Rapid Assessments for Selected California Fisheries

Compiled by the
California Ocean Science Trust

on behalf of the
California Ocean Protection Council

August 2013

CALIFORNIA OST Ocean Science Trust
Connecting Science to Ocean Management

About the Rapid Assessments

This report is intended to help inform the California Ocean Protection Council's California Sustainable Seafood Initiative as well as serve the broader utility of identifying science needs in California fisheries. Rapid assessments are a synopsis of publicly available scientific information and interviews with fishery managers and scientists on a fishery. They use the Marine Stewardship Council (MSC) assessment tree as a framework to understand how a fishery might measure up against MSC international seafood certification standards. The rapid assessments also serve as a tool to provide a preliminary look at how much information is available for a fishery, and identify data gaps and research needs. These assessments were conducted at the behest of the California Ocean Protection Council (OPC), a cabinet level state body encompassing multiple state agencies that was created in 2004 to help protect, conserve, and maintain healthy coastal and ocean ecosystems and the economies they support. The OPC is responsible for implementing Assembly Bill 1217 (Monning, 2009), known as the California Sustainable Seafood Initiative (CSSI), which requires California to develop and implement a voluntary sustainable seafood program that will highlight California's fisheries. The 11 fisheries contained herein were selected by representatives from the California Department of Fish and Wildlife (CDFW), the Fish and Game Commission, and the OPC based on considerations such as management interest, seasonal landings, economic value, and likelihood of meeting Marine Stewardship Council (MSC) certification standards.

Each Rapid Assessment in this report was compiled by OST staff members and went through a rigorous scientific and technical review process (with the exception of albacore tuna). This process involved multiple rounds of review by fishery scientists from CDFW and NOAA's Southwest Fisheries Science Center, as well as other experts close to the fishery. Albacore tuna was not reviewed; this fishery has already been MSC certified and a full assessment is publicly available from 2010.

About the California Ocean Science Trust

The California Ocean Science Trust (OST) is a nonprofit 501(c)(3) public benefit corporation established pursuant to the California Ocean Resources Stewardship Act (CORSA) of 2000. OST's mission is to advance a constructive role for science in decision-making by promoting collaboration and mutual understanding among scientists, citizens, managers, and policymakers working toward sustained, healthy, and productive coastal and ocean ecosystems. OST is committed to remaining neutral and facilitating the integration of unbiased, rigorous science into decision-making.

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Guide to the Rapid Assessments

Scope and Purpose

The California Ocean Protection Council (OPC) is responsible for implementing AB 1217 by designing and implementing a California voluntary Sustainable Seafood program that will highlight the state's fisheries. This project was conducted in part to inform the Ocean Protection Council's (OPC) California Sustainable Seafood Initiative (CSSI). For more information on CSSI, visit the OPC's website. California Ocean Science Trust (OST) conducted a set of rapid assessments of 11 fisheries to begin the process of identifying which California fisheries may be eligible for possible Marine Stewardship Council (MSC) certification, as well as California's own certification standards. Rapid assessments are a preliminary look at selected fisheries[1] based on public scientific information about the fishery and interviews with fishery managers and scientists; the purpose of these assessments is to synthesize existing scientific knowledge to gain an initial understanding of how each fishery might measure up against MSC certification standards. Each rapid assessment falls somewhere in between a formal rapid assessment and MSC Pre-assessment (Figure 1). The information generated can help identify key gaps in understanding, potential fishery improvement projects, and critical research questions.

Included in each rapid assessment is a synopsis of the fishery and an evaluation against the standards of the MSC sustainable fisheries certification program. The MSC certification program is based on three core principles which include: 1) Health of the fish stock, 2) Impacts to the ecosystem, and 3) Fishery management system; within these principles, 31 performance indicators (PI) are used to evaluate how well each fishery meets the principles (Figure 2).

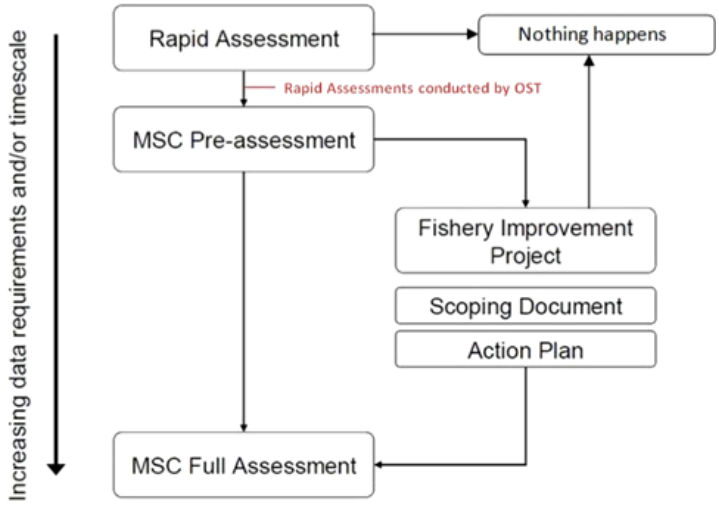


Figure 1. Framework to show types of analyses one could undertake to measure the performance of a fishery (modified from MRAG 2011). The assessments conducted by OST fall in between a rapid assessment and MSC pre-assessment.

[1]Please refer to Appendix A at the end of this document for an overview of how fisheries were selected for rapid assessments.

Figure 2. The Marine Stewardship Council (MSC) Assessment Tree. MSC certification is based on three principles which are represented through 31 performance indicators (PI). The following diagram illustrates the component groupings (orange boxes) and PIs (white boxes) that were established for rating fisheries against the MSC Principles and Criteria for Sustainable Fishing.

Rapid Assessment Framework

The guide below provides a framework for navigating the rapid assessments, including the rating system and key questions used to evaluate each MSC performance indicator (PI); information in the rapid assessments addresses these PIs when possible. We strongly recommend referring to this guide when you are reviewing the rapid assessments.

Possible unit(s) of Certification

The 'unit of certification[1]' is the unit that is assessed by certifiers against the MSC environmental standard. It is defined as the fishery or fish stock (a biologically distinct unit) combined with the fishing method/gear and practice (the vessel/s) pursuing that stock.

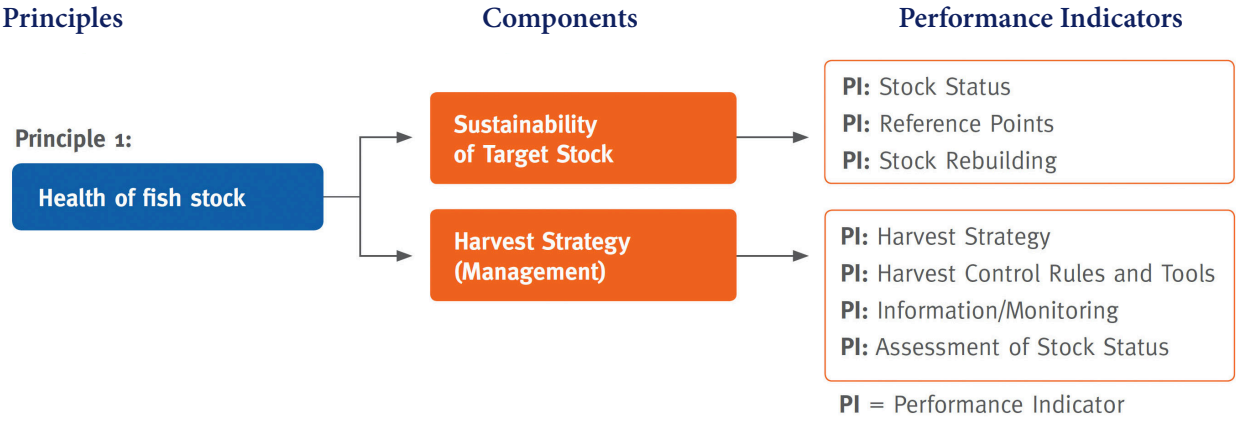
Rating System

Rapid assessments are not scored numerically and are not meant to determine the sustainability of a fishery. Instead, rapid assessments provide a preliminary look at how much information is available for each MSC performance indicator, where there are data gaps that need to be filled, and the likelihood of a PI passing an MSC assessment with the available data. These assessments are also not meant to evaluate management strategies, but rather if management strategies exist and the amount of information that is available on the strategies. A general color-coded rating of green, yellow, or gray is used to indicate the amount of information available for each PI and how the PI might measure up against MSC standards.

	Enough information is available to assess the PI; the PI would likely score high on an MSC assessment
	Some information is available, but more is needed to assess the PI; the PI would likely pass an MSC assessment
	Information is not available to assess the PI

[1]Definition of 'unit of certification' may be accessed at: http://www.msc.org/documents/schemedocuments/directives/TAB_D_003_Unit_Of_Certification.pdf/view

MSC Principle One: Resource Sustainability (Health of fish stock)



Criteria – A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted; the fishery must be conducted in a manner that demonstrably leads to their recovery.

Sustainability of Target Stock

Stock status (PI 1.1.1)[1]: Is there a high degree of certainty that the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing? Is there a high degree of certainty that the stock has been fluctuating around its target reference point, or has it been above its target reference point in recent years?

Reference points (PI 1.1.2): Are limit (LRP) and target reference points (TRP) explicit or implicit, appropriate, and justified for the stock such that the stock is maintained at a level consistent with BMSY or some proxy?

Stock rebuilding (PI 1.1.3): Where the stock is depleted, is there evidence of stock rebuilding within a specified timeframe? (Note: This PI is only triggered if PI 1.1.1 scores <80 and will not be 'scored' during the rapid assessment)

Harvest Strategy (Management)

Performance of the harvest strategy (management) (PI 1.2.1): Is there a robust and precautionary harvest strategy (monitoring, assessment, harvest control rules and management actions) in place? Is it responsive to the state of the stock, with evidence to support that it is able to maintain stocks at target levels?

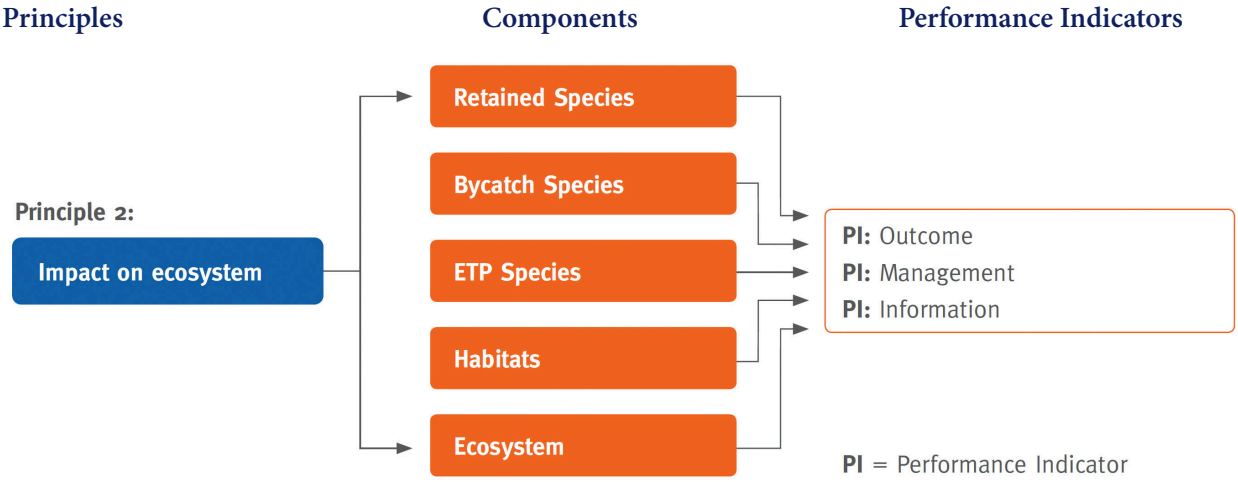
Harvest control rules and tools (PI 1.2.2): Are there well defined and effective harvest control rules in place that limit exploitation rates as the limit reference points are approached? Is there clear evidence to indicate tools in use are effective in achieving the exploitation levels required under the harvest control rules?

Information and monitoring (PI 1.2.3): Is relevant information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information) collected to support the harvest strategy?

Assessment of stock status (PI 1.2.4): Is there an adequate assessment of the stock? Are assessment methods tested and found to be reliable (internally and externally peer reviewed)?

[1]Note: For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

MSC Principle Two: Impact on Ecosystem



Criteria – Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

The focus of Principle 2 is non-target species and stocks – the target fishery's effect on the 5 specific components. This section assesses each of the defined sections below per fishing gear method for each parameter apart from the ecosystem. The assessment should be for the impact of the removal of the target species as a whole on the wider ecosystem.

Non-Target Retained Species

This section is about those species that are caught and landed along with the target species, discussed according to gear type.

Status of non-target retained species (PI 2.1.1): Does the fishery pose a risk of serious or irreversible harm to the retained species and/or hinder recovery of depleted retained species? Are target reference points defined for retained species?

Management strategy (PI 2.1.2): Is there a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species?

Information and monitoring (PI 2.1.3): Is the information on the nature and extent of retained species adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species? Is information available on the catch of all retained species?

Bycatch Species (discarded species)

This section is about those species which are caught and subsequently discarded as part of the fishery. The difference from non-target retained species is that these are always discarded. This section is discussed according to gear type.

Status of bycatch species (PI 2.2.1): Does the fishery pose a risk of serious or irreversible harm to the bycatch species or species groups and hinder the recovery of depleted bycatch species or species groups? Are bycatch species within their biological limits?

Management strategy (PI 2.2.2): Is there a strategy in place for managing bycatch species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch species?

Information and monitoring (PI 2.2.3): Is the information on the nature and extent of all bycatch adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch? Is information available on the amount of all bycatch?

Endangered, Threatened, & Protected (ETP) Species

This section includes species that are subject to international treaty and/or national and state legislation.

ETP species outcome (PI 2.3.1)[1]: Does the fishery pose a risk of serious or irreversible harm to ETP species and or hinder recovery of ETP species? Does the fishery meet national and international requirements for protection of ETP species?

ETP species management strategy (PI 2.3.2): Does the fishery have in place precautionary management strategies designed to meet national and international requirements, ensure the fishery does not pose a risk of serious or irreversible harm to ETP species, ensure the fishery does not hinder recovery of ETP species, and minimize mortality of ETP species?

ETP species information (PI 2.3.3): Is relevant information (i.e. magnitude of all impacts, mortalities and injuries) collected to support the management of fishery impacts on ETP species, including information for the development of the management strategy, information to assess the effectiveness of the management strategy, and information to determine the outcome status of ETP species?

Habitat

Habitats outcome (PI 2.4.1): Does the fishery cause serious or irreversible harm (i.e. changes are expected to take much longer to recover than in an un-fished situation) to habitat structure, considered on a regional or bio regional basis and function?

Habitat management strategy (PI 2.4.2): Is there a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types?

Information and monitoring (PI 2.4.3): Is information (distribution of habitat types across the species range) adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types?

Ecosystem

Ecosystem encompasses trophic structure, communities, and biodiversity to name a few, and is discussed according to entire species.

Ecosystem outcome (PI 2.5.1): Does the fishery cause serious or irreversible harm (indirectly) to the key elements of ecosystem structure and function (trophic relationships, biodiversity, etc.)?

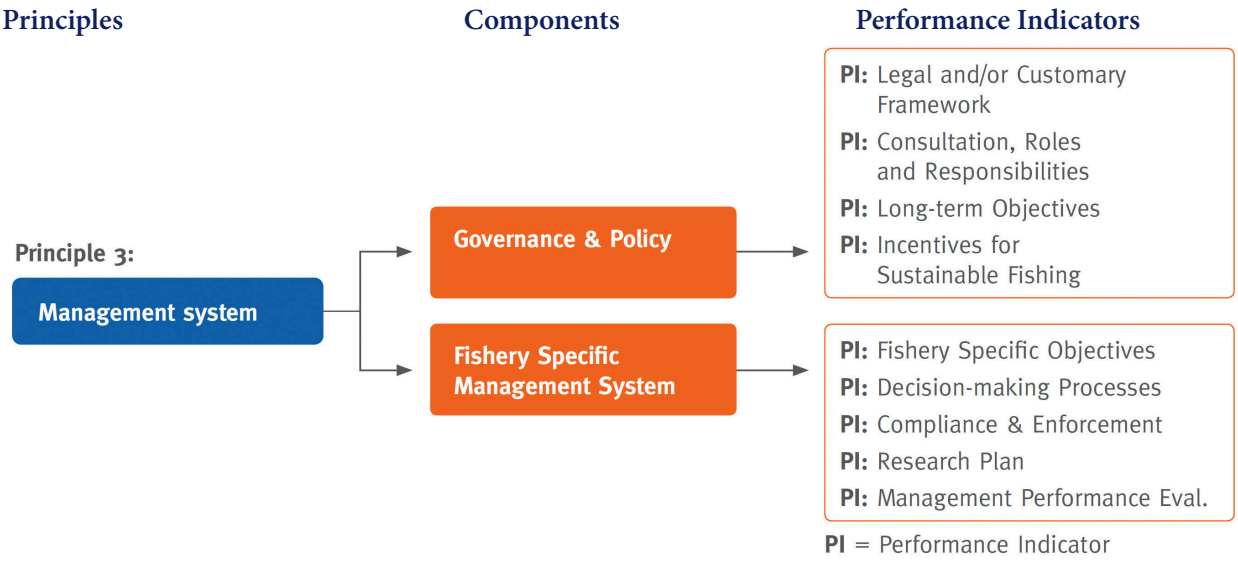
Ecosystem management strategy (PI 2.5.2): Are there measures in place, based on well understood functional relationships between the fishery and elements of the ecosystem, to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure

[1]Note: This includes one of the two performance indicators that the California certification will require a higher score (80) than MSC (60 on any PI, and an average of 80 at the Principle level).

and function?

Ecosystem information and monitoring (PI 2.5.3): Is there adequate knowledge and understanding of the impacts on target, bycatch, retained and ETP species and habitats?

MSC Principle Three: Management System



Criteria - The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

Governance and Policy

This section describes the overarching management system. The goal is to put this fishery in the broader management context.

