effect on natural mortality. Id.

1124 FED, 3-16 – 3-21.

1125 FED, 5-5. Information on both impacts of the fishery on habitat and impacts of other human activities on herring habitat are needed. FED, 5-5. Essential habitat information and the impacts of the fishery have not been revisited since the FED, in which the Department stated that damage from herring fishing gear will be minimal because the soft bottom benthic community is dynamic and subject to constant natural change. FED, 4-15.
White Seabass

Executive Summary
In existence since the 1800’s, the Californian white seabass (WSB) fishery targets WSB, a migratory species found in waters off the west coast of California and Mexico.\footnote{Cal. Dep’t of Fish and Game, Final White Seabass Fishery Management Plan 1-1; 1-3 (2002) [hereinafter WSFMP].} The fishery’s recreational and commercial components are equally important, and the fishery exceeded $1 million in ex-vessel revenues from 2010 through 2011.\footnote{Rapid Assessment for Selected California Fisheries, 203. California Ocean Science Trust. Oakland, California, USA. August 2013 [hereinafter Rapid Assessment].} The fishery is managed by the California Fish and Game Commission (Commission) under the WSB Fishery Management Plan (WSFMP), which aims to (1) achieve optimum long-term benefits for intergenerational Californians, (2) consolidate management under one authority, and (3) create a framework responsive to environmental and socio-economic changes.\footnote{WSFMP, 1-4; 1-5.} This document provides a preliminary and foundational overview of how WSB are managed. It specifically discusses how the management of the WSB fishery reflects certain overarching goals of the Marine Life Management Act (MLMA) and identifies: (1) ways in which the WSFMP serves as a model for other fisheries (adaptive management and points of concern), and (2) opportunities ripe for improvement (data collection, data analysis, the hatchery program, and funding opportunities).

Enabling Authorities and General Regulatory Structure
The WSB fishery is managed solely by the State, where authority is divided between the Department of Fish and Wildlife (Department), and the Commission.\footnote{“The Commission’s rulemaking process is provided in §200-221 of the Fish and Game Code (FGC). Basic minimum procedural requirements for the adoption, amendment or repeal of regulations are provided in the California Government Code §11346. Emergency rulemaking considerations are provided in California Government Code §11346.1 and in FGC §240.” WSFMP, 1-10.} The MLMA granted the Commission authority to regulate the commercial WSB fishery through the adoption of a FMP in June 2002.\footnote{WSFMP, 1-9.} The Fish and Game Code (FGC) contains general provisions applying to the take and possession of fish by commercial and recreational
fishermen. The California Code of Regulations (CCR) also contains commercial and sport fishing regulations specific to the take of WSB.

The Commission conducts an annual review of the fishery and may implement any of the following measures, or combination of measures, to ensure the fishery meets the goals of the WSFMP. The available fisheries management measures include, but are not limited to: (1) harvest control rules, (2) catch quotas, (3) bycatch limits, (4) time or area closures, (5) landing limits and trip frequency limits, (6) allocation, (7) size limits, (8) mesh size, (9) bag limits, (10) effort controls, (11) fishing gear controls, (12) reporting and observer programs, (13) fees and permits, and (14) vessel identification.

**Brief Snapshot of the Fishery**

**Who is fishing?**

The use of gill nets is a limited entry and restricted access fishery in California State waters. Estimates from 2000 indicate that the commercial fishery has been composed of fishermen targeting WSB with set gill nets and hook and line gear, with an annual average of 141 vessels participating in this fishery. Notably, 20 vessels participated in the directed fishery, landing 80% of the annual catch. There is no limit to the number of recreational participants, but any person taking WSB for any reason other than profit who is over the age of 16 must hold a fishing license while fishing. Estimates from 2000 indicate that there were approximately 63,000 recreational anglers and approximately 110 scuba and skin divers targeting WSB.

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1131 Cal. Fish & Game §§ 7100-7400. All provisions relevant to the commercial and recreational take of WSB are listed in Appendix B of the WSFMP. WSFMP, 1-9.

1132 Cal. Code Regs. tit. 14 §§ 27.60, 27.65, 28.35. All regulations relevant to the commercial and recreational take of WSB are listed in Appendix B of the WSFMP. WSFMP, 1-9.

1133 WSFMP, 5-1.

1134 WSFMP, 5-1 – 5-4. In addition to the management measures listed here, there are other types of valid actions available to the Commission so long as “they are consistent with the criteria and procedures contained in this WSFMP.”


1136 WSFMP, 3-5.

1137 Cal. Fish & Game § 7145.

1138 WSFMP, 3-4.
What do they fish?
Filets taken from WSB must be at least 19 inches in length, and must bear intact a one-inch square patch of silver skin. The minimum size for both recreational and commercial WSB is 28 inches total length (TL), or 20.5 inches alternate length (AL). It is unlawful to sell, possess, or purchase any WSB smaller than 28 inches TL. In the 2011/2012 fishing season, 100% of WSB sampled from the commercial fishery complied with the 28-inch requirement, and approximately 50% of WSB sampled were greater than 46 inches (12.5 years of age).