Legal and/or customary framework (PI 3.1.1): Does the management system exist within an appropriate and effective legal and/or customary framework which ensure that it is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2?

Consultation, roles and responsibilities (PI 3.1.2): Does the management system have effective consultation processes that are open to interested and affected parties? Are the roles and responsibilities of organizations and individuals who are involved in the management process clear and understood by all relevant parties?

Long term objectives (PI 3.1.3): Does the management policy have clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria and incorporate the precautionary approach?

Incentives for sustainable fishing (PI 3.1.4): Does the management system provide economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing?

Fishery Specific Management System

This section discusses the governance structure of the fishery itself.

Fishery specific objectives (PI 3.2.1): Does the fishery have clear, specific short- and long-term objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2?

Decision-making processes (PI 3.2.2): Does the fishery-specific management system include effective decision-making processes that result in measures and strategies to achieve the objectives and have an appropriate approach to actual disputes in the fishery under assessment?

Compliance and enforcement (PI 3.2.3): Do monitoring, control and surveillance mechanisms ensure the fishery management measures are enforced and complied with?

Research plan (PI 3.2.4): Does the fishery have a comprehensive research plan that addresses the information needs of management?

Monitoring and management performance evaluation (PI 3.2.5): Is there a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives? Is there effective and timely review of the fishery-specific management system?

Rapid Assessments

Albacore Tuna (*Thunnus alalunga*)

Certification Units Covered Under this Species:

- Pole and Line
- Troll and Jig

Summary

Albacore tuna is a highly migratory species (HMS) distributed throughout the world's oceans. In the North Pacific, the stock is jointly managed by two international organizations: the Inter-American Tropical Tuna Commission (IATTC) for waters east of 150˚ W longitude, and the Western and Central Pacific Fisheries Commission (WCPFC) for waters west of 150˚ W longitude. Along the U.S. West Coast, albacore tuna are managed under the Pacific Fishery Management Council's Highly Migratory Species Fishery Management Plan. In the U.S., albacore are fished commercially primarily using pole and line and troll and jig. The north Pacific albacore stock is considered to be healthy at current levels of recruitment and fishing mortality.

NOTE:

This fishery has already been certified by the Marine Stewardship Council. This assessment is a summary of the existing full MSC assessment by Global Trust Certification, Ltd (GTCL).

Unless otherwise noted, all text, figures and tables in this Rapid Assessment are from GTCL 2010:

Global Trust Certification Ltd. (GTCL) 2010. MSC Fishery Assessment Report: Public Certification Report. The Canadian Highly Migratory Species Foundation (CHMSF) British Columbia North Pacific Albacore (*Thunnus alalunga*) Tuna Fishery and the American Western Fishboat Owners Association (WFOA) North Pacific Albacore (Thunnus alalunga) Tuna Fisheries. Global Trust Certification Ltd., Riverlane, Dundalk Ireland.

Strengths:

- Stock is considered healthy
- Harvest strategy is responsive to the state of the stock and regular stock assessments are conducted
- Bycatch is low

Weaknesses:

- No biomass-based reference points
- No ongoing observer coverage of commercial fishing vessels

History of the Fishery in California

Biology of the Species

[From GTCL 2010]: Albacore tuna (*Thunnus alalunga*) is a highly migratory tuna found in all of the global oceans and Mediterranean Sea. In the Pacific Ocean there are two separate and distinct stocks of albacore, one in the North Pacific and the other in the South Pacific. Albacore tuna mature at approximately 5 years or at about 85 cm and has a lifespan of about 10 to 12 years. Growth rates are moderate, with fork lengths at 1 year of age of nearly 40 cm. Fecundity is estimated to be 0.8 to 2.6 million eggs per spawning. North Pacific albacore spawn from March through July on grounds located in the Western and Central Pacific Ocean in subtropical waters between about 10˚ to 25˚ N latitudes (Figure 1).

In general, the bulk of the juvenile albacore recruiting into the North Pacific fisheries first enter the Japanese western Pacific fisheries off Japan and then move eastward. Recovery of tagged juveniles (ages 1 to 5) indicates that fish tagged off Japan appear in the North American fishery; movement is along the North Pacific Transition Zone. Albacore tagged off North America seem to move across the Pacific during the fall and appear in Japan in the late-winter/spring fisheries. These fish then appear to migrate back to North America. There are few tag returns of mature fish. Based on catch patterns it would seem that adults move to lower latitudes. In addition to this general pattern of movement there may be variations associated with recruitment. It appears that a small portion of the population may spawn further east than the bulk of the population and first enter the fishery off North America.

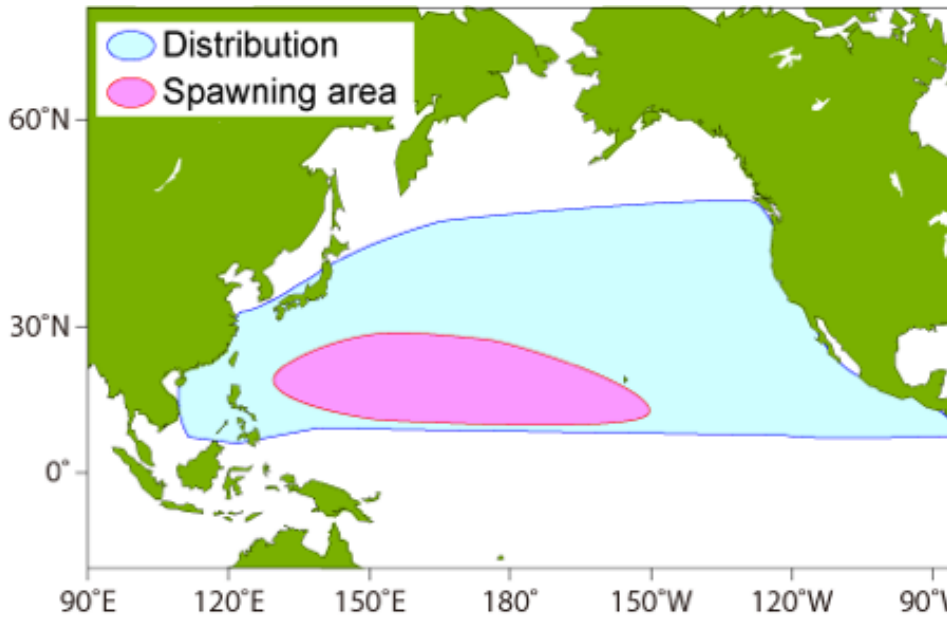


Figure 1. Distribution and spawning area of albacore tuna in the North Pacific Ocean (from ISC 2013).

Albacore, like other tunas, have a number of physiological and morphological specializations that adapt them to a fast, continuous swimming lifestyle in the pelagic open ocean environment. The most notable of this is a “counter current multiplier system” (heat exchanger) which allows them to regulate their body temperatures. The albacore tuna body temperature may be as

much as 15˚ above ambient temperature. Their metabolic rates are 2 to 10 times higher than most other bony fishes, and they have very large eyes for detecting prey and specialized fins and body form to reduce drag. Albacore are opportunistic carnivores and as adults have few predators, although they may be preyed on by large marine mammals, sharks, and billfish.

Commercial Fishery

[From GTCL 2010]: The U.S. surface troll fishery for albacore has been operating since the early 1900's in the North Pacific. Fishermen commenced targeting seasonally migrating albacore in nearshore ocean waters off southern California to meet the needs of a tuna cannery established there. The troll fishery gradually spread northwards, but was restricted to waters off California until the late 1930's, when it extended to waters off the states of Oregon and Washington, and eventually to waters off British Columbia, Canada. Until the late 1970's, the troll fishery began operations in early July, when migrating albacore approach the west coast of North America, and was primarily conducted in near shore oceanic waters. From 1961 through 1979, approximately 99% of the reported U.S. catches of North Pacific albacore were made within 200 miles of the North American coast, with 84% off the U.S. coast and 9% and 7% in the jurisdictional waters of Mexico and Canada, respectively. Since the late 1970's, U.S. albacore fishers with larger vessels begin troll fishing in the early spring months on the high seas. Some of these vessels operate as far west as the International Dateline and beyond, to extend the fishing season by intercepting albacore migrating towards the coast of North America and locating high catch rate areas. The extent of the albacore migration is variable and a significant characteristic of the U.S. surface fishery is the wide north-south variation in the geographical locations of the most productive fishing grounds. Uniquely, a large proportion of this variability is at the multi-decade rather than the inter-year time scale.

The estimated number of vessels landing albacore peaked at more than 2,000 in the mid-1970's. However, fewer vessels have been active in recent years. During the past five years the number of U.S. troll vessels that landed albacore ranged from 652 to 870, with vessels smaller than about 17 m outnumbering larger vessels by approximately two to one.

The history of the U.S. pole-and-line fishery for albacore differs somewhat from that of the troll fishery, and is linked to the U.S. tropical tuna fishery for yellowfin, bigeye, and skipjack tunas. The pole-and-line method of catching albacore also began in the early 1900's with vessels operating within a one-day run from port to provide product for a tuna cannery located in southern California. A poor catch of albacore in 1918 forced pole-and-line boats to shift to fishing for tropical yellowfin and skipjack to fill the cannery's demand for tuna. In subsequent years even though the availability of albacore may have been high, the amount of pole-and-line effort expended for albacore was thereafter greatly influenced by events in the tropical tuna fishery. Today there are, fewer than about 200 U.S. vessels using this fishing method for catching North Pacific albacore.

Recreational Fishery

North Pacific albacore are a popular recreational species. Recreational charter vessels are required to maintain logbooks to document their catch. From Point Conception to the Mexican border, there is a limit of 10 fish per day, and from Point Conception north to the Oregon border there is a limit of 25 fish per day (CDFG 2012). In 2010, the estimated number of albacore retained by recreational fishermen was 15,301 and in 2011 it was 4,416 (PFMC 2012).

MSC Principle 1: Resource Sustainability

*Sustainability of Target Stock

[From ISC 2011]: The most recent stock assessment was completed in June 2011. The north Pacific albacore stock is considered to be healthy at current levels of recruitment and fishing mortality. Current estimated mortality, F2006-2008, is well below the fishing mortality that would lead the spawning stock biomass (SSB) to fall below a threshold established of the average of the ten historically lowest estimated SSBs (SSB-ATHL) in at least one year of a 25-yr (2010-2035) projection period. The stock is expected to fluctuate around the long-term median SSB (~405,000 t; Figure 1) in the foreseeable future given average historical recruitment levels and constant fishing mortality at F2006-2008 (Figure 2). Based on these findings, the Working Group concludes that overfishing is not occurring and that the stock likely is not in an overfished condition, although biomass-based reference points have not been established for this stock. However, recruitment is a key driver of the dynamics in this stock and a more pessimistic recruitment scenario increases the probability that the stock will not achieve the management objective of remaining above the SSB-ATHL threshold with a probability of 50%. Thus, if future recruitment declines about 25% below average historical recruitment levels (Figure 3) due either to environmental changes or other reasons, then the impact of F2006-2008 on the stock is unlikely to be sustainable. Therefore, the working group recommends maintaining present management measures.

[From GTCD 2010][1]: It is highly likely that the stock is above the point where recruitment would be impaired. Evidence of this can be summarized as follows:

- Current level of Spawning Stock Biomass (SSB) and information on temporal trends in spawning biomass levels and subsequent recruitment
- Temporal trends in recruitment over the last two decades
- Recent F (F2002-2004= 0.75) correspond to a level at which good recruitment has been observed (ISC, 2007)

Implicitly, reference points are appropriately defined. Reference points were scored based on the following issues:

- The appropriateness of the reference points is unknown
- The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity
- The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.
[1]The MSC Full assessment by GTCL 2010 was conducted before the latest June 2011 stock assessment was completed, thus justifications for scoring use old data.

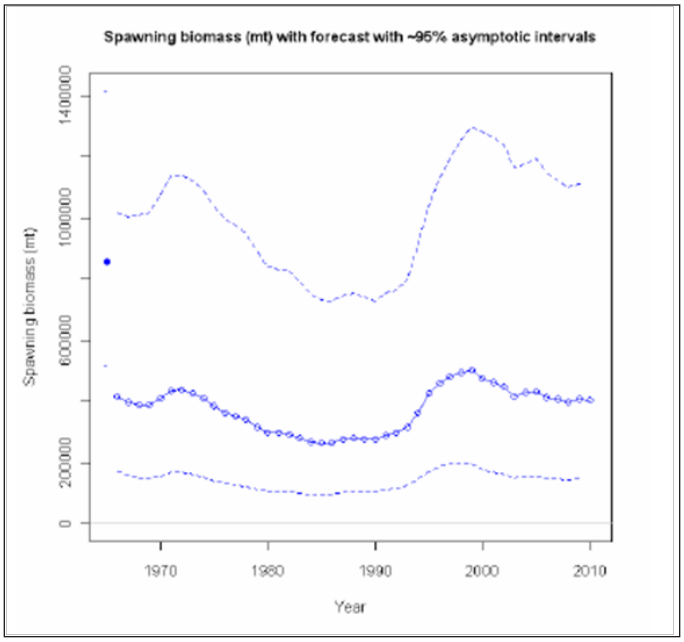


Figure 2. Estimated spawning biomass of albacore tuna in the North Pacific Ocean. The open circles represent the maximum likelihood estimates of each quantity and the dashed lines are the 95% asymptotic intervals of the estimates (± 2 standard deviations) in lognormal space (from ISC 2011).

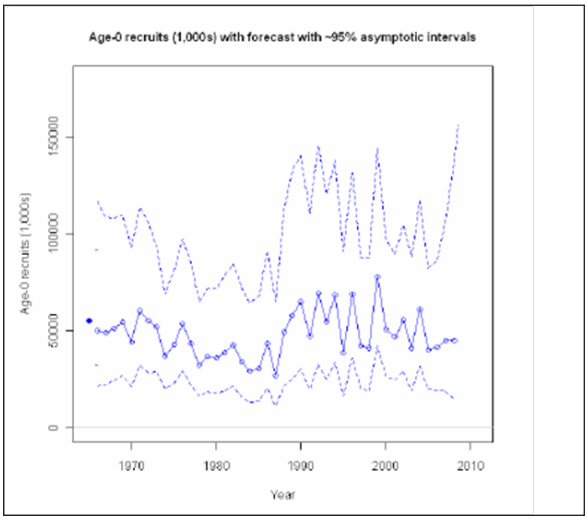


Figure 3. Estimated age-0 recruitment of albacore tuna in the North Pacific Ocean. The open circles represent the maximum likelihood estimates of each quantity and the dashed lines are the 95% asymptotic intervals of the estimates (± 2 standard deviations) (from ISC 2011).

Scores for MSC Component 1.1: Sustainability of Target Stock (from GTCL 2010)

Performance Indicator	Rating	Justification
1.1.1 Stock Status		80; It is highly likely that the stock is above the point where recruitment would be impaired
1.1.2 Reference Points		75; Reference points are implicit
1.1.3 Stock rebuilding		Not triggered; stock is considered healthy

Harvest Strategy (Management)

[From GTCL 2010]: The international management of the North Pacific albacore stock is shared by two international organizations: the Inter-American Tropical Tuna Commission (IATTC) for waters east of 150˚ W longitude, and the Western and Central Pacific Fisheries Commission (WCPFC) for waters west of 150˚ W longitude. The IATTC and WCPFC have legal authority within their administrative boundaries. Domestically, for the US troll & jig and pole & line albacore fisheries management is through the Highly Migratory Species Fishery Management Plan (HMS FMP) of the Pacific Fishery Management Council (PFMC). The ISC for Tuna and Tuna-like Species in the North Pacific Ocean conduct stock assessments as well as enhance scientific research and cooperation for the conservation and rational utilization of tuna and tuna-like species of the North Pacific Ocean. North Pacific management measures adopted by the IATTC and the WCPFC are passed to the respective member countries that conduct fishing operations on Pacific albacore for implementation.

Internationally, the harvest strategy has been defined by the Antigua Convention of the IATTC, and the Convention on the Conservation and Management of Highly Migratory Fish Stocks of the Western and Central Pacific (WCPFC). The objective of these conventions is to ensure the long-term conservation and sustainable use of the fish stocks covered by these conventions, in accordance with the relevant rules of international law. In order to achieve the overall objective the convention texts define the harvest strategy framework, which must be implemented through the Pacific Region Integrated Tuna Fisheries Management Plan (IFMP) and the Fisheries Management Plan for U.S West Coast Fisheries for Highly Migratory Species (HMS FMP) in Canada and the United States, respectively.

The Harvest Strategy Framework is based on the precautionary approach. The legal framework for the precautionary approach is embodied in a number of international agreements of which the USA is a signatory:

- UN Convention of the Law of the Sea (1982)
- Rio Declaration on Environment and Development (1992)
- FAO Code of Conduct for Responsible Fisheries (1995)
- UN Fish Stocks Agreement UNFA (1995)
- US and Canada Albacore treaty

Evidence given by stock effort monitoring programs, and stock assessment outputs, indicates that tools in use to limit fishing effort are effective in achieving exploitation levels required (F =

0.75) by management.

Scores for MSC Component 1.2: Harvest Strategy (from GTCL 2010)

Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		95; Harvest strategy is responsive to the state of the stock and is working in achieving its objectives
1.2.2 Harvest Control Rules and Tools		80; Well defined harvest control rules that take into account uncertainties, tools used are effective
1.2.3 Information/Monitoring		100; All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information and the robustness of assessment and management to this uncertainty
1.2.4 Assessment of Stock Status		100; The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery

MSC Principle 2: Environment

Retained Species

Troll and Jig

[From GTCL 2010]: The US FMP requires all commercial vessels to maintain and submit logbooks to NMFS (US HMS FMP). Albacore troll vessels catch minor amounts of other non targeted pelagic fish species that are usually caught during transit to or from the fishing grounds and may be retained. The most common species that are incidentally caught include skipjack tuna (*Katsuwonus pelamis*), mahi mahi (*Coryphaena hippurus*), yellowtail (*Seriola lalandi*), Eastern Pacific bonito (*Sarda chiliensis*), bigeye tuna (*Thunnus obesus*), and bluefin tuna (*Thunnus thynnus*) (Childers and Betcher, 2008 – NOAA Southwest Fisheries Science Center) and incidental catches of these species are typically very low (ISC 2009/Annex 6). No 'main' retained species which are caught during fishing operations are known to occur in the fishery. Trolling vessels are known to use frozen anchovies on occasion to attract albacore to the artificial jigs/fishing lures. No quantitative data are available on the amount of anchovies used in this manner but the quantities are considered to be small and insignificant in terms of impact on the anchovy stock. No 'main' retained species therefore occur and the fishery scores 100 for component Retained species (Point 7.2.3 in the MSC guidance document).

Scores for MSC Component 2.1: Retained Catch, troll and jig (from GTCL 2010)

Performance Indicators	Rating	Justification
2.1.1 Outcome		100; No 'main' retained species
2.1.2 Management		100; No 'main' retained species, thus this category is not applicable.
2.1.3 Information		100; No 'main' retained species occur, thus this category is not applicable

Pole and Line

[From GTCL 2010]: Albacore pole & line fisheries are acknowledged to have very low levels of bycatch species with a documented average discard rate of 0.1% in global pole & line fisheries for tuna and other highly migratory species (FAO 2005). Data on retained species caught during fishing operations are collected by US mandatory logbook, and onboard observers collected bycatch data from US pole & line vessels between 2004 – 2006 which verified the occurrence of insignificant levels (less than 1%) of overall bycatch (retained and/or discarded non target species) in the Pacific albacore fishery (NMFS 2007). The quantities of non target species which are retained onboard can be considered as minor given the low overall observed bycatch rate (retained and/or discarded non target species) and no main retained species, caught during fishing operations, occur in the fishery.

Live anchovies are, however, retained onboard as bait in the pole and line fishery and can be considered as a 'main' retained species. Northern anchovy is a monitored species under the US Coastal Pelagic Species (CPS) Fisheries Management Plan (FMP). Most of the US landings come from California (PFMC 2008). The recommended default Maximum Sustainable Yield (MSY) control rule gives an Allowable Biological Catch (ABC) for the entire Northern Anchovy - northern sub population of 25% of the MSY catch but MSY has not been estimated in recent years as a stock assessment has not been deemed required under the monitoring program (PFMC 2009). The stock is considered to be sustainable with minimal impact from harvest for the live bait fishery (pers. Comm. Mike Burner, Staff Officer Pacific Fisheries Management Council (PFMC)). Quantitative evidence is not available which demonstrate that the stock is within biological limits. Strong justification exists, however, in terms of extensive monitoring of landings, larval abundance, environmental variables (pers. Comm. Mike Burner, PFMC) and the existence of an extensive framework on 'Point of Concern' which triggers full stock assessment if required (PFMC 2009), of very low risk of serious or irreversible harm to the stock.

There is a strategy in place for managing Northern anchovy under the Coastal Pelagic Species Fishery Management Plan; the annual SAFE report includes all available information that may be used to determine if a point- of-concern exists e.g. overfishing or if a stock should be considered for Active management. Active management is not currently required for the Northern Anchovy stock. The

California Department of Fish and Wildlife (CDFW) operates a Live Bait Log for live bait fishers and an extensive time series extending back over 40 years on anchovy landings is used in monitoring the fishery (PFMC 2008). Therefore the strategy is based on information directly

about the fishery and 'testing' under evaluation by the Pacific Fishery Management Council supports 'high confidence' that the strategy will work. Monitored fisheries data provide 'clear evidence' that the strategy is being 'implemented successfully' and there is some evidence from historical fisheries data that the strategy is 'achieving its overall objective' which is sustainability of the stock.

Scores for MSC Component 2.1: Retained Catch, pole and line (from GTCL 2010)

Performance Indicators	Rating	Justification
2.1.1 Outcome		90; Low levels of retained species
2.1.2 Management		100; Main retained species is managed under the CPS FMP
2.1.3 Information		100; Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.

Bycatch Species

Troll and Jig

[From GTCL 2010]: The US FMP requires all commercial vessels to maintain and submit logbooks to NMFS. Albacore troll vessels catch minor amounts of other pelagic fish species that are usually caught during transit to or from the fishing grounds. The most common species that are incidentally caught include skipjack tuna (*Katsuwonus pelamis*), mahi mahi (*Coryphaena hippurus*), yellowtail (*Seriola lalandi*), Eastern Pacific bonito (*Sarda chiliensis*), bigeye tuna (*Thunnus obesus*), and bluefin tuna (*Thunnus thynnus*) (Childers and Betcher 2010) and incidental catches of these species are typically very low (ISC, 2009/Annex 6). Fishermen generally use barbless hooks as this method speeds up fishing operations and fish are landed individually so bycatch fish may be returned alive. NMFS contracted observers collected bycatch data from US troll vessels between 2004 – 2006 which verified the occurrence of insignificant levels of bycatch in the Pacific albacore fishery (NMFS 2007). No 'main' bycatch species are known to occur, bycatch is exceptionally rare and negligible in its impact and the fishery, therefore, meets SG 100.

Scores for MSC Component 2.2: Bycatch, troll and jig (from GTCL 2010)

Performance Indicators	Rating	Justification
2.2.1 Outcome		100; No 'main' bycatch species
2.2.2 Management		100; No 'main' bycatch species, thus this category is not applicable.
2.2.3 Information		90; There is no ongoing observer coverage

Pole and Line

[From GTCL 2010]: Albacore pole & line fisheries are acknowledged to have very low levels of bycatch species with a documented average discard rate of 0.1% in global pole & line fisheries for tuna and other highly migratory species (FAO 2005). Data on bycatch are collected by US mandatory logbook and onboard observers collected bycatch data from US pole and line vessels between 2004 – 2006 which verified the occurrence of insignificant levels of bycatch in the Pacific albacore fishery (NMFS 2007). No 'main' bycatch species are known to occur, bycatch is exceptionally rare and negligible in its impact and the fishery, therefore, meets SG 100.

Scores for MSC Component 2.2: Bycatch, pole and line (from GTCL 2010)

Performance Indicators	Rating	Justification
2.2.1 Outcome		100; No 'main' bycatch species
2.2.2 Management		100; No 'main' bycatch species, thus this category is not applicable.
2.2.3 Information		90; There is no ongoing observer coverage

Endangered, Threatened, & Protected Species

Troll and Jig

[From GTCL 2010]: The US is subject to international requirements on the protection of ETP species under the CITES/Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora and national legislation such as the Endangered Species Act, the Marine Mammal Protection Act, and the Migratory Bird Treaty Act (NMFS 2009). Mandatory logbook data provided by US fishermen includes provision of data on any ETP species and none were reported in 2007 (Childers and Betcher 2010). US independent observer data from the same fishery do not show catch of any ETP species (NMFS 2007). All fish are landed individually on barbless hooks (http://wfoa-tuna.org/boats/) so if an incidental catch event of an ETP species occurs the animal may be returned alive. No catch of ETPs was reported in independent observer reports. This suggests there is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species. There is a high degree of confidence that there are no significant detrimental effects (direct and indirect) of the fishery on ETP species. The fishery meets all issues of SG100 and scores 100 (PI 2.3.1).

The HMS FMP final rule adopts measures to minimize interactions of HMS gears with protected species and to ensure that the fisheries are operating consistent with federal law. These measures include time and area closures, gear requirements, and safe handling and release techniques for protected seabirds and sea turtles. Protected species interactions for gears other than drift gillnet and longline fisheries are not major issues (PFMC 2007) US fishermen are obliged to complete mandatory logbooks (PFMC 2007) and provision of data on ETP species is included. These data are used to address International and National requirements. Neither US logbook data (Childers and Betcher 2010) nor independent observer data (NMFS 2007) show catch of any ETP species. All fish are landed individually and barbless hooks are used so if an

incidental catch event of an ETP species occurs the animal may be returned alive. Logbook data verified by observer data, combined with the practice of using barbless hooks permitting release of non target species alive, represents a strategy in place for managing the fisher's impact on ETP species. Independent observer data provides an objective basis that the strategy will work. This is based on some information about the fishery. There is evidence from logbook data that the strategy is being implemented successfully. Therefore all issues in SG80 are met.

In the context of exceptionally rare incidences of ETP species being caught in this fishery, a comprehensive strategy can be considered to be in place in terms of monitoring through provision of mandatory log book data, and the use of barbless hooks as a measure to improve the mortality of returned species. US fishermen also have detailed guidelines on safe handing and release methods to minimize mortality of ETP species (PFMC 2007) so the strategy achieves 'above' national and international requirements for the protection of ETP species so the first issue of SG is met. Comprehensive independent monitoring data are not available however so a quantitative analysis that supports high confidence that the strategy will work is not possible. The lack of ongoing independent monitoring means that clear evidence that the strategy is being successfully implemented is not available. On this basis troll & jig and pole & line score 85 for this PI (2.3.2).

Scores for MSC Component 2.3: Endangered, Threatened, & Protected Species, troll and jig (from GTCL 2010)

Performance Indicators	Rating	Justification
2.3.1 Outcome		100; No ETP bycatch
2.3.2 Management		85; No ongoing independent monitoring
2.3.3 Information		80; No ongoing independent monitoring

Pole and Line

See section above for troll and jig.

Scores for MSC Component 2.3: Endangered, Threatened, & Protected Species, pole and line (from GTCL 2010)

Performance Indicators	Rating	Justification
2.3.1 Outcome		100; No ETP bycatch
2.3.2 Management		85; No ongoing independent monitoring
2.3.3 Information		80; No ongoing independent monitoring

Habitat

Troll and Jig

[From GTCL 2010]: Trolling for albacore tuna is carried out by towing up to 14 artificial jigs on individual lines of monofilament in the epipelagic zone of the open ocean (Dotson 1980). No

contact is made with the seabed and contact with the epipelagic zone is negligible because of the minimal dimensions of the fishing gear. Oceanic pelagic species such as albacore tuna are migratory and spend the majority of their lives in deep waters offshore, typically beyond the continental shelf in waters deeper than 100m. Based on limited data available for oceanic pelagic species, benthic-pelagic linkages are predictably weak (Grober-Dunsmore et al. 2008). Evidence exists therefore that the fishery is highly unlikely to reduce habitat structure and function to the point where there would be serious or irreversible harm.

Evidence exists that the fishery is highly unlikely to reduce habitat structure and function to the point where there would be serious or irreversible harm. Therefore a management strategy is not required and the fishery scores 100 under this PI.

Scores for MSC Component 2.4: Habitat, troll and jig (from GTCL 2010)

Performance Indicators	Rating	Justification
2.4.1 Outcome		100; Unlikely to cause irreversible harm
2.4.2 Management		100; Management strategy not required
2.4.3 Information		100; Geographic range of fishery is well documented

Pole and Line

[From GTCL 2010]: Pole & line fishing for albacore tuna is carried out by deploying a single baited hook at the end of a leader of heavy monofilament at the end of a fishing pole in the epipelagic zone of the open ocean. No contact is made with the seabed and contact with the epipelagic zone is negligible because of the minimal dimensions of the fishing gear. Oceanic pelagic species such as albacore tuna are migratory and spend the majority of their lives in deep waters offshore, typically beyond the continental shelf in waters deeper than 100m. Based on limited data available for oceanic pelagic species, benthic-pelagic linkages are predictably weak (Grober-Dunsmore et al 2008). Evidence exists therefore that the fishery is highly unlikely to reduce habitat structure and function to the point where there would be serious or irreversible harm.

Evidence exists that the fishery is highly unlikely to reduce habitat structure and function to the point where there would be serious or irreversible harm. Therefore a management strategy is not required and the fishery scores 100 under this PI.

Scores for MSC Component 2.4: Habitat, pole and line (from GTCL 2010)

Performance Indicators	Rating	Justification
2.4.1 Outcome		100; Unlikely to cause irreversible harm
2.4.2 Management		100; Management strategy not required
2.4.3 Information		100; Geographic range of fishery is well documented

Ecosystem

[From GTCL 2010]: No major impacts have been identified in relation to retained species, bycatch, ETP species and habitat. Key ecosystem elements relative to the scale and intensity of the trolling fishery are, therefore, restricted to the target species, albacore tuna. Key elements which therefore need to be considered are: depletion of top predators and tropic cascade caused by depletion of albacore as a prey/forage species, trophic cascade effects caused by depletion of albacore as a predator, and changes in genetic diversity of albacore caused by selective fishing. Information on the effects on size composition and species biodiversity of the ecological community relates specifically in this case to the effects of fishing on albacore tuna and trophic cascade analyses for this species.

Extensive research has been carried out on albacore tuna as a top predator in Pacific tuna ecosystem and trophic status studies which primarily use the Ecopath with Ecosim model (Cox et al. 2002a, Cox et al. 2002b, Hinke et al. 2004, Sibert et al. 2006). Albacore tuna is not considered to be a common forage species and the body of research which considers albacore tuna as a top predator, infers that the fishery for albacore tuna and therefore removal of a portion of the stock as a potential forage species, is highly unlikely to adversely affect the diet of other species.

A number of studies have occurred on albacore diet since 1949, and diet has remained stable over this period. Despite a recent resurgence of Pacific sardine, only Northern anchovy and Pacific saury consistently have been important prey. The results support theoretical predictions of optimal foraging models that albacore prefer cold, near –shore waters containing anchovy and saury while minimizing time in warmer, offshore habitat of sardine. An estimated 0.1% to 5% of anchovy recruitment biomass was removed annually by albacore tuna from 2005 to 2006 and research has shown that top-down impacts of predation potentially occur, that albacore and anchovy interact strongly and populations may be sensitive to changes in the other (Glaser 2009). Extensive monitoring of the anchovy stock has shown the stock to be in good condition and recruitment/abundance is heavily influenced by oceanic climatic changes (PFMC 2008, pers. Comm. Mike Burner, PFMC). Saury abundance is also heavily influenced by oceanic climatic changes (Tian et al. 2002). Although top-down impacts of predation potentially occurs on Northern anchovy and Pacific saury, it is highly likely that these impacts are significantly outweighed by the effects of oceanic climatic conditions. This infers that the albacore fishery and therefore removal of a portion of the stock, is highly unlikely to significantly alter abundance of the main prey species.

Most stock assessments include the implicit assumption that an overfished resource will revert to its original status, the “virgin stock”, if fishing is discontinued. It now appears, however, that ‘severe overfishing’ can produce irreversible consequences (in terms of genetic diversity), which may be due to the elimination of one or more sub-populations (FAO 2001). Analysis of stock status in P1 of this report has shown that the Pacific albacore tuna stock is not considered to be overfished and therefore genetic diversity of the overall population is unlikely to change due to current levels of fishing effort. In addition, the highly migratory behaviour of albacore tuna (Kohin et al. 2005), which results in wide spread dispersion throughout the Pacific should prevent sub populations from being overfished. This infers that fishing effort is highly unlikely to disrupt the genetic diversity of albacore tuna. The low impact of albacore tuna on other species in terms of trophic cascade as previously described in Principle 2 of this assessment, infers that the genetic diversity of tropic related species is also highly unlikely to be disrupted.

Based on the information provided above, there is evidence that the albacore fishery is highly

Scores for MSC Component 2.5: Ecosystem (from GTCL 2010)

Performance Indicators	Rating	Justification
2.5.1 Outcome		100; Unlikely to disrupt key elements to ecosystem structure
2.5.2 Management		100; No impact identified, thus no management strategy is needed
2.5.3 Information		100; Evidence is available that shows the fishery is unlikely to disrupt the ecosystem

unlikely to disrupt the relevant key elements (predator – prey, prey – predator relationships and genetic diversity) underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.

MSC Principle 3: Management System

Governance and Policy

[From GTCL 2010]: The Magnuson-Stevens Fishery Conservation and Management Act (as amended through 2008) is the principal law governing marine fisheries in the United States. It was originally adopted to extend control of U.S. waters to 200 nautical miles in the ocean; to phase out foreign fishing activities within this zone and to conserve and manage fishery resources.

The operational framework for the North Pacific albacore tuna fishery is generally consistent with local, national and international laws or standards. Evidence of this is provided by The Magnuson-Stevens Fishery Conservation and Management Act and the Fishery Management Plan for highly migratory species, the High Seas Fishing Compliance Act, the Tuna Conventions Act, the Canada/USA Treaty, and membership in the WCPFC and the IATTC. Other evidence that demonstrate that the USA is consistent with international laws or standards include; UN Convention on the Law of the Sea (1982), Rio Declaration (1992), FAO Code of Conduct for Responsible Fisheries (1995), UN Straddling Stocks Agreement UNFA (1995).

Evidence of the existence of a management system that incorporates transparent mechanism for the resolution of legal disputes, effective in dealing with most issues and that is appropriate to the context of the fishery is provided in the FMP. Section 1.3 of the FMP states “The United States shall cooperate directly or through appropriate international organizations with those nations involved in fisheries for highly migratory species with a view to ensuring conservation and shall promote the achievement of optimum yield of such species throughout their range, both within and beyond the exclusive economic zone.” The National Court provides the ultimate system for resolution of domestic disputes. Also Section 1.3 of the FMP provides evidence of the existence of a system to comply in a timely fashion with binding judicial decisions arising from any legal challenges Section 6 of the FMP contain mechanisms to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food: “Pacific Coast treaty Indian tribes have treaty rights to harvest HMS in their usual and accustomed fishing areas in U.S. waters.”

The consultative process for North PACIFIC Albacore is extensive at both the scientific and management levels. First, the ALBWG of the ISC generates the primary assessments. The International Scientific Committee (ISC) is a formal scientific body made up of scientists from countries throughout North Pacific which reviews tuna assessments and research in the North Pacific. In the USA the consultation process is described in the Fisheries Management Plan for Highly Migratory Species. The consultation process provides evidence that organizations and individuals involved in the management process have a say in the proceedings. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction. Functions, roles and responsibilities are defined in the terms of reference of PFMC bodies and the international Committees. The PFMC process provides opportunity and encouragement for parties involved in the albacore tuna fishery to express their views. Parties can provide briefs to appropriate PFMC Committees. The HMS FMP provides the regulatory mechanisms needed for the US albacore fishery and the mechanisms for advising the US on negotiations for access rights with other countries (Canada). The commissions formulate overarching management regulations based upon recommendations from scientific committees or staff. Regulations are then implemented by individual member and cooperating countries. The USA is a member country of the WCPFC and IATTC.