When do they fish?
The commercial fishing season for WSB occurs from September 1 through August 31 of the following year. Commercial fishing for WSB is prohibited between Pt. Conception and the Mexican border between March 15 and June 15, inclusive, to protect WSB during spawning; however, commercial fishermen are allowed to take 1 WSB during the closure if taken incidental to gill and trammel net fishing operations. Recreational fishing occurs primarily from March through September, but is open all year for WSB 28 inches TL or longer or 20.5 inches AL. There is a maximum daily bag and possession limit of 3 WSB with only 1 fish taken south of Pt. Conception between March 15 and June 15.

Where do they fish?
Both sport and commercial harvest is permitted throughout the State’s open waters, except where prohibited or restricted including in state refuges, reserves, and national parks, and in specific regulations implementing the WSFMP. The majority of the

1141 Cal. Fish & Game § 8383.5.
1143 Cal. Code Regs. tit. 14 § 155; Cal. Fish & Game § 8383.5; WSFMP, 4-1.
1144 Personal Communication with Chuck Valle, Cal. Dep’t of Fish and Wildlife, Marine Region (July 2014).
1145 Rapid Assessments, 204.
1146 Rapid Assessments, 204.
1149 WSFMP, 1-1.
commercial catch shifted from U.S. waters in the 1930’s-50’s to Mexican waters in the 1960’s-70’s. With Mexican waters closed to U.S. commercial fishermen since 1982, the fishery now concentrates in southern California, south of Pt. Conception, increasing in the last decade north of Pt. Conception. The WSB recreational fishery occurs almost entirely (97%) south of Pt. Arguello with the majority of fishing occurring between San Pedro and San Diego. Commercial fishing occurs between Santa Barbara and San Diego. Conflicts between these two sectors of WSB fishing increased when the recreational fishery grew and expanded north to Santa Barbara and the northern Channel Islands. Moreover, gear regulations specifically restrict the use of gill nets by commercial fishermen in specified regions.

**How do they fish?**
The commercial fishery lands WSB by gill nets (set & drift), hook and line, long line, and as incidental catches to other gears; gear has remained relatively unchanged since the 1890’s. The most significant development is the mechanized net reel, which helps set and retrieve nets, allowing fishermen to set an increased number of longer nets. Gear controls that mainly target gill nets are in effect in certain areas and seasons in

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1150 Personal Communication with Chuck Valle, Cal. Dep’t of Fish and Wildlife, Marine Region (July 2014).
1153 WSFMP, 3-1.
1154 In recent years, commercial landings in Ventura, Oxnard, and Santa Barbara have surpassed those in San Pedro. Therefore it is more correct to say that commercial fishing occurs between Santa Barbara and San Diego. Personal Communication with Valerie Taylor, Cal. Dep’t of Fish and Wildlife, Marine Region (Sept.-Oct. 2013).
1155 WSFMP, 3-1.
1156 WSFMP, 3-1. See Cal. Fish & Game § 8610.2(d)(1-3); Cal. Fish & Game § 8610.3(b). These gear regulations stipulate that WSB cannot be taken by gill or trammel nets in ocean waters: 1) 0-3 miles from the mainland shore between Pt. Arguello and the US – Mexico border, 2) in waters less than 35 fathoms between Pt. Fermin and the south jetty at Newport Beach, or 3) in waters less than 70 fathoms deep or within one mile, whichever is less, of the Channel Islands.
1158 WSFMP, 3-6.
response to declining landings in the 1920-30’s. The recreational fishery primarily lands WSB using the hook and line method with live bait, from small boats. Recreational fishing methods also include spear fishing, scuba or free diving, and alternatives to live bait include the fast trolled spoon, artificial squid, and bone jig.

**How much can they fish? (e.g., what are the regulatory limits on total catch?)**

When the Commission adopted the WSFMP and its implementing regulations in 2002, the WSB optimum yield (OY) was set at 1.2 million pounds based on a target reference point of 75% of the maximum-sustainable-yield proxy. The OY has not been reached since. In general, for recreational fisheries the daily bag and possession limit is 3 fish, but the limit is 1 fish between March 15 and June 15 in waters south of Pt. Conception, Santa Barbara County. Alternatively, in Mexico, at the time the WSFMP was drafted, there was a bag limit of 10 fish, of which no more than 5 can be WSB. Additionally, for scuba the 10 fish must have weighed less than 55 lbs. Further investigation into Mexican law will be required to determine whether these specific requirements have changed in recent years.

**Meeting the Goals and Requirements of the MLMA**

The MLMA contains several goals to guide the sustainable management of fisheries. Many of the goals are broad and a great deal of overlap exists between them. The primary goals include: conserve entire ecosystems, recognize non-consumptive values, allow only those activities that are sustainable, maintain, restore, or enhance habitat, restore depressed fisheries, minimize bycatch, minimize

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1159 WSFMP, 4-2. For instance, purse seine or round haul nets are banned for vessels targeting or possessing WSB unless the vessel is fishing in Mexican waters. Cal. Fish & Game § 8623(b).