Scores for MSC Component 3.1: Governance and Policy (from GTCL 2010)

Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		90; The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.
3.1.2 Consultation, Roles and responsibilities		100; The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.
3.1.3 Long-term Objectives		100; Magnuson-Stevens Act and FMPs
3.1.4 Incentives for Sustainable Fishing		80; The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2 and seeks to ensure that negative incentives do not arise.

Fishery Specific Management System

[From PFMC 2011]: In California, A general resident or non-resident commercial fishing license and a current California Department of Fish and Game (CDFG) vessel registration are required to catch and land albacore. Additionally, the HMS FMP requires a federal permit with a surface hook-and-line gear endorsement for all U.S. commercial and recreational charter fishing vessels

that fish for HMS within the West Coast exclusive economic zone (EEZ, 3–200 nautical miles) and for U.S. vessels that pursue HMS on the high seas (seaward of the EEZ) and land their catch in California, Oregon, or Washington.

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Please see the Harvest Strategy section under Principle 1 for further information.

Scores for MSC Component 3.2: Fishery Specific Management System (from GTCL 2010)

Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		100; HMS FMP
3.2.2 Decision-making Processes		95; Established decision-making processes use the precautionary approach and respond to important issues that may arise
3.2.3 Compliance & Enforcement		95; An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		90; HMS FMP
3.2.5 Management Performance Evaluation		80; The fishery has in place mechanisms to evaluate key parts of the management system and is subject to regular internal and occasional external review.

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency,

and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available.

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Appendix A

MSC Assessment Tree			Albacore Tuna*	
			Pole and line	Troll and jig
Principle	**Component**	**Performance Indicator**	**All**	**All**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status		
		1.1.2: Reference points		
		1.1.3: Stock rebuilding	*Did not assess*	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy		
		1.2.2: Harvest control rules		
		1.2.3: Info/ monitoring		
		1.2.4: Stock assessment		
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status		
		2.1.2: Mgmt strategy		
		2.1.3: Information		
	By-catch species	2.2.1: Status		
		2.2.2: Mgmt strategy		
		2.2.3: Info		
	ETP species	2.3.1: Status		
		2.3.2: Mgmt strategy		
		2.3.3: Info		
	Habitats	2.4.1: Status		
		2.4.2: Mgmt strategy		
		2.4.3: Info		
	Ecosystem	2.5.1: Status		
		2.5.2: Mgmt strategy		
		2.5.3: Info		
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework		
		3.1.2: Consultation, roles, and responsibilities		
		3.1.3: Long term objectives		
		3.1.4: Incentives for sustainable fishing		
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives		
		3.2.2: Decision making process		
		3.2.3: Compliance & enforcement		
		3.2.4: Research plan		
		3.2.5: Management performance evaluation		

California Halibut (*Paralichthys californicus*)

Certification Units Covered Under this Species:

- Central region, trawl
- Southern region trawl

Summary

California halibut are primarily located from Magdalena Bay in Baja California to Bodega Bay in California. The California population is divided into two stocks, a southern California stock and a central California stock. The southern stock is estimated to be depleted to about 14% of its unexploited spawning biomass level while the central stock is healthy and has been increasing since 1995. Shallow water embayments appear to be important nursery habitat for California halibut and populations may be limited by the amount of nursery habitat available. California halibut are managed by the California Fish and Game Commission and the California Department of Fish and Wildlife. Commercial fishing gears include trawl, gillnet and hook and line.

Strengths:

- Central California stock is healthy
- Recruitment is density-independent; MSY occurs at a low level
- Stock assessment completed in 2011; some data gaps are being filled and another assessment is planned in the next few years

Weaknesses:

- Southern California stock is depleted to 14% of its unexploited spawning biomass level
- No harvest control rules or reference points have been developed yet
- ETP bycatch in federal waters

History of the Fishery in California

Biology of the Species

California halibut (*Paralichthys californicus*) are flatfish from the family Pleuronectidae, or the “right eyed flounders.” Despite being from the family of right eyed flounders, about 40% of California halibut are actually left eyed (Love 2011). The body of the California halibut is oblong and compressed with a small head and large mouth with big teeth. A distinguishing characteristic of California halibut is the presence of a high arch in the lateral line located above the pectoral fin. The halibut is typically dark on the top, “eyed” side, and white on the bottom, “blind” side; they can also change the color and pattern of their top side to match their

surroundings. They reside primarily on soft bottoms such as sand or mud and have been found from the surf zone out to 281 m of depth. However, halibut are most common from the surf zone out to 60 m of depth (Love 2011). [From CDFG 2004]: California halibut are ambush predators. Adult halibut feed primarily on Pacific sardine, northern anchovy, squid, and other nearshore fish species that swim in the water column. Small juvenile halibut in bays primarily eat crustaceans, including copepods and amphipods. At 2.5 in., they are large enough to eat small fish. As juvenile halibut increase in size, the percentage of fish in their diet increases. California halibut appear to have a cycle of abundance of approximately 20 years that is tied to environmental conditions (Maunder et al. 2011).

[From Maunder et al. 2011]: California halibut range from Magdalena Bay, Baja California (Gilbert and Scofield 1898), to the Quillayute River in Washington (Pattie and Baker 1969), however is most common from Bodega Bay south. Fish in central California tend to be larger at a given age than fish in southern California. Large adult fish inhabit deeper water (Sunada 1985), outer banks, and islands (Wallace 1990), except during the peak spawning season (April - May) when they move inshore to spawn (Clark 1931). California halibut are batch spawners, with a typical 5-year old fish releasing about 300,000 eggs at a time, although the number of eggs released is dependent on the size of the fish (Lavenberg 1986). [From CDFG 2004]: Halibut have a relatively short free-drifting larval stage (less than 30 days), transforming and settling to the bottom at a small size (about 0.3 to 0.5 in.). Newly settled and larger juvenile halibut are frequently taken in un-vegetated shallow-water embayments and infrequently on the open coast, suggesting that embayments are important nursery habitats. The overall decline in halibut landings corresponds to a decline in shallow water habitats in southern California associated with dredging and filling of bays and wetlands.

There are sex-specific differences in age, size, maturity, and distribution. California halibut females live longer, grow larger, mature later and appear to be more common or more easily captured than males. Females live to 30 years of age and males to 23 years of age. Maximum length of female halibut (which are larger than males after 3-4 years of age) is 152 cm and male halibut is 108.5 cm. Length at 50% maturity is 47.1 cm for females or 4-5 years of age and 22.7 cm for males or 2-3 years of age. Sampling halibut with various fishing gears suggests females are in greater abundance and/or more vulnerable to capture than males (Reed and MacCall 1988, Sunada et al. 1990, Pattison and McAllister 1990), although one study did find a greater percentage of males captured using a smaller than normal trawl net (MacNair 2001). Additionally, the female to male sex ratio appears higher in inshore areas compared to offshore areas (Sunada et al. 1990). The 2011 stock assessment (Maunder et al. 2011) concluded that it is likely males have a higher natural mortality rate than females, there are spatial or depth differences in the distribution of males and females, and males and females have different vulnerabilities to the various fishing methods.

Commercial Fishery

[From Maunder et al. 2011]: California halibut is an important target species for both recreational and commercial fisheries. The commercial fisheries have caught California halibut using trawl, set gillnets, and hook-and-line. Bottom gillnets historically accounted for a significant portion of the catch, but their use has declined due to the banning of this gear in several areas along the California coast. Trawl and bottom gillnets are the primary gears used in southern California, while mostly trawl and hook-and-line gear are used in central California (Figures 1 and 2). In southern California, there is also a live halibut fishery which has been active since 1990; live fish fetch a higher price than fresh dead fish (CDFW 2013). The commercial catch has shown three

large peaks in the 1910s, 1940s, and the 1960s (Figure 3). Prior to 1960, the commercial catch landed north of Point Conception (San Francisco and Monterey port areas) was only a small portion of the total commercial catch. However, it increased in the late 1960s and by the mid 1980s the catch landed north of Point Conception was about 40% of the total commercial catch. Revenue peaked in the late 1980s and again in the late 1990s at close to $4 million (Figure 4).

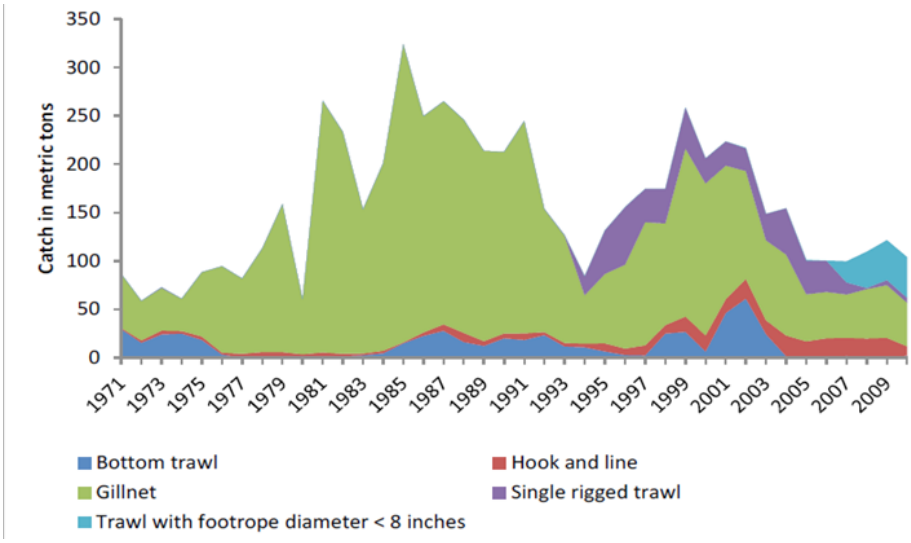

Figure 1. Commercial catch south of Point Conception in metric tons by gear type (Maunder et al. 2011).

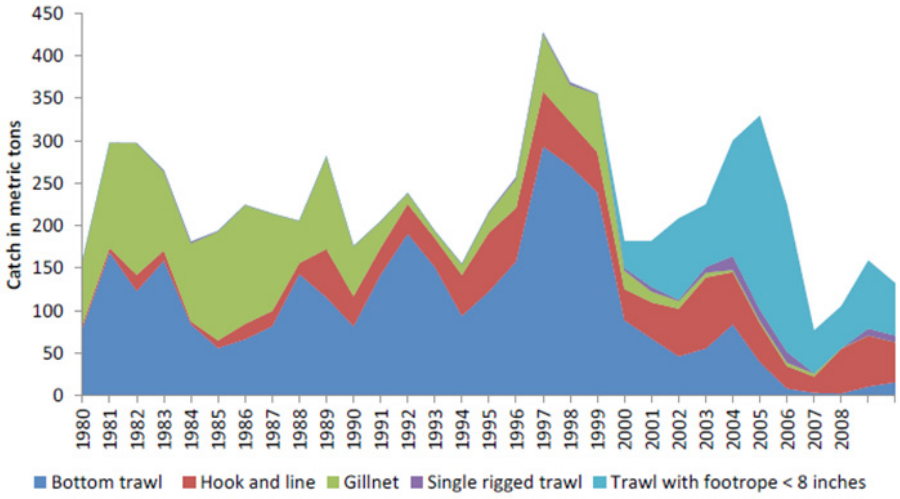

Figure 2. Commercial catch north of Point Conception in metric tons by gear type (Maunder et al. 2011).

[From CDFG 2003]: The decline in commercial California halibut landings after 1919 (Figure 3) is attributed to increased fishing pressure during World War I and to subsequent overfishing. Fishing restraints during World War II may have allowed halibut stocks to increase, resulting in peak landings in the late 1940s, followed by low catches in the 1950s. Warm waters during El Niño years in the late 1950s were followed by increased landings through the mid-1960s. Thereafter, annual landings decreased again to a historical low of 128.5 mt in 1970; after 1970

landings gradually increased. Since 1980, landings have averaged a little more than 500 mt annually.

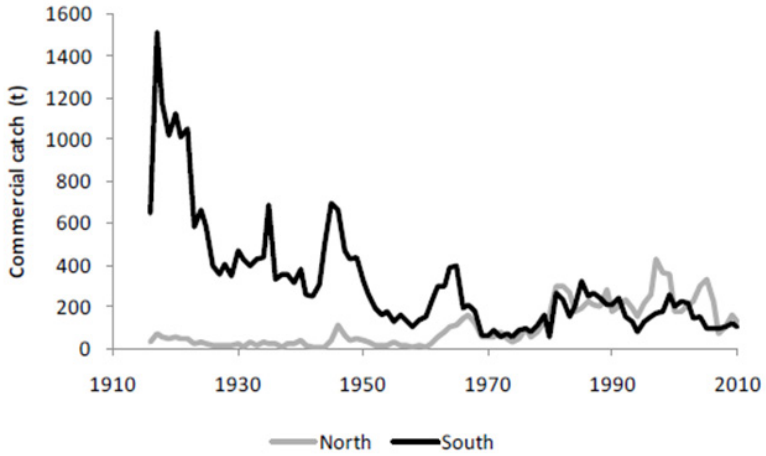

Figure 3. Commercial catch over the last 100 years north and south of Point Conception (Maunder et al. 2011).

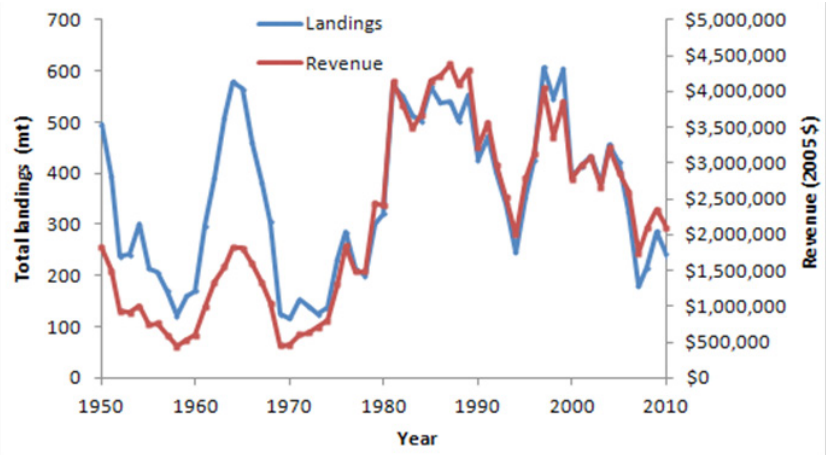

Figure 4. Total landings and revenue from California halibut from 1950 – 2010 (data from Center for the Blue Economy).

Recreational Fishery

Recreational anglers target California halibut from shore, private and rental skiffs, and CPFVs using hook and-line gear. Some catch also occurs from scuba divers and free divers using spear guns or pole spears. The recreational fishery is open year round, although California halibut are usually only available seasonally when they move inshore to spawn (Maunder et al. 2011). The daily bag and possession limit is three fish north of Point Sur, Monterey County and five fish south of Point Sur. The minimum size limit is 22 inches total length. From 1980 to 2004, the method for estimating recreational catch was the Marine Recreational Fisheries Statistical Survey (MRFSS). After 2004, the California Recreational Fishing Survey (CRFS) was used to estimate recreational catch. Because these two data sets use different survey methods for collecting data, the data sets are not comparable (CDFW 2013). While the data from MRFSS and CRFS are not comparable, there were several peaks (1982, 1995, 2002, and 2008) in recreational halibut catch (CDFW 2013; Figure 5 & 6).

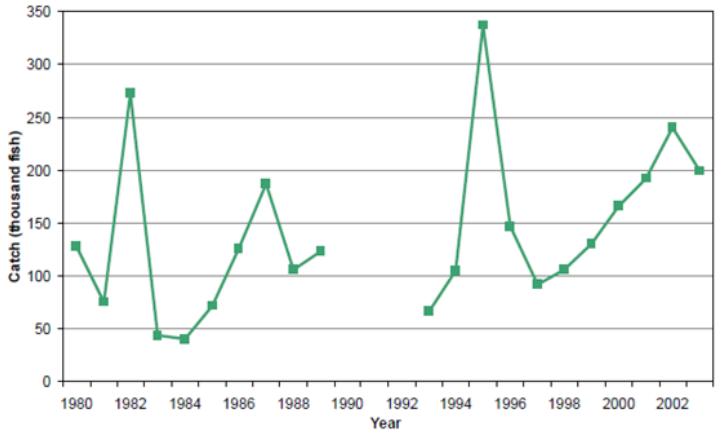

Figure 5. California halibut recreational catch, 1980-2003 (from CDFW 2013). Data source: MRFSS data, all fishing modes and gear types combined. Data for 1990-1992 are not available.

Figure 6. California halibut recreational catch, 2004-2011 (from CDFW 2013). Data source: CRFS data, all fishing modes and gear types combined.

MSC Principle 1: Resource Sustainability

*Sustainability of Target Stock

There is no fishery management plan and no management or biological reference points for California halibut. Catch is controlled by limited-entry permits, minimum size, gear, and area restrictions. A stock assessment was completed in 2011 (Maunder et al. 2011) and separated the California halibut population into two stocks: southern California and central California. In southern California, the stock is estimated to be depleted to about 14% of its unexploited spawning biomass level (Figure 7) as a result of low recruitment levels since 1999; recruitment is linked to environmental conditions and the availability of suitable shallow water habitats for juvenile halibut (CDFW 2013). Environmental conditions have been poor over the last decade in southern California, and there has been a decline in shallow water habitats associated with the dredging and filling of bays and wetlands. In central California, the population is healthy and has been increasing since 1995 (Figure 8). The increase in abundance in central California is due to large recruitments, which appear to occur in cyclic patterns. The magnitude of the cycles increased after 1990 (Figure 9).