1160 WSFMP, 3-4.

1161 WSFMP, 5-15.


1164 WSFMP, 4-4.

1165 Cal. Fish & Game § 7050(b)(1).

1166 Cal. Fish & Game § 7050(b)(3).

1167 Cal. Fish & Game § 7050(b)(2).

1168 Cal. Fish & Game § 7055(b).

1169 Cal. Fish & Game § 7055(b).
adverse effects on fishing communities, establish processes for adaptive management, establish a program for external peer review, and ensure collaboration and stakeholder involvement. This review is meant to be preliminary and foundational and therefore is not a comprehensive analysis of every goal and objective found within the MLMA. We focus on the listed above goals because they encapsulate several other specific goals listed in sections 7050 and 7056 of the Act. For example, the best available science requirement is reflected in the goals of restoring depressed fisheries, ensuring adaptive management and sustainability, conserving entire ecosystems, and the goal of establishing a peer review process.

“The MLMA requires that Fishery Management Plans (FMPs) form the primary basis for managing the State’s marine fisheries. An FMP is a planning document based on the best available scientific knowledge and other relevant information, that contains a comprehensive review of the fishery along with clear objectives and measures to ensure its sustainability.” The implementation of the FMP for the WSB under the MLMA is the primary basis used to address the fishery’s sustainability, ensure that the resource will remain available for consumptive and non-consumptive uses, identify overfished or depressed conditions in a timely manner, and provide benefits of the resource to future generations. Other management measures such as gear limitations, seasonal closures, and closed areas are intended to minimize bycatch, habitat impacts, and other adverse ecosystem effects of WSB fishing activities.

The WSFMP has three primary goals based on the desire to responsively manage the fishery under one authority for the long-term benefit of Californians:

1. To manage the WSB resource for the optimum long-term benefits of present and future generations of Californians.

1170 Cal. Fish & Game § 7056(d).
1171 Cal. Fish & Game § 7056(i-j).
1172 Cal. Fish & Game § 7056(g), (l).
1173 Cal. Fish & Game § 7062.
1174 Cal. Fish & Game § 7056(h), (k).
1176 WSFMP, 1-4 – 1-5.
2. To bring management of this valuable recreational and commercial fishery under one authority.
3. To develop a framework for management that will be responsive to environmental and socio-economic changes.

The WSFMP has eight objectives:1177

1. Provide for sustainable use of WSB resource and stock growth for commercial and sport fisheries
2. Use adaptive management to provide for necessary changes and modifications of management in a timely and efficient manner
3. Minimize bycatch and waste of WSB and other species
4. Support and promote increased understanding of WSB natural history, population dynamics, and its ecosystem’s role to improve management
5. Ensure effective monitoring of the WSB population and its fisheries
6. Ensure effective enforcement of regulations and improved compliance
7. Identify, protect, and restore critical WSB habitat
8. Minimize the adverse impacts of management on small-scale fisheries coastal communities and local economies

The following discussion is organized according to some of the primary goals1178 identified in the MLMA and each of the WSFMP goals objectives are sorted and detailed under each of the applicable MLMA goals.

Conserve entire ecosystems [e.g., Fish and Game Code §7050(b)(1)]

The MLMA recognizes that the health of fish populations is closely related to the health of their ecosystem. “Maintaining the health of marine ecosystems is key to productive fisheries and non–consumptive uses of marine living resources.”1179 The MLMA broadly requires that entire ecosystems be conserved.1180 More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.”1181 Similar to requiring sustainability, conserving entire ecosystems

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1177 WSFMP, 1-5.
1178 Cal. Fish & Game § 7050(b)(9), which refers in part to coordination and collaboration with Mexico is not discussed below but is relevant given the prevalence of white seabass south of the border.
1180 Cal. Fish & Game § 7050(b)(1).
1181 Cal. Fish & Game § 7084(a).
is an overarching goal that encompasses many of the other goals and objectives of the MLMA.

Relevant to this MLMA goal is the WSFMP’s objective to support and promote increased understanding of WSB natural history, population dynamics, and its ecosystem’s role to improve management. Historical management of the WSB fishery is informed by surveys, landing receipts, logbooks, market sampling, onboard observer programs, and data from the Marine Recreational Fishery Statistical Survey (MRFSS) program. The WSFMP authorizes data reporting and collection, and each year the WSB Scientific and Constituent Advisory Panel conducts a review of current management measures to assess protection of the WSB resource, and reports its findings. To guide the Panel’s report, the Commission adopted points of concern criteria to help determine when management measures are needed to address resource issues, including a point of concern pertaining to the availability of WSB forage. While not specific reference points, these provide a step towards conserving ecosystems by ensuring that qualitative negative impacts to the food chain are identified early and further studied. The most recent report addresses the commercial catch of WSB forage species, including northern anchovy, jack mackerel, market squid, Pacific mackerel, and Pacific sardine. Knowledge of WSB relationships with other species in the ecosystem is limited, and it is unknown how increased takes of WSB would impact the food chain.

**Recognize non-consumptive values [e.g., Fish and Game Code §7050(b)(3)]**
The MLMA recognizes that marine ecosystems provide important benefits to people beyond the consumption of seafood. Important non-consumptive values include “educational, scientific, and recreational uses that do not involve the taking of California’s marine living resources.” The objectives for management set out in the MLMA encourage the protection of marine resources to ensure their continued availability for non-consumptive uses.

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1182 WSFMP, 1-5.
1183 WSFMP, 7-5.
1184 WSFMP, 5-4.
1187 WSFMP, 6-11.
1188 Cal. Fish & Game § 7050(b)(3).
1189 Cal. Fish & Game § 7050(b)(3).
Relevant to this MLMA goal is the WSFMP’s goal to manage the WSB fishery for optimum long-term benefits of Californians, which goes hand in hand with the WSFMP’s objective to minimize the adverse impacts of management on local economies.\footnote{1190} Non-consumptive uses include scuba and skin diving for the purposes of underwater photography and wildlife viewing, and are recognized by the WSFMP through incorporation of limited existing socioeconomic data.\footnote{1191} The Channel Island Marine Sanctuary and Surrounding Area is prime WSB habitat and a popular diving location\footnote{1192} and in 1997, approximately $6 million was injected into the local economy due to diving opportunities.\footnote{1193} However, beyond the Channel Islands Marine Sanctuary and Surrounding Area, little is known about socioeconomic opportunities or impacts related to the WSB industry.\footnote{1194} Recognition of non-consumptive values is also not considered a point of concern for the annual review of the WSB fishery.\footnote{1195} Therefore, enhancing the socioeconomic data related to diving or other non-consumptive activities and the WSB fishery is an opportunity ripe for exploration.

**Allow only those activities that are sustainable [e.g., Fish and Game Code §7050(b)(2)]**

Sustainability is identified as the primary goal of the MLMA.\footnote{1196} The MLMA defines sustainability as both “continuous replacement of resources, taking into account fluctuations in abundance and environmental variability,” and “securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.”\footnote{1197} The MLMA broadly requires that allowable activities and uses of marine resources must be sustainable and lists several goals and objectives to guide management of sustainable fisheries.\footnote{1198}
Relevant to this MLMA goal are the WSFMP’s objectives to (1) provide for the sustainable use of the WSB resource and stock growth for commercial and sport fisheries, and (2) ensure effective monitoring of the WSB population and its fisheries.\textsuperscript{1199} Mechanisms such as allocation and harvest control rules help promote sustainability.\textsuperscript{1200} Accordingly, the WSFMP recommends a precautionary default MSY/OY control rule to set the total allowable catch for the WSB fishery, which was set at 1.2 million pounds based on a data poor method.\textsuperscript{1201} The current MSY/OY control rule involves uncertainty and risk because it assumes that the existing biomass is near pristine levels.\textsuperscript{1202} This might lead to overfishing, which could eventually lead to a collapse.\textsuperscript{1203} With a stock assessment currently underway, the MSY/OY control rule is ripe for review based on expected data from the stock assessment.

Size limitations also promote the sustainability goal. The annual catch of undersized WSB in the fisheries is small, but the WSB fishery is still impacted by the recreational catch of younger, smaller individuals.\textsuperscript{1204} In the three seasons since the start of the 2009-2010 recreational season less than 10 percent of the measured fish were smaller than the legal size, a significant improvement in compliance from the previous three seasons, in which 17-19 percent of all fish measured were an illegal size.\textsuperscript{1205} Additionally, the catching, handling, and release of these smaller WSB incidental to other commercial fisheries such as halibut and white croaker may have adverse impacts such as injury, permanent damage, or death.\textsuperscript{1206}

Historical management of the WSB fishery was initially informed by data from the Marine Recreational Fisheries Statistics Survey (MRFSS) program.\textsuperscript{1207} Recreational data is now collected through the California Recreational Fisheries Survey (CRFS), which incorporates and updates the comprehensive sampling methodologies of the former WSFMP, 1-5.

\textsuperscript{1199} WSFMP, 1-5.
\textsuperscript{1200} WSFMP, 5-11, 5-12.
\textsuperscript{1201} WSFMP, 5-14 – 5-15.
\textsuperscript{1202} WSFMP, 6-13.
\textsuperscript{1203} WSFMP, 6-13.
\textsuperscript{1204} WSFMP 2012 Annual Review, 3.
\textsuperscript{1205} WSFMP 2012 Annual Review, 3.
\textsuperscript{1206} WSFMP, 3-28. “The percentage of undersized white seabass reported in the halibut and white croaker fisheries totaled more than 50% of the incidental white seabass catch; and nearly all were discarded dead.” WSFMP, 6-23.
\textsuperscript{1207} WSFMP, 7-5.
The goal of the CRFS is “to produce, in a timely manner, marine recreational fishery data needed for sustainable management of California’s marine resources.”