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

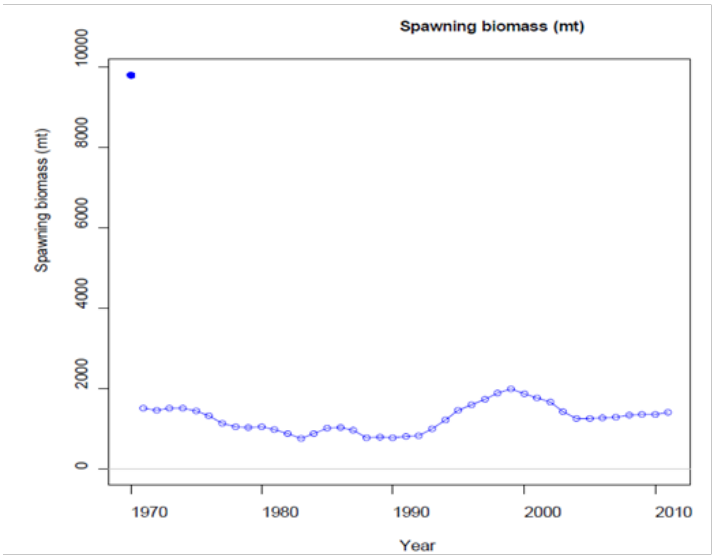

Figure 7. Estimated spawning biomass of California halibut for southern California through the start of 2011 (from Maunder et al. 2011).

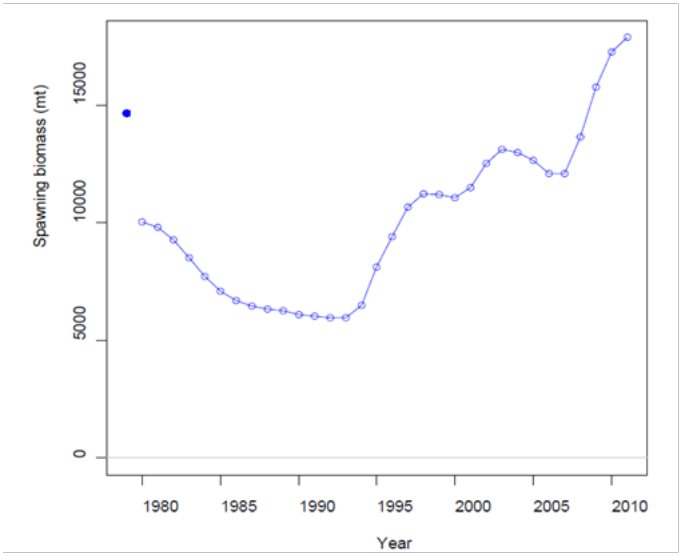

Figure 8. Estimated spawning biomass for central California (from Maunder et al. 2011).

Maximum sustainable yield (MSY) for California halibut is estimated to occur at a very low fraction of the unexploited spawning biomass (7% -12%) (Maunder et al. 2011); this is because recruitment is assumed to be independent of stock density[1] and environmentally driven. El Niño events appear to induce favorable conditions for recruitment by decreasing hypoxic conditions in shallow embayments (Hughes et al. 2012) and keeping halibut fry in the nearshore habitat, allowing them the opportunity to settle out (T. Tanaka, personal communication, 2013). Fishing is not considered to be a major factor controlling recruitment. Because recruitment is independent of stock density, the calculated MSY is not appropriate; instead, the stock assessment suggested using an MSY of 25% as a proxy (Maunder et al. 2011).

The stock assessment stated that despite the resilience of flatfish and the fact that California halibut have sustained high exploitation rates for several decades, uncertainty in the biological

[1]Appendix B of the stock assessment states that reliable data to estimate steepness [a measure of the stock-recruitment relationship] is essentially arbitrary since there are no reliable data available to estimate this parameter. More data is needed to accurately quantify the stock-recruitment relationship.

and fishing processes and the recent series of low recruitments in southern California indicate that management action may be needed to reduce the risk of fishery collapse in southern California (Maunder et al. 2011). To address some of the deficiencies in the stock assessment model, the peer review panel for the stock assessment recommended that DFW increase gender-specific sampling of the fished population, continue ageing studies, divide southern California into smaller sampling regions to increase precision in analysis, and examine the possible link between the north and south through larval abundance (MacCall et al. 2011, CDFW 2013).

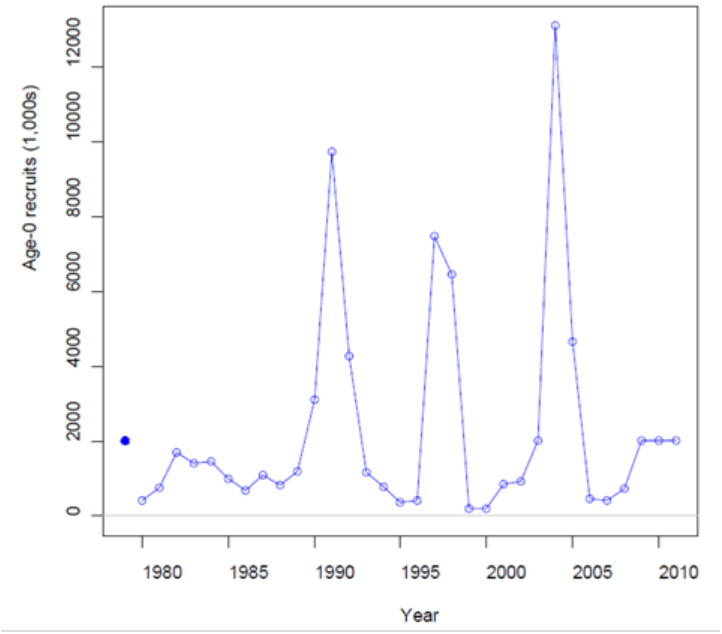

Figure 9. Estimated recruitment for central California (from Maunder et al. 2011).

Evaluation against MSC Component 1.1: Sustainability of Target Stock

Performance Indicator	Rating	Justification
1.1.1 Stock Status		The central stock is healthy according to the recent stock assessment
		The southern stock is depleted to 14% of its unexploited spawning biomass. It also has low recruitment and more information is needed to inform the stock-recruit relationship
1.1.2 Reference Points		No biological reference points have been established, although an initial stock assessment has been completed.
1.1.3 Stock rebuilding		This may be triggered for the southern stock

Harvest Strategy (Management)

California halibut is managed by the state of California in both state waters (0-3 nm from shore) and federal waters (3 – 200 nm). The California Fish and Game Commission adopts regulations for management of the fishery and the California Fish and Wildlife Department (DFW) enforces and implements the regulations. No stock status reference points have been developed for California halibut. The estimated maximum sustainable yield (MSY) from the recent stock assessment is inappropriate as a reference point because of the assumption that recruitment is not density dependent; this causes the spawning stock biomass associated with MSY to occur at a high depletion level (7-12% of the unexploited stock biomass). The stock assessment suggested using an MSY of 25% as a proxy (Maunder et al. 2011). Minimum size limits (22" minimum), gear restrictions, area restrictions and seasonal closures are used to control catch. California halibut are taken by trawl, gillnet, and hook and line. DFW has taken action to control excess capacity in the California halibut gillnet and trawl fisheries by issuing no new permits for these fisheries. However participation in the California halibut hook-and-line fishery is open-access.

[NWFSC 2010]: Vessels that participate in the California halibut trawl sector can belong to the state trawl fleet, the federal limited entry (LE) trawl fleet or both. Trawl vessels that target California halibut in both state and federal waters need to have a California Halibut Bottom Trawl Vessel Permit (CHBTVP), participate in a vessel monitoring system and maintain logbooks. Trawling within state waters for California halibut is restricted to the California Halibut Trawl Grounds (CHTG), which encompass the area between Point Arguello and Point Mugu in waters greater than one nautical mile from shore. The CHTG are closed from March 15 to June 15 to protect spawning fish, require a minimum mesh size of 19 cm (7½ in) for the cod end, and the use of "light touch" trawl gear (since 2009). Light touch trawl gear includes the following requirements to reduce impact to bottom habitat:

- Each trawl net shall have a headrope not exceeding 27.4 m (90 ft) in length.
- The thickness of the webbing of any portion of the trawl net shall not exceed 7 mm (0.27 in) in diameter.
- Each trawl door shall not exceed 227 kg (500 lb) in weight.
- Any chain attached to the footrope shall not exceed 6.3 mm (0.25 in) in diameter of the link material.
- The trawl shall have no rollers or bobbins on any part of the net or footrope. Rollers or bobbins are devices made of wood, steel, rubber, plastic, or other hard material that encircle the trawl footrope.

State trawl vessels also have a 227 kg (500 lb) possession limit on the incidental take of fish other than California halibut. Federal LE trawl vessels targeting California halibut need to have both a limited-entry federal groundfish permit and a state CHBTVP to land more than 68 kg (150 lbs) of halibut (per trip). Federal LE vessels are also subject to federal groundfish regulations, depth-based area closures, gear restrictions, and trip limits for groundfish. Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is

no evidence of systemic non-compliance.

California halibut in Mexico are managed by the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA). There are no specific regulations pertaining to California halibut, so fisheries are virtually unregulated (SAGARPA 2010), and the status of the California halibut population in this region has not been evaluated.

Evaluation against MSC Component 1.2: Harvest Strategy

Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Stock assessment, landings data, and tools to limit catch are present; however no reference points or harvest control rules are in place.
1.2.2 Harvest Control Rules and Tools		No harvest control rules, but tools to limit catch.
1.2.3 Information/Monitoring		Fisheries dependent and independent data are available; however data is limited on gender-specific mortality, stock structure, and the stock-recruit relationship.
1.2.4 Assessment of Stock Status		Stock assessment in 2011; another is planned

MSC Principle 2: Environment

Retained Catch

Bottom trawl

[All data from NWFSC 2012]: Data on retained catch from the California halibut trawl fishery is available from observer coverage and landings receipts in both federal and state waters. Observer coverage varies widely from year to year. In the state trawl fishery, observer coverage has ranged from 1% to 14% from 2003 to 2011. In the federal trawl fishery, observer coverage ranged from 6% to 25% from 2003 to 2010; however as of 2011 the federal California halibut trawl fishery falls under the IFQ groundfish regulations and observer coverage increased to 99%.

The primary species (besides California halibut) retained in the federal trawl fishery (≥ 3% of total catch) between 2008 to 2011 included sand sole and starry flounder (Table 1). Other retained species (< 3% of total catch) included Petrale sole (rebuilding), Curlfin turbot, English sole, Rex sole, Rock sole, Soupfin shark, Hornyhead turbot, octopus, and white croaker (Appendix B). The primary species retained in the state trawl fishery (≥ 3% of total catch) during the same time period was starry flounder. Other retained species (< 3% of total catch) included Sand sole, Hornyhead turbot, octopus, shrimp, and white sea bass (Appendix A). All primary retained species are managed under the federal groundfish FMP.

Table 1. Observer data on retained catch on trawl vessels targeting California halibut from 2008 to 2011 (NWFSC 2012; only catch that is ≥ 3% of total catch is shown in this table).

		% of total catch (% retained)			
Trawl Sector	**Species**	**2011***	**2010***	**2009***	**2008***
Federal Trawl	California halibut	12.3% (100%)	22.1% (97%)	14.5% (93%)	16.4% (73%)
	Sand sole	5.1% (99%)	1.9% (88%)	0.75% (89%)	0.3% (93%)
	Starry flounder	3.1% (96%)	3.5% (90%)	1.2% (82%)	1.9% (93%)
State Trawl	California halibut	24.4% (93%)	19.7% (87%)	40.7% (96%)	20.0% (79%)
	Starry flounder	3.0% (60%)	1.5% (99%)	1.9% (100%)	2.0% (76%)

*Observer coverage: Federal trawl: 2011 = 99%, 2010 = unknown, 2009 = 6%, 2008 = 25%; State trawl: 2011 = 14%, 2010 = 4%, 2009 = 1%, 2008 = 5%

Evaluation against MSC Component 2.1: Retained Catch

Performance Indicators	Rating	Justification
2.1.1 Outcome		None of the primary retained species are depleted and catch levels are relatively low; most retained species are managed under the PFMC Groundfish FMP
2.1.2 Management		Most of the retained catch falls under the PFMC Groundfish FMP. Area and seasonal closures, gear restrictions, and limited entry permits also help manage incidental catch.
2.1.3 Information		Observer coverage is good in the federal fishery; low in the state fishery. Landing receipts should also be available. Information on retained species is fairly comprehensive.

Bycatch

Bottom trawl

[All data from NWFSC 2012]: Data on bycatch from the California halibut trawl fishery is available from observer coverage and logbooks in both federal and state waters. As described above, observer coverage varies widely from year to year. The primary species discarded as

bycatch in both the federal and the state trawl fishery (≥ 3% of total catch) from 2008 to 2011 were Dungeness crab, unidentified jellyfish, bat ray and big skate (Table 2). Other bycatch species (< 3% of total catch) in both the federal and state trawl fishery include Petrale sole, California scorpionfish, California skate, Curlfin turbot, English sole, Leopard shark, Lingcod, Longnose skate, Pacific sanddab, Rex sole, Rock sole, Soupfin shark, Spiny dogfish shark, Spotted ratfish, American shad, Armored box crab, Barred sand bass, Brown smoothhound shark, Common thresher shark, Spider crab, Fantail Sole, Giant sea bass, Graceful crab, Longspine combfish, Northern anchovy, Pacific angel shark, Pacific electric ray, Pacific staghorn sculpin, Red rock crab, Sevengill shark, Sheep crab, Shovelnose guitarfish, Sixgill shark, Specklefin midshipman, squid, Starry skate, Swell shark, Thornback skate, White croaker, and Yellow rock crab (Appendix B). Many of the bycatch species are managed under FMPs or by the State; however several species are not actively managed such as many of the sharks, rays and invertebrates (jellyfish, octopus, and some crab species). A bycatch study by DFW (CDFG 2008) in the CHTG (southern CA trawl fishery) reported that 94% of discards by weight during experimental tows were released alive; the report acknowledged though that the high discard survival rate may not be accurate because tows during their study were 30 minutes in length while typical tow times are 60 to 90 minutes in length. In general though, tows are shorter in duration in the southern trawl fishery compared to the central trawl fishery because the southern fishery supplies a live halibut market while the central fishery supplies a fresh dead fillet market. This would likely result in a higher rate of live discards in the southern California fishery compared to the central California fishery (T. Tanaka, personal communication).

Table 2. Observer data on bycatch on trawl vessels targeting California halibut from 2008 to 2011 (NWFSC 2012; only catch that is ≥ 3% of total catch is shown in the table).

		% of total catch (% discarded)			
Trawl Sector	**Species**	**2011***	**2010***	**2009***	**2008***
Federal Trawl	Dungeness crab	52.8% (100%)	37.8% (100%)	44.8% (100%)	10.8% (100%)
	Jellyfish	15.3% (100%)	11.1% (100%)	32.4% (100%)	48.2% (100%)
	Bat ray	3.0% (100%)	1.0% (100%)	1.4% (100%)	9.4% (100%)
	Big skate	3.7% (88%)	5.0% (100%)	1.7% (85%)	4.3% (100%)
State Trawl	Dungeness crab	18.6% (100%)	49.7% (100%)	No catch	41.1% (100%)
	Jellyfish	11.5% (100%)	5.9% (100%)	No catch	10.2% (100%)
	Bat ray	17.4% (100%)	7.6% (100%)	3.7% (70%)	2.2% (98%)
	Big skate	10.9% (95%)	2.0% (100%)	8.0% (100%)	3.2% (100%)

*Observer coverage: Federal trawl: 2011 = 99%, 2010 = unknown, 2009 = 6%, 2008 = 25%; State trawl: 2011 = 14%, 2010 = 4%, 2009 = 1%, 2008 = 5%

Evaluation against MSC Component 2.2: Bycatch

Performance Indicators	Rating	Justification
2.2.1 Outcome		In the central region, more information is needed on bycatch mortality
		In the southern region, most bycatch species are released alive; the fishery likely does not pose a serious risk to bycatch species.
2.2.2 Management		Area and seasonal closures, gear restrictions, and a limited entry permit system help manage bycatch. Dungeness crab and big skate are managed fisheries.
2.2.3 Information		Observer coverage is good in the federal fishery; lower in the state fishery. Logbook data should also be available. Information on bycatch species appears to be comprehensive

*Endangered, Threatened, & Protected Species

Bottom trawl

Data on ETP bycatch from the California halibut trawl fishery is available from the West Coast Groundfish Observer Program (WCGOP). Bycatch of ETP species include green sturgeon (Al-Humaidhi et al. 2012a), Chinook salmon, and Coho salmon (Al-Humaidhi et al. 2012b). Green sturgeon bycatch is considered a large problem in the California halibut trawl fishery; this fishery is the primary source of mortality for green sturgeon along the U.S. west coast (Al-Humaidhi et al. 2012). Publicly available data on estimated catch of green sturgeon and salmon is available from 2002 to 2010, although some years there was very low or no observer coverage.

Bycatch estimates are calculated by computing ETP bycatch ratios (observed ETP catch / retained weight of California halibut); the bycatch ratio is then multiplied by the entire fleet's landed catch of California halibut to estimate total ETP bycatch. When there is low observer coverage, this can provide a misleading estimate of ETP bycatch. Factors to consider when looking at bycatch estimates from federal and state California halibut trawl sectors include: 1) observer coverage is higher on federal trawl vessels than state trawl vessels (Table 3), 2) bycatch estimates for federal trawl vessels use tows targeting California halibut and tows targeting flatfish in general (Al-Humaidhi et al. 2012), whereas bycatch estimates for state trawl vessels only use tows targeting California halibut, and 3) federal trawl vessels target halibut across a greater area than state trawl vessels.

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Table 3. Estimated bycatch of ETP species on federal and state trawl vessels targeting California halibut from 2006 – 2010 (Al-Humaidhi et al. 2012a & 2012b). Dashed lines (-) indicate no observer coverage.

		# of fish				
Trawl Sector	**Species**	**2010***	**2009***	**2008***	**2007***	**2006***
Federal Trawl	Green sturgeon	182†	150	188	104	786
	Chinook salmon	11†	0	79	125	107
	Coho salmon	0†	0	0	0	48
State Trawl	Green sturgeon	0	139†	0	0	-
	Chinook salmon	0	0	0	0	-
	Coho salmon	0	0	0	0	-

*Observer coverage: Federal trawl: 2010 = unknown, 2009 = 6%, 2008 = 25%, 2007 = 14%, 2006 = 12%; State trawl: 2010 = 4%, 2009 = 1%, 2008 = 5%, 2007 = 7%, 2006 = 0%
†Bycatch estimate is based on fewer than three observed vessels

Evaluation against MSC Component 2.3: Endangered, Threatened & Protected Species

Performance Indicators	Rating	Justification
2.3.1 Outcome		Green sturgeon bycatch is a problem; this fishing sector has the largest amount of green sturgeon bycatch along the West coast.
2.3.2 Management		Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act, etc.
2.3.3 Information		WCGOP observer data, although observer coverage in the state trawl fishery is low.