**Maintain, restore or enhance habitat [e.g., Fish and Game Code §7055(b)]**

The MLMA recognizes that the health of many fish populations is closely related to the health of their habitat. “Healthy habitats are important for maintaining the productivity and diversity of marine ecosystems and viable commercial and recreational fisheries.” The MLMA broadly requires that the habitat of marine wildlife is to be maintained, restored, or enhanced, where appropriate. More specifically, all FMPs must contain “measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.”

Relevant to this MLMA goal is the WSFMP’s objective to identify, protect, and restore critical WSB habitat. WSB inhabit different areas depending on their age, with young-of-year WSB found in shallow areas, juveniles in protected bays and eelgrass and kelp beds, and adults anywhere from large nearshore kelp beds to offshore islands. Anthropogenic habitat interactions related to fishing activities include fishing, boat traffic, and diving activities. Non-fishery related habitat impacts include sewage, wastewater and run-off discharges, dredge material disposal, coastal shipyards and industrial pollutants, and coastal development. To accomplish the WSFMP’s objective of limiting habitat impacts, management measures include limited entry permits, gear restrictions, area closures, and seasonal closures. However, it is unclear whether existing information “on habitat impacts is adequate to assess the risk

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1211 Cal. Fish & Game § 7056(b).

1212 Cal. Fish & Game § 7084(a).

1213 WSFMP, 1-5.

1214 WSFMP, 2-7.

1215 WSFMP, 6-11.

1216 WSFMP, 9-7 – 9-8.

1217 Rapid Assessments, 207.
posed.” Notably, there is an opportunity here to consider the contribution of habitats such as eelgrass and kelp to WSB.

**Restore depressed fisheries [e.g., Fish and Game Code §7055(b)]**
The MLMA classifies a fishery as depressed if “a declining population trend has occurred over a period of time appropriate to that fishery,” or if fish populations decline below abundance levels “consistent with maximum sustainable yield.” A fishery may be depressed due to human impacts such as over-fishing or as a result of natural causes such as changes in ocean conditions. Regardless of the cause, the MLMA requires that all state-managed fisheries include the objective of restoring depressed fisheries to sustainable levels. If overfishing is the cause of a depressed fishery, the MLMA further requires that a time-table and process for rebuilding the fishery be included in all FMPs. Relevant to this MLMA goal are the WSFMP’s objectives to (1) support and promote increased understanding of WSB population dynamics, (2) use adaptive management to provide for necessary changes and modifications of management in a timely and efficient manner, and (3) ensure effective monitoring of the WSB population and its fisheries.

Overfishing may lead to depressed fisheries, but there are mechanisms in place to manage the WSB fishery to reflect the “Restore Depressed Fisheries” goal including harvest controls, quotas, and monitoring. As a result, “stock biomass has increased over the last 2 decades and is considered healthy.”

Adaptive management and the hatchery program are two additional mechanisms intended to assist in the restoration of depressed fisheries. First, adaptive management of the WSB fishery occurs when the Department White Seabass Management Team (WSMT) reviews landings for which harvest controls and quotas have been set and makes projections for future landings at various times. If the rate of landings differs substantially from the projections, in-season adjustments are recommended and quickly implemented. Additionally, one of the points of concern in the annual review is designed to identify and respond to depressed or overfished conditions in the WSB

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1219 Cal. Fish & Game § 90.7.
1220 Cal. Fish & Game § 7056(c).
1221 Cal. Fish & Game § 7086.
1222 WSFMP, 1-5.
1223 Rapid Assessments, 201.
1224 WSFMP, 5-13.
fishery. The following three criteria all must be met to determine whether an overfishing condition exists or is imminent:1225 (1) “[a] 20 percent decline in the total annual commercial landings of white seabass for the past two consecutive seasons compared to the prior 5-season running average of landings, based on landing receipt data,” (2) “[a] 20 percent decline in both the number of fish and the average weight of white seabass caught in the recreational fishery for the same two consecutive seasons, as determined by the best available data,” and (3) “[a] 30 percent decline in recruitment indices for juvenile white seabass compared to prior 5-season running average of recruitment, as determined by the best available data.”1226 The WSB fishery is adaptively managed with points of concern,1227 but conditions have not occurred to trigger them yet.1228 See more on this under the “Management Should be Adaptive” section below.

Second, the Ocean Resources Enhancement and Hatchery Program (OREHP) conducts “research on propagation, rearing, stocking, and distribution” of WSB.1229 Despite program limitations including funding, water quality, and disease,1230 approximately one million WSB were successfully released as of December 2006, with the support of the sport fishing community through effective stakeholder engagement.1231 Research to determine the movement, age, size, and prevalence of hatchery fish in the wild is underway,1232 and if the program proves successful, it will serve as a blueprint hatchery program for other depressed fisheries.1233 Funding for the collection of fishery independent data was cut from 2009-2011, but partial funding was restored in 2012.1234

1227 Rapid Assessments, 207.
1228 Personal Communication with Chuck Valle, Cal. Dep’t of Fish and Wildlife, Marine Region (July 2014).
1229 WSFMP, 4-4; Cal. Fish & Game § 6592.
1230 WSFMP, 4-6 – 4-7.
1232 WSFMP, 4-7 – 4-8.
1234 Rapid Assessments, 207.
Minimize bycatch [e.g., Fish and Game Code §7056(d)]
The MLMA defines bycatch as “fish or other marine life that are taken in a fishery but which are not the target of the fishery . . . includ[ing] discards.” Bycatch is often discarded dead or kept unreported and can be a serious problem, affecting vulnerable marine species. The MLMA requires monitoring of bycatch and discards and reduction of bycatch that is deemed “unacceptable.”

Relevant to this MLMA goal is the WSFMP’s objective to “[m]inimize bycatch and waste of WSB and other species.” The commercial WSB gill net and hook and line fisheries have a high incidental catch of Pacific sardines, spiny dogfish, Pacific mackerel, and swell shark. Recreational anglers targeting WSB commonly catch undersized WSB, along with other species. Beyond fish, invertebrates, seabirds, and marine mammals have also died as a result of gear interactions.

Commission closures may keep fishing boats away from marine mammal rookeries. Mechanisms to reduce bycatch that are authorized, some of which have been developed, include (1) implementation of a more precautionary approach to setting OY, (2) measures set for incidental allowance, and (3) data reporting and onboard observer programs. While an observer program for the gill net fleet is operational, data are limited.

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1235 Cal. Fish & Game § 90.5.
1236 MLMA Guide, 32.
1237 Cal. Fish & Game Code § 7056(d).
1238 WSFMP, 1-5.
1239 WSFMP, 6-4.
1240 WSFMP, 6-3. “...barred sand bass, kelp bass, California halibut, California barracuda, bat rays, shovelnose guitarfish, Pacific mackerel, soupfin shark, and other species of sharks. In addition to these species, sargo, yellowfin croaker, and yellowtail are caught aboard CPFV’s while fishing for white seabass.”
1241 WSFMP, 6-4 – 6-10.
1242 WSFMP, 6-8.
1243 WSFMP, 6-17.
1244 WSFMP, 5-1 – 5-4.
Minimize adverse effects on fishing communities [e.g., Fish and Game Code §7056(i),(j)]

Because the MLMA is concerned with the management of fisheries, impacts on fishing communities and coastal economies are inevitable. The MLMA requires that managers consider the “long-term interests of people dependent on fishing for food, livelihood, or recreation,” and minimize adverse effects of management on local economies and communities.\textsuperscript{1245}

Relevant to this MLMA goal are the WSFMP’s objectives to (1) to develop a framework for management that will be responsive to environmental and socio-economic changes, and (2) minimize the adverse impacts of management on small-scale fisheries coastal communities and local economies.\textsuperscript{1246} Through what the WSFMP calls “the Socio-Economic Process,” the Commission or the WSMT prepares a report containing the rationale for why a management action is necessary to address a social or economic issue.\textsuperscript{1247} The report must include, but is not limited to, discussion on economic impacts, particularly the cost to the fishing industry, and how the action is expected to accomplish at least one of a number of goals including reducing gear conflicts or conflicts between user groups and increasing economic yield.\textsuperscript{1248} Following review of the report and public input, the Commission may implement management measures to address the stated socioeconomic concern.\textsuperscript{1249} Reflecting the MLMA’s objectives, the Commission takes into account numerous considerations relevant to the WSB fishery, including, but not limited to: present and historical participation in and dependence on the fisheries, economics of the fisheries, and any existing agreements or negotiated settlement between the affected participants in the fisheries.\textsuperscript{1250} While expressly outlined

\textsuperscript{1245} Cal. Fish & Game Code § 7056(i-j).

\textsuperscript{1246} WSFMP, 1-5.

\textsuperscript{1247} WSFMP, 5-10.

\textsuperscript{1248} The full list of goals are: (1) reduce gear conflicts or conflicts between competing user groups, (2) extend fishing and marketing opportunities as long as practicable during the fishing year, (3) maintain or improve product volume and flow to the consumer or user, (4) increase economic yield, (5) maintain or improve the safety of fishing operations, (6) maintain or improve product quality, (7) enable a quota, harvest control rule, or allocation to be achieved, (8) avoid exceeding a quota, harvest control rule, or allocation, (9) increase sustainable landings, (10) reduce discards, (11) increase fishing efficiency, (12) maintain or improve the recreational fishery, (13) maintain or improve data collection, including means for verification (14) maintain or improve monitoring and enforcement, or (15) any other measurable benefit to the fishery. WSFMP, 5-10.

\textsuperscript{1249} WSFMP, 5-10.

\textsuperscript{1250} WSFMP, 5-11.
in the WSFMP, the Socio-Economic Process appears underutilized in fisheries management practices.