Habitat

Bottom trawl

[CDFG 2008]: The CHTG is located in the Santa Barbara Channel (SBC) over a shallow, broad shelf with an average depth of 29 fathoms. The seafloor within the CHTG is comprised of approximately 86 percent soft substrate and 14 percent hard substrate. Logbook data indicates that trawlers generally avoid the hard substrate within the CHTG. Few studies on the impacts of bottom trawl gear to the seafloor habitat have been conducted off the west coast of the United States. Information prepared by the National Marine Fisheries Service (NMFS) indicates that

habitat impacts by bottom trawl gear in areas where California halibut trawling occurs have the lowest sensitivity classification for impacts to seafloor habitat by bottom trawl gears. Mean recovery time for trawl gear impacts in the CHTG is estimated by NMFS to be less than one year in the absence of continued fishing.

Evaluation against MSC Component 2.4: Habitat

Performance Indicators	Rating	Justification
2.4.1 Outcome		Habitat where trawling for California halibut occurs has a low sensitivity to impacts by bottom trawl gear according to NMFS
2.4.2 Management		Limited entry permits, gear restrictions, area closures and seasonal closures help limit habitat impacts
2.4.3 Information		It is unclear if the information available on habitat impacts is adequate to assess the risk posed

Ecosystem

[CDFG 2004]: California halibut are ambush predators. On the coast, adult halibut feed primarily on Pacific sardine, northern anchovy, squid, and other nearshore fish species that swim in the water column. Small juvenile halibut in bays primarily eat crustaceans, including copepods and amphipods. At 2.5 in., they are large enough to eat fish such as the gobies that are commonly found in bays. The percentage of fish in juvenile halibut diets increases as the halibut grows. Predators of juvenile halibut in the bays and estuaries include various shore birds and fishes (Haugen 1990). Adults may be preyed upon by Pacific angel shark, juvenile white sharks, Pacific electric eels, giant sea bass, and some marine mammals like the California sea lion and the bottlenose dolphin (Fitch and Lavenberg 1971).

[CDFG 2008]: There are no agreed upon quantitative measures of ecosystem health that can be specifically applied to this fishery. Current state and federal California halibut management measures were not implemented to specifically address ecosystem management, although the current management measures (season and area closures, gear restrictions, observer coverage, and limited entry program) may collectively foster a sustainable bottom trawl fishery and indirectly promote a healthy ecosystem by reducing potential fishery impacts on the system. Possible impacts that may occur are to corals and sea pens. At least four taxa of coral or coral like species occur in waters within and adjacent to the CHTG, and all but sea pens require hard substrate for attachment. Coral habitats are susceptible to damage from bottom trawling (Whitmire and Clarke 2007), however direct study of the areas impacted by the California halibut trawl fleet in the CHTG has not been done. While trawlers generally avoid hard substrate where corals are found and areas containing debris from former oil drilling operations, trawling does occur on soft substrates where sea pens occur.

Although not a fishery impact, the overall decline in halibut landings in southern California corresponds to a decline in shallow water habitats associated with the dredging and filling of bays and wetlands (CDFG 2004). The establishment of MPAs along the coast will provide protection of some of these shallow water habitats and could help increase juvenile halibut survival. For example, in southern California, MPAs account for 13.8% of soft bottom habitat within the appropriate depth range.

Evaluation against MSC Component 2.5: Ecosystem

Performance Indicators	Rating	Justification
2.5.1 Outcome		Likely does not cause irreversible harm to ecosystem, but no quantitative measures are available to assess
2.5.2 Management		No direct measures to address ecosystem health, however existing mgmt may indirectly benefit ecosystem health; MPAs will protect some juvenile habitat
2.5.3 Information		More information needed on the biology of CA halibut to understand ecosystem impacts

MSC Principle 3: Management System

Governance and Policy

This fishery is managed by the state of California; it is regulated by the California Fish and Game Commission (FGC) and managed by the California Department of Fish and Wildlife (DFW). It is subject to and managed under all relevant US federal laws as well as California state regulations pertaining to fisheries management, such as the Marine Life Management Act (MLMA). The MLMA lays out several goals and tools to promote sustainable fishing in California. The FGC meets at least ten times each year to publicly discuss various proposed regulations and holds subcommittee meetings and a variety of special meetings to obtain public input on a variety of regulatory items. Besides attending public meetings, the public can also submit written comments to the FGC and suggestions for management action or new regulations through the FGC's rule making process.

Evaluation against MSC Component 3.1: Governance and Policy

MSC Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		FGC and DFW manage the fishery within an effective framework for delivering sustainable fisheries
3.1.2 Consultation, Roles and responsibilities		Roles and responsibilities are clearly laid out; FGC meetings are open to the public and to public comments
3.1.3 Long-term Objectives		Marine Life Management Act
3.1.4 Incentives for Sustainable Fishing		Marine Life Management Act

Fishery Specific Management System

California halibut is managed by the state of California in both state waters (0-3 nm from shore) and federal waters (3 – 200 nm). The California Fish and Game Commission adopts regulations for management of the fishery and the California Fish and Wildlife Department (DFW) enforces and implements the regulations.

Vessels that participate in the California halibut trawl sector can belong to the state trawl fleet, the federal limited entry (LE) trawl fleet or both. Trawl vessels that target California halibut in both state and federal waters need to have a California Halibut Bottom Trawl Vessel Permit (CHBTVP), participate in a vessel monitoring system and maintain logbooks. Trawling within state waters for California halibut is restricted to the California Halibut Trawl Grounds (CHTG), which encompass the area between Point Arguello and Point Mugu in waters greater than one nautical mile from shore. The CHTG are closed from March 15 to June 15 to protect spawning fish, require a minimum mesh size of 19 cm (7½ in) for the cod end, and the use of "light touch" trawl gear (since 2009). Light touch trawl gear includes the following requirements to reduce impact to bottom habitat:

- Each trawl net shall have a headrope not exceeding 27.4 m (90 ft) in length.
- The thickness of the webbing of any portion of the trawl net shall not exceed 7 mm (0.27 in) in diameter.
- Each trawl door shall not exceed 227 kg (500 lb) in weight.
- Any chain attached to the footrope shall not exceed 6.3 mm (0.25 in) in diameter of the link material.
- The trawl shall have no rollers or bobbins on any part of the net or footrope. Rollers or bobbins are devices made of wood, steel, rubber, plastic, or other hard material that encircle the trawl footrope.

State trawl vessels also have a 227 kg (500 lb) possession limit on the incidental take of fish other than California halibut. Federal LE trawl vessels targeting California halibut need to have both a limited-entry federal groundfish permit and a state CHBTVP to land more than 68 kg (150 lbs) of halibut (per trip). Federal LE vessels are also subject to federal groundfish regulations, depth-based area closures, gear restrictions, and trip limits for groundfish. Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		No clear objectives outlined, no FMP; DFW does present a rationale to the FGC for current mgmt practices though
3.2.2 Decision-making Processes		DFW provides recommendations that are vetted through the FGC
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		Annual research plans are developed by DFW but are internal; can be obtained if requested
3.2.5 Management Performance Evaluation		No fishery-specific mgmt objectives; there is an internal review of mgmt measures by DFW though. Stock assessment was externally reviewed; DFW is required to report to FGC on habitat impacts in CHTG.

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available

Recommendations

This is a fishery where MPAs could benefit the stock by providing protection of shallow water habitat for juvenile halibut. Recruitment is linked to both environmental conditions and the

availability of suitable shallow water habitat for juvenile halibut; protection of shallow water habitat could help to increase juvenile halibut survival.

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Appendix A

MSC Assessment Tree			CA Halibut	
			Trawl	
Principle	**Component**	**Performance Indicator**	**Central**	**Southern**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status		
		1.1.2: Reference points		
		1.1.3: Stock rebuilding	*Did not assess*	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy		
		1.2.2: Harvest control rules		
		1.2.3: Info/ monitoring		
		1.2.4: Stock assessment		
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status		
		2.1.2: Mgmt strategy		
		2.1.3: Information		
	By-catch species	2.2.1: Status		
		2.2.2: Mgmt strategy		
		2.2.3: Info		
	ETP species	2.3.1: Status		
		2.3.2: Mgmt strategy		
		2.3.3: Info		
	Habitats	2.4.1: Status		
		2.4.2: Mgmt strategy		
		2.4.3: Info		
	Ecosystem	2.5.1: Status		
		2.5.2: Mgmt strategy		
		2.5.3: Info		
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework		
		3.1.2: Consultation, roles, and responsibilities		
		3.1.3: Long term objectives		
		3.1.4: Incentives for sustainable fishing		
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives		
		3.2.2: Decision making process		
		3.2.3: Compliance & enforcement		
		3.2.4: Research plan		
		3.2.5: Management performance evaluation		

Appendix B

Table 1. Observer data on retained species from trawl vessels targeting California halibut in 2010 and 2011 (NWFSC 2012). N/A refers to species that had ≥ 50% discarded (see Table 2 for this data).

		2011		2010	
Trawl sector	Species	% of total catch (% retained)	Catch (mt)	% of total catch (% retained)	Catch (mt)
Federal	California halibut	12.3% (100%)	11.73	22.1% (97%)	6.59
	Sand sole	5.1% (99%)	4.87	1.9% (88%)	0.58
	Starry flounder	3.1% (96%)	2.92	3.5% (90%)	1.04
	Skates, unidentified	0.4% (100%)	0.38	N/A	
	White sea bass	0.2% (95%)	0.16	0.1% (100%)	0.04
	English sole	0.1% (64%)	0.13	N/A	
	Soupfin shark	0.07% (96%)	0.07	0.5% (100%)	0.14
	Petrale sole*	0.07% (83%)	0.07	0.002% (90%)	0.04
	White croaker	0.06% (95%)	0.06	N/A	
	Rock sole	0.05% (97%)	0.05	1.7% (73%)	0.50
	Hornyhead turbot	0.05% (82%)	0.05	N/A	
	Octopus	0.01% (81%)	0.01	0.03% (100%)	0.01
State	California halibut	24.4% (93%)	13.39	19.7% (87%)	2.71
	Starry flounder	3.0% (60%)	1.67	1.5% (99%)	0.21
	Sand sole	1.0% (81%)	0.56	1.3% (97%)	0.18
	Flatfish, unidentified	0.4% (57%)	0.22	0.1% (61%)	0.02
	White sea bass	0.1% (92%)	0.06	0.2% (74%)	0.03
	Shrimp, unidentified	0.04% (80%)	0.02	0.4% (99%)	0.06
	Octopus	0.02% (54%)	0.01	N/A	
	Common thresher shark	N/A		0.07% (100%)	0.01
	Shark, unidentified	N/A		0.07% (100%)	0.01

*Rebuilding species

Table 2. Observer data on bycatch species from trawl vessels targeting California halibut in 2010 and 2011 (NWFSC 2012). N/A refers to species that had > 50% retained (see Table 1 for this data).

		2011		2010	
Trawl sector	Species	% of total catch (% discarded)	Catch (mt)	% of total catch (% discarded)	Catch (mt)
Federal	Dungeness crab	52.8% (100%)	50.49	37.8% (100%)	11.26
	Jellyfish	15.3% (100%)	14.63	11.1% (100%)	3.31
	Bat ray	3.0% (100%)	2.88	1.0% (100%)	0.31
	Big skate	3.7% (88%)	3.57	5.0% (100%)	1.50
	Spiny dogfish shark	1.1% (100%)	1.02	0.6% (100%)	0.18
	California skate	0.8% (100%)	0.75	2.5% (100%)	0.74
	Curlfin turbot	0.5% (69%)	0.46	1.4% (100%)	0.43
	Pacific sanddab	0.3% (77%)	0.24	3.9% (100%)	1.17
	White croaker	N/A		1.6% (100%)	0.49
	Hornyhead turbot	N/A		0.9% (100%)	0.28
	English sole	N/A		0.9% (100%)	0.27
	Red Rock crab	0.2% (100%)	0.19	0.1% (100%)	0.03
	Brown Smoothhound shark	0.1% (100%)	0.12	0.2% (100%)	0.07
	Anchovy, unidentified	0.1% (100%)	0.12	0	0
	Shark, unidentified	0.09% (97%)	0.09	0.2% (100%)	0.07
	Leopard shark	0.09% (86%)	0.09	0.1% (100%)	0.03
	Green sturgeon	0.08% (100%)	0.08	0.07% (100%)	0.02
	Common thresher shark	0.08% (92%)	0.08	0	0
	Pacific electric ray	0.06% (100%)	0.06	0.03% (100%)	0.01
	American shad	0.05% (100%)	0.05	0.3% (100%)	0.08
	Sculpin, unidentified	0.03% (100%)	0.03	0.1% (100%)	0.04
	Thornback skate	0.03% (100%)	0.03	0.07% (100%)	0.02
	Spotted ratfish	0.02% (100%)	0.02	0.1% (100%)	0.04
	Croaker, unidentified	0.02% (100%)	0.02	0	0
	Sixgill shark	0.02% (100%)	0.02	0	0
	Striped bass	0.02% (100%)	0.02	0	0
	Lingcod	0.01% (88%)	0.01	0.3% (74%)	0.10
	Longnose skate	0.01% (97%)	0.01	0.03% (100%)	0.01
	Rex sole	0.01% (67%)	0.01	0.03% (100%)	0.01
	Chinook salmon	0.01% (100%)	0.01	0.0% (100%)	0.00
	White sturgeon	0.01% (100%)	0.01	0	0
	Starry skate	0.00% (100%)	0.00	0.3% (100%)	0.09
	Longspine combfish	0% (100%)	0.00	0.2% (100%)	0.05
State	Dungeness crab	18.6% (100%)	10.21	49.7% (100%)	6.83
	Jellyfish	11.5% (100%)	6.32	5.9% (100%)	0.81
	Bat ray	17.4% (100%)	9.51	7.6% (100%)	1.04
	Big skate	10.9% (95%)	5.99	2.0% (100%)	0.27
	California skate	1.7% (100%)	0.95	0.9% (100%)	0.13
	Leopard shark	1.6% (99%)	0.87	0.0% (100%)	0.00
	Graceful crab	1.3% (100%)	0.73	1.0% (100%)	0.14
	Skate, unidentified	0.9% (67%)	0.49	0.7% (100%)	0.09
	Brown Smoothhound shark	0.8% (100%)	0.45	0.07% (100%)	0.01
	Hornyhead turbot	0.7% (50%)	0.36	0.4% (100%)	0.05
	Shovelnose guitarfish	0.6% (100%)	0.33	1.2% (100%)	0.16
	White croaker	0.6% (100%)	0.33	0.2% (100%)	0.03
	Soupfin shark	0.5% (87%)	0.29	0	0
	English sole	0.4% (100%)	0.22	0.4% (100%)	0.05
	Pacific sanddab	0.4% (100%)	0.22	0.2% (100%)	0.03
	Shark, unidentified	0.3% (95%)	0.19	N/A	
	Sheep crab	0.2% (100%)	0.13	1.5% (100%)	0.21

		2011		2010	
Trawl sector	Species	% of total catch (% discarded)	Catch (mt)	% of total catch (% discarded)	Catch (mt)
	Thornback skate	0.2% (100%)	0.12	0.1% (100%)	0.02
	Pacific Angel shark	0.2% (100%)	0.11	0.6% (100%)	0.08
	Pacific Electric ray	0.2% (100%)	0.09	0.7% (100%)	0.09
	Spiny dogfish shark	0.1% (100%)	0.08	0.2% (100%)	0.03
	Longspine combfish	0.1% (100%)	0.08	0.1% (100%)	0.02
	Yellow Rock crab	0.1% (100%)	0.08	0.1% (100%)	0.02
	Fantail sole	0.1% (100%)	0.07	0.4% (100%)	0.05
	California scorpionfish	0.07% (100%)	0.04	0.1% (100%)	0.02
	Curlfin turbot	0.07% (100%)	0.04	N/A	
	Barred Sand bass	0.07% (100%)	0.04	0	0
	Armored Box crab	0.05% (100%)	0.03	0.2% (100%)	0.03
	Crab, unidentified	0.05% (53%)	0.03	0.1% (100%)	0.02
	Common thresher shark	0.05% (100%)	0.03	N/A	
	Lingcod	0.05% (100%)	0.03	0.0% (100%)	0.00
	Longnose skate	0.05% (100%)	0.03	0.0% (100%)	0.00
	Decorator crab	0.05% (100%)	0.03	0	0
	Sevengill shark	0.05% (100%)	0.03	0	0
	Red Rock crab	0.04% (100%)	0.02	0.8% (100%)	0.11
	Starry skate	0.04% (100%)	0.02	0.2% (100%)	0.03
	Green sturgeon		0.02	0	0
	Sculpin, unidentified	0.04% (100%)	0.02	0	0
	Spotted ratfish	0.02% (100%)	0.01	0.07% (100%)	0.01
	Swell shark	0.02% (100%)	0.01	0.07% (100%)	0.01
	Petrale sole*	0.02% (100%)	0.01	0.0% (100%)	0.00
	Rock sole	0.02% (88%)	0.01	0.0% (100%)	0.00
	American shad	0.02% (100%)	0.01	0.0% (100%)	0.00
	Giant sea bass	0.02% (100%)	0.01	0	0
	Northern anchovy	0.02% (100%)	0.01	0	0
	Pacific Staghorn sculpin	0.02% (100%)	0.01	0	0
	Specklefin midshipman	0.02% (100%)	0.01	0	0

Dungeness Crab (*Metacarcinus magister*)

Certification Units Considered Under this Species:

- California Trap fishery

Summary

Dungeness crab was the highest value fishery in California during the 2011-12 commercial fishing season. The commercial fishery is managed by the state Legislature using the "3-S principle" – restricting take by sex, season, and size. Formal fishery management plans and stock assessments have not been produced for any West Coast population, though a "healthy" status has been assigned since landings have fluctuated around a moderately stable long-term mean for over 30 years. California, Oregon, and Washington Dungeness crab fisheries coordinate and develop consistent and potentially complementary management actions under a tri-state committee, and the Dungeness Crab Task Force (DCTF) was established in California to review and evaluate Dungeness crab management measures and makes recommendations to the Joint Committee on Fisheries and Aquaculture, the Department of Fish and Wildlife, and the Fish and Game Commission. California has created a pot limitation program to be implemented in the 2013-14 commercial fishing season. As of 2010, the Oregon Dungeness crab commercial trap fishery is certified sustainable by the Marine Stewardship Council (MSC). If California pursues certification, Oregon will serve as an excellent example.