**Management should be adaptive [e.g., Fish and Game Code §7056(g), (l)]**

The MLMA defines adaptive management as a “scientific policy that seeks to improve management of biological resources . . . by viewing program actions as tools for learning.”\(^{1251}\) Even if a chosen management measure fails, it “will provide useful information for future actions.”\(^{1252}\) Management is adaptive when fisheries managers are able to respond to changing environmental and socio-economic conditions, and update regulations accordingly.\(^{1253}\) The MLMA requires that management decisions are “adaptive and are based on the best available scientific information.”\(^{1254}\)

*a. Types of Adaptive Regulatory Changes*

Relevant to the MLMA’s adaptive management objectives is the WSFMP’s objective to use adaptive management to provide for necessary changes and modifications in a timely and efficient manner.\(^{1255}\) There are four types of adaptive management for the WSB fishery: routine management measures, in-season adjustments, annual reviews, and framework actions. First, designated as such through a rule-making process, routine management measures are those that are likely to be adjusted frequently.\(^{1256}\) They may be implemented more quickly than FMP amendments.\(^{1257}\)

The second form of adaptive management, in-season adjustments, was discussed in detail under the “restore depressed fisheries” goal. In-season adjustments allow for response to “. . . factors that cannot be precisely anticipated during a review process.”\(^{1258}\)

Third, framework actions, like routine measures, may be implemented more quickly than FMP amendments. Three different categories of framework actions exist. First, the

\(^{1251}\) Cal. Fish & Game § 90.1.

\(^{1252}\) Cal. Fish & Game § 90.1.

\(^{1253}\) Cal. Fish & Game § 7056(l).

\(^{1254}\) Cal. Fish & Game § 7056(g)

\(^{1255}\) WSFMP, 1-5.

\(^{1256}\) WSFMP, 5-7. Measures are defined as routine if they are the “type normally used to address the issue at hand and may require further adjustment to reach its purpose with accuracy.” WSFMP, 5-6 – 5-7.

\(^{1257}\) WSFMP, 5-8.

\(^{1258}\) WSFMP, 5-5 – 5-6.
Commission uses a regulatory amendment for highly controversial measures or ones that directly allocate resources. During this action, the Commission follows a 3 meeting procedure. Second, the Commission uses notice actions for non-discretionary actions or actions whose impacts have been previously analyzed. These actions require only one Commission meeting, but the Commission must provide as much advance information to the public as possible concerning the issues. Third, the Commission uses prescribed actions for ministerial actions, the impacts of which have already been taken into account. The Department or the Commission may initiate these actions without prior public notice, opportunity to comment, or a Commission meeting.

Fourth, the White Seabass Scientific and Constituent Advisory Panel (WSSCAP) together with the Department undertake annual reviews each year. The reviews consider the most current fishery data, along with any socio-economic changes that have occurred in the industries utilizing WSB in the State. The Commission and the public then consider the Department’s review based recommendations or amendments. Since 2001, reviews have been conducted annually, and the findings through the 2011-2012 season are public. The annual review process uses a set of criteria referred to as the “Points of Concern,” described in the next subsection.

b. Points of Concern

The WSFMP framework includes a “Points of Concern” process, which gives the Commission specific guidelines for making management decisions. A point of concern occurs when any of the following is found or expected: (1) catch is projected to significantly exceed the current harvest control rule or quota, (2) any adverse or significant change in the biological characteristics of the WSB (age composition, size composition, age at maturity, or recruitment) is discovered, (3) an overfished condition

1259 WSFMP, 5-7.
1260 WSFMP, 5-7.
1261 WSFMP, 5-7.
1262 WSFMP, 5-7.
1263 WSFMP, 5-20.
1264 WSFMP, 5-20.
1266 WSFMP, 5-8.
1267 WSFMP, 5-9.
exists or is imminent, (4) any adverse or significant change in the availability of WSB forage or in the status of a dependent species is discovered, or (5) an error in data or a stock assessment is detected that significantly changes estimates of impacts due to current management. When a point of concern is identified, the WSMT evaluates the issue to determine if a resource conservation issue exists. If an issue does exist, the WSMT recommends an “alternative measure or other necessary measure” from those listed in the WSFMP in a report that is presented to the Commission. The Commission analyzes how the action will address the resource conservation issue, likely impacts on other management measures and other fisheries, and economic impacts. A Points of Concern framework has been applied in every WSFMP annual review but has not yet triggered any action.

**Establish an external program for peer review [e.g., Fish and Game Code §7062]**

External peer review is identified as a tool to ensure that the best available scientific information is used in achieving the goals of the MLMA. The MLMA requires that documents such as FMPs and fishery research protocols undergo external peer review, and gives discretion to the Department to submit other management documents for peer review. Relevant to this MLMA goal is the WSFMP’s specification that the “Department is required to set up a formalized procedure for examining the science that is used as the basis for any management recommendation. The peer review panel must be given all pertinent comments received by the Department from fishery participants or other interested parties.” Any recommendations may be used in whole, part, or not; however, justification must be given for not using recommendations. The WSFMP was sent out for scientific peer review on July 5, 2001. The conclusions of the peer review panel were received in October 2001 and several of its recommendations were incorporated into the latest revision of the WSFMP. Appendix E of the WSFMP outlines the procedure for selecting a peer