Strengths:

- Relatively stable landings for over 30 years
- High value fishery in California
- High observed mating success of Dungeness crab
- DCTF established to make management recommendations
- Trap limitation program to be implemented for 2013-14 season will reduce impacts on marine habitats
- Traps have low habitat impacts
- Management measures largely coordinated among CA, OR, and WA

Weaknesses:

- No formal stock assessments
- Reference points not explicit
- Long-term fishery objectives and research plan unclear
- Bycatch data not collected

History of the Fishery in California

Biology of the Species

Dungeness crab, *Metacarcinus magister* (formerly *Cancer magister*), are endemic from Alaska to Magdalena Bay, Baja California though are rarely seen south of Santa Barbara, CA (CDFW 2001). Water temperature determines their distribution, and the 38° to 65° F (3° – 18° C) surface isotherms are considered the limits of the range. The geographic range of the species probably depends more on the restricted thermal tolerance range of larvae than of adults. This species has a preference for sandy to sandy-mud bottoms but may be found on almost any bottom type. Dungeness crabs may range from the intertidal zone to a depth of at least 750 feet (229 meters), but are not abundant beyond 300 feet (91 meters).

Crab mating occurs from March to July in offshore locations. After female crabs have molted, a male deposits a spermatophore inside a female, which contains sperm that is viable for up to several years (Hankin et al. 1989). Female eggs are fertilized upon extrusion during September to November (Orcutt et al. 1976; Wild 1983), after which they are carried beneath an abdominal flap for 60 – 120 days. Development of early stages is temperature-dependent and decreases in duration from north to south along the coast. A single brood may contain from one to two million eggs (Wild 1983), and a female may produce three to four broods during her lifetime. Larvae shed their outer skeleton (molt) through five planktonic zoeal stages (Poole 1966; Reed 1969; Lough 1976), and can be transported 3.1 – 3.7 miles (5 – 6 kilometers) offshore. Larvae metamorphose into megalopae and then settle as juveniles in shallow coastal waters and estuaries that provide nursery grounds for young crabs. Juveniles typically molt 11 to 12 times before reaching sexual maturity in approximately 2 to 3 years (Butler 1960; Butler 1961). Most adults reach marketable size in about 4 years and have a maximum lifespan of 8 to 10 years (Hankin et al. 2001). Food sources for adults include clams, crustaceans and fish (Gotshall 1977).

Commercial Fishery

The Pacific Ocean fishery for Dungeness crab is administered in the State waters of California, Oregon, Washington and Alaska in the exclusive economic zone (EEZ) adjacent to those States. The California commercial fishery occurs in two main areas: northern and central California (divided at the Sonoma-Mendocino border). Central California fishing areas include Santa Barbara, Avila-Morro Bay, Monterey, Half Moon Bay and San Francisco-Bodega Bay. Northern California fishing grounds extend from Fort Bragg to the California-Oregon border, with the prime area located between Eureka and Crescent City.

Dungeness crab populations undergo cyclic fluctuations due to varying oceanic conditions, including wind-driven currents, ocean temperature, and food availability (Higgins et al. 1997; WDFW 2006; Hankin and Warner 2001). As a result, Dungeness crab landings in California have experienced periods of highs and lows (Figure 1; CDFG 2001). Total statewide Dungeness crab landings for the past 50 seasons have averaged 10.3 million pounds (4700 metric tons), 12.7 million pounds (5800 metric tons) for the past 20 seasons, and 16.0 million pounds (7300 metric tons) for the past 10 seasons (CDFG 2011). Four of the top five record seasons have occurred in the past ten years. A new statewide record of 31.7 million pounds (14,370 mt) was landed in the 2011-12 season.

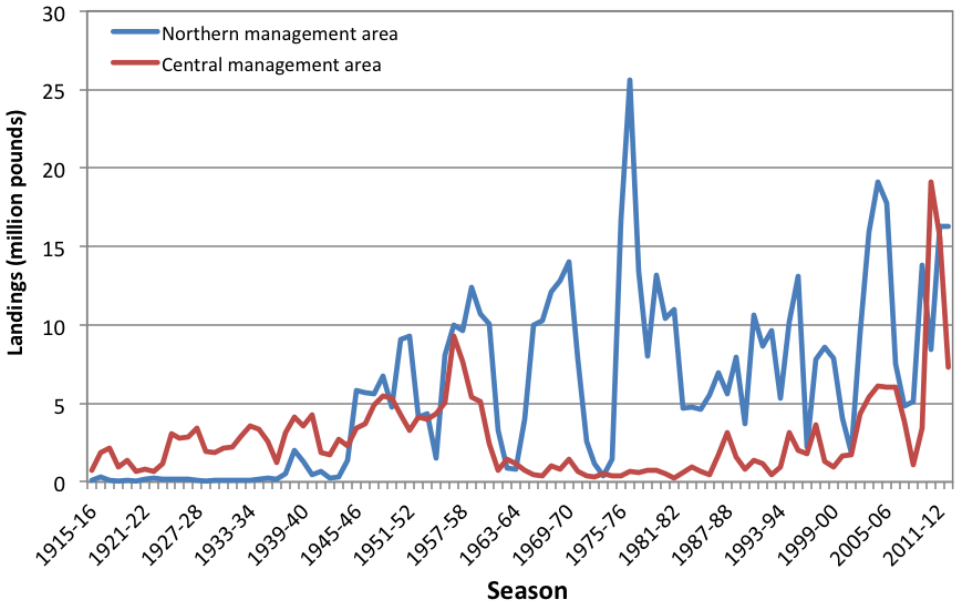

Figure 1. Dungeness crab commercial landings by season (1915-16 – 2012-13) and management region (divided at the Mendocino/Sonoma County line), all gear types combined (CDFG 2011).

Ex-vessel value (price paid to the fishermen for their catch) during the past 10 seasons has averaged $30.4 million, maintaining Dungeness crab as one of the most valuable fisheries in California (CDFG 2011). For the past 10 years Dungeness crab has ranked first compared to all other commercial fisheries in ex-vessel value for the following years: 2003, 2004, and 2006, and second after market squid for all other years. The 2011-12 catch was valued at $94.9 million ($2.99/lb), a record for Dungeness crab.

In California, commercial Dungeness crab is caught using traps. The traps are made from 2 circular iron frames 3 to 3.5 feet (0.9-1.1 meters) in diameter that are connected with spokes on the outer edges. The frame is wrapped with strips of rubber and the entire frame is enmeshed with stainless steel wire. Two entrance tunnels fitted with trigger bars prevent escapement of larger crabs and every trap must contain at least two escape ports with openings not less than 4.25 inches (10.8 centimeters) for the purpose of decreasing the likelihood of catching and retaining the generally smaller females and sublegal males. In the event the trap is not recovered, traps are equipped with a destruct device to allow the eventual escape of all crabs (CDFG 2011). Steel traps weigh 60 to 120 pounds (27 – 54 kilograms) and usually fished at depths from 60 to 240 feet (18 – 73 meters) overnight or longer, depending on sea conditions and regulations. The fishery includes vessel lengths from 22 -100 feet (7 – 30 meters) (CDFG 2004).

Recreational Fishery

The California Dungeness crab recreational fishery is regulated by the Fish and Game Commission (FGC), which controls take by season, daily bag limits, gear and size. Historically, California Recreational Fisheries Sampling (CRFS) have informally estimated the recreational catch at about one percent of commercial catch (CDFG 2011). However, due to the sparse sampling efforts, this number may not be an accurate representation. Recently, the CRFS

program began opportunistic sampling of the Dungeness crab catch for Catch Per Unit Effort (CPUE), size and sex ratios beginning with the 2009-10 season. However, due to funding restrictions the sampling is not rigorous enough to create reliable estimates of catch and effort at this time. Recreational catch is generally accepted by managers to be lower than commercial catch, in part based on Commercial Passenger Fishing Vessel (CPFV) logbook data (P. Kalvass, CDFW, pers.comm.).

The recreational fishery is open from November through June. Both sexes may be taken (unlike the commercial fishery), the bag limit is 10 crabs and the size limit is 5.75 in carapace width, except when fishing from a commercial passenger fishing vessel in Sonoma, Marin, San Francisco, San Mateo, Santa Cruz and Monterey counties, when the size limit is 6 in and the bag limit is 6 crabs.

MSC Principle 1: Health of Fish Stock

*Sustainability of Target Stock

The California Department of Fish and Wildlife (CDFW) (formerly, the California Department of Fish and Game prior to 2013) and the other west coast fishery agencies do not conduct formal stock assessments for Dungeness crab primarily due to the stochastic nature of recruitment that appears to be minimally linked to fishing pressure. This fact and the high costs associated with a formal stock assessment would not make for a cost-effective assessment (P. Kalvass, CDFW, pers. comm.). As a result, current population abundance and occurrence of overfishing in Dungeness crab fisheries are unknown, and biological reference points are not designated for this fishery. The Oregon Dungeness crab fishery used an age structure model a yield-per-recruit (YPR) and eggs-per-recruit to evaluate trade-offs in yield, and recommended a limit reference point (Heppell 2009):

"Recommended LRP: Decline in catch sustained over 4 years (approximately 1 generation time) and an overall reduction in catch of >=80% from the 20 year average (approximately 5 generations; current floor would be 2.8 million pounds)."

However, the major shortcoming of this LRP is that it is based on catch rather than an index of abundance.

Exploitation rates indicate from 80% to 90% of all legal-sized male crabs (typically one or two year classes) are captured annually in the fishery, but studies suggest this does not translate into decreased mating success for females (Hankin et al., 1997). Virtually all sexually mature females are fertilized each year and the size limit allows the males to spawn at least once, thus it may not be cost effective to conduct stock assessments for this species (P. Kalvass, CDFW, pers. comm.).

California populations have produced landings that have fluctuated around a moderately stable long-term mean for over 30 years. Although landings experienced dramatic and periodic cycles from around 1945 to 1982 (Figure 1), researchers suggest changes in climate and other oceanographic factors (including warming) and increased pollution in the San Francisco Bay as likely explanations for the observed fluctuations. It is probable that crab populations, similar to other crustacean populations such as Pacific shrimp, experience large natural variations in abundance since crabs produce large amounts of eggs and have vulnerable early life stages. In the past 4 – 5 years, CDFW researchers in association with UC Davis Wildlife Health Center at

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Bodega Marine Lab have been conducting Dungeness crab megalopae trapping studies utilizing light traps to attract megalopae at night, and monitored daily to obtain an index of abundance during the spring transition (CDFG 2011). Megalopae have been captured in Bodega Bay, Fort Bragg's Noyo Harbor, and in Humboldt Bay from about mid March to July, though results are not yet available (CDFG 2011; P. Kalvass, CDFW, pers. comm.).

The Dungeness crab fisheries along the coastal western states are considered sustainable due in part to the combination of a simple but effective fishery management scheme optimized by crab life history (CDFG 2011). Dungeness crabs exhibit life history characteristics that make them inherently resilient to fishing pressure, as they have a low age at first maturity, a short lifespan, and high fecundity (Table 1). It has been hypothesized that because the males also mature before they recruit to the fishery, there is no evolutionary pressure towards smaller size at age, as often is seen in finfish as a result of fishing selectivity (Field, NOAA Southwest Fisheries Science Center, pers. comm.). However, to definitively determine if variation in landings is a result of changes in abundance or differences in effort per season, it is necessary to examine CPUE data. CDFW do not collect CPUE data, so although stocks are believed to be healthy there is lack of empirical evidence to support this conclusion based solely on landings data. In the most recent 2012-13 season, researchers at Oregon State University obtained tissue samples for genetic analysis of Dungeness crab during the preseason testing to explore genetic connectivity of West Coast Dungeness crab stocks, though results are not yet available (P. Kalvass, CDFW, pers. comm.). Previous research suggests there is weak connectivity and likely genetic separation between the states (Toonen and Grosberg, 2003). Oregon State University and three west coast state's fish and wildlife agencies have initiated a collaborative project to further examine the population genetic structure of Dungeness crab off the west coast which will provide a higher degree of spatial and genetic resolution (ODFW, 2013)

Table 1. Life history characteristics of Dungeness crab (Hankin et al. 2001; Pauley et al. 1989; CDFG 2011).

Age at Maturity	Max Age	Max Size	Fecundity	Species Range
2-3 years	8-10 years	Males: 8.6 in (22 cm) CW; Females: 6.3 in (16 cm) CW	0.5-2 million eggs per brood	Aleutian Islands to Santa Barbara

Evaluation against MSC Component 1.1: Sustainability of Target Stock

MSC Performance Indicators	Rating	Justification
1.1.1 Stock Status [1]		Landings have fluctuated around a moderately stable long-term mean; stock assessments not conducted, though fishery is generally considered healthy due to management measures and crab life history characteristics
1.1.2 Reference Points		No designated reference points or landings limits, but other management measures in place ('3-S' principle, limited entry)
1.1.3 Stock Rebuilding		Was not assessed

Harvest Strategy (Management)

The west coast Dungeness crab fishery is conducted in both state (0-3 nautical miles from shore) and federal (3-200 nautical miles) waters of Oregon, Washington and California. Most fishing is conducted within 50 miles (80 kilometers) from shore (ODFW 2006c). A fishery spanning both state and federal zones is normally managed through a federal fishery management plan (FMP) developed through a regional fishery management council, with explicit state-federal coordination. The Dungeness crab fishery is an exception to this rule. Section 302(e) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) exempts the Dungeness crab fishery from the requirement of a federal FMP and instead authorizes the states of California, Oregon, and Washington to adopt and enforce state laws and regulations governing Dungeness crab fishing and processing in the federal exclusive economic zone adjacent to each state. California, Oregon and Washington share many management concerns and have the ability to discuss and align management of Dungeness crab through the Tri-State Dungeness Crab Committee which is overseen by the Pacific States Marine Fisheries Commission, and a Memorandum of Understanding is in effect among the three states in setting size, sex, and season limits (U.S. House of Representatives 1998; Anon. 2005; CDFG 2012c; CDFG 2011). To date, California has had less success in passing legislation to update and streamline the management of the Dungeness crab fishery in coordination with Oregon and Washington. As of 2010, the Oregon Dungeness crab commercial trap fishery is certified sustainable by the Marine Stewardship Council (MSC) (MSC 2010).

Currently, Dungeness crab management plans and stock assessments have not been produced for any West Coast populations. Landing quotas have never been used in this fishery, however the limited entry program limits the number of permits issued each season. Commercial Dungeness crab management relies on the "3-S" principle (sex, season and size restrictions), and is considered successful since males can reproduce several times before reaching legal size, females are protected and the season is set to avoid molting and mating periods and make sure crabs are ready for harvesting. In the northern region, a delay of season opening may be authorized based on quality tests of the stock, conducted in concert with tests in Washington and Oregon. The states then mutually agree on whether to delay the opening of the season in

[1]This includes one of the two performance indicators (PI 1.1.1) that the California certification will require a higher score (80) than MSC.

order to let the crabs accumulate more body meat. Seasonal openings differ between regions since central California crabs typically molt earlier and achieve adequate market condition earlier than northern region crabs due to the temperature dependence of crab development.

In 2009, pursuant to Senate Bill (SB) 1690, the Dungeness Crab Task Force[1] was established in California. The DCTF is composed of commercial and recreational Dungeness crab fishermen from ports between Morro Bay and Crescent City and crab processors, as well as non-voting members from CDFW, Sea Grant, and non-governmental organizations (CDFG 2011). The DCTF is charged with making recommendations on commercial and recreational management measures such as trap limits, fleet size reduction, and season opening date changes, among others, to the Legislature's Joint Committee on Fisheries and Aquaculture, CDFW, and FGC. Through the efforts of the DCTF, new legislation was passed in 2011, which re-established the DCTF and implemented trap limits on commercial Dungeness crab vessel permit holders. The trap limit program is scheduled to take effect by the 2013-14 season which will limit the number of traps allowed per permitee based on a their total catch from a consecutive five-season period.

Commercial permits are required on all commercial fishing vessels that use Dungeness crab traps, and a permitee is allowed to fish only in the state, or management region within a state, for which that permit is designated; additionally, catch does not have to be landed in the state from which the permit was issued. In 1995, a limited entry program was implemented which limits the total number of permits in the fishery. As of 2012, there are currently less than 600 permits, with approximately 450 active permits (CDFG 2012c). Crab traps must contain escape openings for sub-legal males that do not meet catch regulations, and must also possess a destruction device that will release crabs should the trap become lost or derelict. Recreational crabbing is not allowed from vessels licensed for commercial Dungeness crab fishing (CDFG 2012a).

Evaluation against MSC Component 1.2: Harvest Strategy (Management)

MSC Performance Indicators	Rating	Justification
Harvest Strategy (PI 1.2.1)		The 3-S principle limits take by sex, season and size; limited entry; Trap limits to be implemented starting for the 2013-14 season
Harvest Control Rules and Tools (PI 1.2.2)		3-S principle, gear restrictions, limited entry permitting, season closures
Information/Monitoring (PI 1.2.3)		Landings data, fishery dependent and independent research, logbooks
Assessment of Stock Status (PI 1.2.4)		Stock assessments are not performed; Megalopae trapping studies currently being conducted to assess abundance but results not yet available

[1]More information about the Dungeness crab task force may be found on Ocean Protection Council's website: http://www.opc.ca.gov/2009/04/dungeness-crab-task-force/

MSC Principle 2: Impact on Ecosystem

Retained Species

Traps

Incidental catch is reportedly low but an unquantified number of octopuses are often kept (P. Kalvass, CDFW, pers. comm.). Octopuses are allowed incidentally in several fisheries though no direct octopus fishery is allowed. Legislation in 2009 permits the incidental commercial take of other rock crab species in Dungeness crab traps and Dungeness crab in rock crab traps, provided that all crabs retained are in season and fishermen possess the proper licenses and permits (CDFG 2011). Any fish may be taken incidentally in crab traps being used to take Dungeness crab; data on the species and number retained are likely available from landings receipts (CDFG 2012a).