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1268 WSFMP, 5-8.
1270 Cal. Fish & Game § 7062.
1271 Cal. Fish & Game § 7062(a).
1272 WSFMP, 1-4.
1273 WSFMP, 1-4.
1274 WSFMP, A-32.
It is unclear whether there is a peer review process built into the annual status report, but the WSSCAP was established to aid the Department and the Commission in reviewing the fishery assessments, management proposals, and plan amendments.1276

Collaboration & stakeholder involvement [e.g., Fish and Game Code §7056(h),(k)]
Collaboration and stakeholder involvement refers to the involvement of interested parties and members of the public throughout the management process.1277 This involvement can occur through research collaborations or at the public comment stage of regulation development.1278 The MLMA requires that the “management decision-making process is open and seeks advice and assistance of interested parties,” and strongly encourages collaboration with “fishery participants, marine scientists, and other interested parties.”1279

The MLMA requires the Department to solicit input from those who may be affected by the FMP before development of a FMP, or amendment. Additionally, the Department may engage with various advisory committees and organizations for advice. The FMP submitted to the Commission is then subject to a public comment period.1280 FMP amendments are required for major changes or controversial actions, which are outside the scope of the original FMP.1281 Amendments must undergo the same extensive development, adoption, and rulemaking process as the initial FMP including: input from advisory committees, public hearings, and an extended period for public comment and peer review and CEQA analysis of the proposed changes to the document.1282 Constituent involvement in development of an FMP includes: (1) exploring issues, concerns, and management measures from various perspectives, (2) providing increased understanding of a resource and its fishery from participants and non-participants perspectives through consensus building, and (3) sharing responsibility of

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1277 Cal. Fish & Game § 7059(a).
1278 Cal. Fish & Game § 7056(h), (k).
1279 Cal. Fish & Game § 7056(h), (k).
1280 WSFMP, 1-4.
1281 WSFMP, 5-6.
1282 WSFMP, 5-6.
sustainable fisheries management with all interested constituents. Involvement in the management process also occurs through the WSSCAP, a panel designed to work with the Department to “evaluate the fishery against criteria set forth in the WSFMP.”

**Opportunities and Challenges**

**Data gaps**

The WSB fishery is transitioning away from data poor with several research projects led by the Pfleger Institute of Environmental Research (P.I.E.R.) focused on better understanding the movements, spawning dynamics, and stock structure of WSB off the California and Mexican coastlines. Moreover, the WSB stock assessment is currently underway. Data limitations impact the MLMA’s goal to conserve entire ecosystems because knowledge of WSB relationships with other species in the ecosystem is limited. Though a point of concern does address the availability of WSB forage species there is still a gap with respect to information regarding the WSB predators. Data limitations also impact the MLMA’s goal to recognize non-consumptive values, because socioeconomic information regarding divers is sparse outside of the Channel Islands Marine Sanctuary. This gap in data is ripe for development, where overlays of WSB areas and diving areas would identify local communities that may be receiving economic injections from diving due, in part, to the WSB fishery. The MLMA’s goal to maintain, restore, or enhance habitat is also impacted by data limitations because it is unclear whether existing data on habitat impacts is sufficient to assess risk. Here there is an opportunity to consider how habitats such as eelgrass and kelp contribute to the WSB fishery. Finally, data limitations also manifest in the MLMA’s goal to minimize bycatch, in part, because the federal gillnet observer program is contracted out and data are unavailable.

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1283 WSFMP, 1-5.

1284 Rapid Assessments, 206.


1286 WSFMP, 7-11.

Funding
Resources and time are obstacles to accomplishing the short and long-term goals outlined in the WSB fishery research protocol and obtaining data necessary to fill essential fishery information gaps.\textsuperscript{1288} Criteria rely on survey efforts, and in one instance, funding reductions curtailed a survey effort, and since 2008 sampling has been inconsistent.\textsuperscript{1289} Additionally, the WSB hatchery program, which has the potential to serve as a blueprint hatchery program for other depressed fisheries, requires extensive funding. Notably, the hatchery program’s research is partly funded through recreational and commercial stamps on fishing licenses.\textsuperscript{1290}

Conclusion
The WSB fishery is managed by the State of California through harvest control rules, area closures, gear restrictions, and size limits. Detailed adaptive management is outlined in the WSFMP through “points of concern,” a socioeconomic process, framework actions, and acceptable management measures.\textsuperscript{1291} The points of concern and adaptive measures present in the WSFMP serve as a good model for other fisheries. Annual reviews of the fishery have not resulted in any management changes based on points of concern or other factors. Two opportunities ripe for action include review of the soon to be completed WSB stock assessment, and studies of the WSB hatchery program.

\textsuperscript{1288} WSFMP, 7-14.
\textsuperscript{1289} WSFMP 2012 Annual Review, 4.
\textsuperscript{1290} Cal. Fish & Game §§ 6595-6596.
\textsuperscript{1291} WSFMP, 5-1 – 5-11.
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