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		Low levels of octopus retained but not quantified; any fish may be taken incidentally in traps – species and quantity unknown; likely green but more information is necessary
2.1.2 Management		Qualitative reports suggest incidental catch is minimal; octopus are allowed incidentally; unclear which fish species are retained; likely green but more information is necessary
2.1.3 Information		Landings receipts; likely green but information is currently inaccessible

Bycatch Species

Traps

Non-target species captured in the California Dungeness crab fishery are known synoptically but are not quantified. Bycatch is perceived to be very low by managers; thus no effort is made to record information on non-target catch when it occurs and, to date, no consistent studies have been done that address non-target species in the Dungeness crab fishery (MSC 2010). According to Harrington et al. (2005), pot/trap fisheries produce less bycatch than most fisheries (MSC 2010). Bycatch is minimized by characteristics of the gear and the style of harvest. For instance, Valdemarsen and Suuronen (2001) point out that traps initiate selectivity through the use of bait that has the potential to attract the target species and/or repel unwanted organisms. Moreover, catch of non-target species is reduced by design elements, including mesh sizes and the size, shape, location(s) and design of pot entrances and escape openings (Valdemarsen and Suuronen 2001). Occasionally, sublegal male Dungeness crabs, lingcod, sculpins, flat fish, rockfish, and sea stars are caught in the pots, but they either exit through the pots' escape mechanisms or are discarded alive at sea (Kalvass, CDFW, pers. comm.). Dungeness crab

bycatch that dies relative to landings is less than 5%, however for soft shell crabs, mortality has been reported as high as 22% to 25% (Alverson et al. 1994). Since the Northern season does not open until shells are harder, this is not a major issue in this region. Additionally, egg-bearing female Dungeness crabs typically bury themselves in the sand and do not enter traps. In the most recent 2012-13 season, federal groundfish observers collected preliminary data on bycatch rates in the Dungeness crab fishery during preseason testing, although this data is not yet available (Kalvass, CDFW, pers. comm.). Although trap gear may be highly selective, the lack of data on bycatch rates in the California Dungeness crab fishery make it difficult to assess if the fishery poses a risk of serious or irreversible harm to bycatch species.

Evaluation against MSC Component 2.2: Bycatch Species

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch is low but not quantified; likely green but more empirical data is needed on species and quantities discarded to determine if the fishery poses a risk to bycatch
2.2.2 Management		Bycatch is low and many species can be discarded alive, however rates are unknown; likely green but more data is necessary on species discarded to determine what management measures exist
2.2.3 Information		Preseason observer data collected for 2012-13 season; likely green but information is currently inaccessible

*Endangered, Threatened, & Protected Species

Traps

National Marine Fisheries Service (NMFS) classifies all U.S. commercial fisheries into one of three categories (I, II, III) based on the level of serious injury and mortality of marine mammals that occurs in each fishery. NMFS List of Fisheries (LOF) classified the California Dungeness crab trap fishery as a category II, indicating occasional incidental mortality or serious injury of marine mammals. Humpback whales (*Megaptera novaeangliae*) and gray whales (*Eschrichtius robustus*) may occasionally become entangled in Dungeness crab fishing gear (NMFS 2012; MSC 2010). The two serious injury humpback whale entanglement events (occurring from 2002-2006) could not be identified to a trap fishery by gear type, although the Dungeness crab fishery operates with similar gear in the same location as the confirmed humpback whale entanglement events (NMFS 2012). Similarly, NMFS had not determined which specific fisheries were involved in the entanglements of gray whales in trap gear (NMFS 2012). However, the Dungeness crab fishery is the largest fishery with trap gear in California and along the west coast (around 400,000 pots allowed to fish each year) and approximately 10% of these pots are lost each year; thus it is highly likely that pot entanglements are a consequence of this fishery (PFMC 2013).

Two additional species, bocaccio (*Sebastes paucispinus*) and cowcod (*Sebastes levis*), may

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

also interact with Dungeness crab fisheries (MSC 2010). However, no records were available describing these two particular species as bycatch in crab pots in the Oregon Dungeness crab fishery. While traps may be highly selective, there is some evidence to suggest that crab traps are responsible for periodic entanglements and may pose some risk to endangered, threatened and protected species.

Evaluation against MSC Component 2.3: ETP Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		NMFS category II fishery indicates occasional incidental mortality of marine mammals
2.3.2 Management		Management measures exist to protect ETP species, including CEQA, Migratory Bird Act, Marine Mammal Protection Act
2.3.3 Information		Logbooks

Habitats

Traps

The coastal Dungeness crab fishery is for the most part conducted in areas of low relief and low complexity (MSC 2010). Most commercial fishing occurs in nearshore waters with silty sand to sandy bottoms less than 40 m deep, habitats less affected by fishing activity than structurally complex habitats (PFMC 1978; Kaiser et al. 2001). Morever, these habitats tend to be more prone to natural disturbance, such as wave, surge, current and tidal forces that may disturb and/or redistribute material. Kaiser et al. (2001) suggests that benthic communities adapted to high levels of natural disturbance have shorter recovery trajectories than more structurally complex habitats and may be less likely to experience long-term shifts in community structure or composition as a result of fishing (MSC 2010). Dungeness crabs are captured with traps, which are not highly mobile, so although they are bottom gear, they have contact with a substantially smaller area of the seafloor than do other gears. Traps can affect habitat, however, because they do not always remain entirely stable on the seafloor. They bounce off the seafloor in the presence of large swells, and get dragged across the bottom when being removed, especially during a storm or when traps are stuck in the sand, and may dislodge sessile organisms or disturb biogenic structures (Morgan and Chuenpagdee 2003; MSC 2010). Moreover, some estimates suggest that as many as 10% of traps are lost each year as a consequence of fishing in inclement weather (PFMC 2013)

The impact of fishing gear on habitat also depends on the spatial scale of the fishery because although each trap may have a small impact, the cumulative effect of thousands of traps can be larger (Morgan and Chuenpagdee 2003). While it is unclear what impact the density of Dungeness crab traps have had on the west coast, a new pot limitation program is being established in California and will be implemented for the 2013-14 season that may reduce the impact of traps.

While there is some data indicating minimal impacts to low complexity habitat, more empirical evidence may be necessary for the California Dungeness crab fishery should they pursue MSC

certification.

Evaluation against MSC Component 2.4: Habitats

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Trap impacts are moderate, likely do not irreversibly damage the seafloor but more empirical evidence is necessary in California to support this assertion
2.4.2 Management		Measures in place to limit habitat impacts (area and seasonal closures); trap limitation program to be implemented for the 2013-14 season which may reduce the impact of traps
2.4.3 Information		Trap impacts are documented in several research studies, but none specific to habitats in California

Ecosystem

The Marine Life Management Act (MLMA) sets out an underlying goal of conserving entire systems. It is not simply exploited populations of marine life that are to be conserved, but the species and habitats that make up the ecosystem of which they are a part. Rather than focusing on single fisheries management, the MLMA requires an ecosystem perspective including the whole environment.

The '3-S' management approach is generally believed to provide adequate opportunity for sexually mature male Dungeness crabs to mate for one to two years before reaching legal fishery size. Although a study conducted in the British Columbia Dungeness crab fishery, which also has a minimum size limit, suggested that heavy exploitation of large males in the fishery can greatly reduce the amount of mating opportunities for females resulting in low or no egg production (Smith and Jamieson 1991), research on Northern California Dungeness crabs indicated that intense fishing of male crabs did not impair mating success of females (Hankin et al, 1997).

Dungeness crabs consume a wide variety of food organisms and are prey to numerous predators. Crabs contribute to several trophic levels as they progress through successive life stages. The larvae largely consume plankton (Lough 1976) and are preyed upon by numerous fishes. Adults and juveniles are preyed upon by sea otters, fishes, and octopuses (Butler 1954; Waldrom 1958; Stevens 1982; Reilly 1983; Kimker 1985). In their various life stages, Dungeness crabs feed on a variety of mollusks, crustaceans, and fish species (Stevens et al. 1982). The impacts of fishing mortality on the ecosystem inhabited by Dungeness crab are unclear.

Another concern in the trap fishery is "ghost fishing" when pots are lost or abandoned but continue to fish. Annual percentage of commercial traps lost has been estimated at 10% for the Oregon fishery and 11% (Breen 1987) in other Dungeness crab fishing sectors (SCS 2010). Dungeness crab fisheries have adopted regulations that require escape rings and time release devices (e.g., biodegradable meshes or cord ties on trap doors) that allow crab to escape from

derelict traps. Moreover, derelict gear removal programs have been undertaken in some areas and continue to be discussed by the DCTF.

While existing management measures (including Marine Protected Areas) may indirectly benefit ecosystem health, direct measures to assess ecosystem impacts of Dungeness crab fishing are lacking. The California Dungeness crab fishery likely does not cause serious or irreversible harm to key elements of ecosystem structure and function, though more information is necessary to support this assertion.

Evaluation against MSC Component 2.5: Ecosystem

MSC Performance Indicators	Rating	Justification
2.5.1 Outcome		Likely does not cause irreversible harm to ecosystem, but no quantitative measures available to assess
2.5.2 Management		MLMA contains ecosystem based management goals; MPAs will protect some habitat; destructive devices to prevent ghost fishing
2.5.3 Information		Some data available on retained, bycatch species, and habitat impacts, however more information is needed to assess

MSC Principle 3: Management System

Governance and Policy

The California Legislature manages various fisheries within state waters, including commercial Dungeness crab. Once the Legislature adopts a regulation and it is signed into law, Fish and Game Code or the Public Resources Code is amended to reflect any new management changes (OPC 2011). The recreational fishery is managed by FGC and placed in Title 14 of the California Code of regulations. CDFW is responsible for enforcement of regulations for both fisheries.

Any changes to the current commercial management regime must be done by introducing a bill into the state legislature. After introduction, the bill goes through a process of hearings, reading, reviewing, and amending. If approved by the houses, the bill is given to the Governor for final approval. Once the Governor signs the bill, it becomes law and amends either Fish and Game Code or the Public Resources Code. Once the bill becomes law, CDFW is the body that enforces the new regulations. Regulations must comply with the goals and objectives outlined in the Marine Life Management Act (MLMA), including (but not limited to) sustainability, limited bycatch and habitat conservation.

Evaluation against MSC Component 3.1: Governance and Policy

MSC Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		A management system exists - changes to fishery must be done by introducing a bill into legislature – a process of hearings, reviews and amending
3.1.2 Consultation, Roles and Responsibilities		State management authority clearly defined; Legislative process is open to interested parties
3.1.3 Long-term Objectives		Goals and objectives outlined in Marine Life Management Act
3.1.4 Incentives for Sustainable Fishing		Sustainability is an underlying goal of the Marine Life Management Act

Fishery Specific Management System

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) exempts the Dungeness crab fishery from the requirement of a federal FMP, recognizing a fiscal burden on taxpayers, and detraction from efforts to conserve and manage other species. Instead, it authorizes the states of California, Oregon and Washington to adopt and enforce state laws and regulations governing Dungeness crab fishing and processing in the federal exclusive economic zone adjacent to each state. Under the MSA, California, Oregon and Washington have jurisdiction over their respective permit holders and permit conditions (such as gear and seasons) as well as control over conditions for making landings within a state.. Regulatory issues that affect more than one state's fishery are negotiated through the Tri-State Dungeness Crab Committee coordinated by the Pacific States Marine Fisheries Commission (PSMFC). The Committee comprises one member from each state management agency, each with five industry advisors, and is chaired by the PSMFC. The committee signed an interstate Memorandum of Understanding (MOU) stating that all 3 state management agencies will develop consistent and complementary management actions for Dungeness crab. There is concern that although CDFW are represented on the Committee, they don't have authority to change regulations in concert with Oregon and Washington. In addition, Washington and Oregon vessels are allowed to fish in California waters, and while steps have been taken to address this with amendments to the MSA that give authority to the three states to manage the fishery (Dungeness Crab Conservation and Management Act in 1998), the concern may not be fully resolved.

The PSMFC is required to submit to the Senate Committee on Commerce, Science and Transportation and the House Committee on Resources a biennial report on the status and management of the fishery including:

- stock status and trends throughout its range;
- description of the research and scientific review processes used to determine stock status and trends; and
- measures implemented or planned to prevent or end overfishing.

The DCTF was established in California in 2009, pursuant to SB 1690, and re-established by SB 369, to review and evaluate Dungeness crab management measures and make recommendations related to Dungeness crab fishery to the Legislature's Joint Committee on Fisheries and Aquaculture, the Department of Fish and Wildlife, and the Fish and Game Commission. The DCTF is comprised of the following stakeholders: commercial and recreational fishermen, crab processors, commercial passenger fishing vessels, non-governmental organizations (NGOs), as well as representatives from California Sea Grant and CDFW. The DCTF is expected to generate recommendations addressing the need for a permanent task force; the economic impact of the trap limit program; the cost of the program to CDFW, including enforcement costs; refining commercial and sport Dungeness crab management; and the need for statutory changes to accomplish task force objectives (CDFW 2011).

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

MSC Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		No well defined goals or objectives – lacking measure of overfishing, target or limit reference points or biomass thresholds
3.2.2 Decision-making Processes		Changes to fishery must be done by introducing a bill into legislature – a process of hearings, reviews and amending; the DCTF does provide recommendations for the Legislature, CDFG, and FGC
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		No research plan due to lack of funding – OR has a plan (ODFW 2013)
3.2.5 Management Performance Evaluation		No formal evaluation of management; the DCTF does review management measures and make recommendations

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "Bycatch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available.

Recommendations

California may want to consider working with Oregon (whose Dungeness crab fishery is already certified) and Washington as well as MSC to certify the fishery for the entire west coast. This may result in reduced costs for certification and recertification in the future for all three states. If California pursues certification, Oregon will serve as an excellent example.

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Appendix A

MSC Assessment Tree			Dungeness Crab
			Trap
Principle	**Component**	**Performance Indicator**	**All**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status	
		1.1.2: Reference points	
		1.1.3: Stock rebuilding	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy	
		1.2.2: Harvest control rules	
		1.2.3: Info/ monitoring	
		1.2.4: Stock assessment	
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status	
		2.1.2: Mgmt strategy	
		2.1.3: Information	
	By-catch species	2.2.1: Status	
		2.2.2: Mgmt strategy	
		2.2.3: Info	
	ETP species	2.3.1: Status	
		2.3.2: Mgmt strategy	
		2.3.3: Info	
	Habitats	2.4.1: Status	
		2.4.2: Mgmt strategy	
		2.4.3: Info	
	Ecosystem	2.5.1: Status	
		2.5.2: Mgmt strategy	
		2.5.3: Info	
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework	
		3.1.2: Consultation, roles, and responsibilities	
		3.1.3: Long term objectives	
		3.1.4: Incentives for sustainable fishing	
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives	
		3.2.2: Decision making process	
		3.2.3: Compliance & enforcement	
		3.2.4: Research plan	
		3.2.5: Management performance evaluation	

Market Squid (*Loligo (Doryteuthis) opalescens*)

Certification Units Considered Under this Species:

- California round haul fishery (purse and drum seine)
- California brail fishery

Summary

In terms of volume and revenue, market squid (*Loligo (Doryteuthis) opalescens*) represents one of the most important commercial fisheries in California, generating millions of dollars of income annually from domestic and foreign sales. Market squid is managed by the state, consistent with federal fishery management guidelines. Because squid live less than a year and die after spawning, there is difficulty in assessing annual recruitment or estimating stock biomass. Bycatch rates are low, and the majority of incidental catch is other coastal pelagic species (CPS).

Strengths:

- Low incidental catch and bycatch
- Managed under a state FMP and monitored under a federal FMP
- New analytical approach to estimate abundance of the spawning population (Dorval et al. 2013)

Weaknesses:

- Catch limits are fixed
- Biomass is largely influenced by environmental factors
- Market squid are an important forage species - more information is needed to determine how current harvest levels impact the ecosystem

History of the Fishery in California

Biology of the Species

Squid belong to the class Cephalopoda of the phylum Mollusca (CDFG 2005). There are approximately 750 recognized species of squid alive today and more than 10,000 fossil forms of cephalopods. Squid have large, well-developed eyes and strong parrot-like beaks. They use their fins for swimming in much the same way fish do and their funnel for extremely rapid "jet" propulsion forward or backward. The squid's capacity for sustained swimming allows it to migrate long distances as well as to move vertically through hundreds of meters of water during daily foraging (feeding) bouts.

Market squid, *Loligo (Doryteuthis) opalescens*, range from the southern tip of Baja California, Mexico (23° N latitude) to southeastern Alaska (55° N latitude) (CDFG 2005). Juveniles and adults range throughout the California and Alaska Current systems (Roper and Sweeney 1984). Paralarvae, the life stage of market squid at the time of hatching, are often collected closer to shore (Zeidberg and Hamner 2002). Their distribution is patchy, yet if squid are found at one site, it is likely that additional squid will be found in close proximity (known as contagious distribution).

Market squid generally have a mixed, iridescent (opalescent) coloration of milky white and purple; however, color changes occur rapidly in response to environmental conditions (CDFG 2005). Similar to most squid species, market squid possess an ink sac, which serves as a defense mechanism by expelling ink to confound predators. Market squid are less than 3 mm (0.1 in) at hatching and grow to an average mantle length of 152 mm (6 in) at the time of spawning. Squid have eight arms and two longer feeding tentacles. Males are larger and more robust than females. Squid predominantly recruit in spring–summer in northern California (Monterey) and in autumn–winter in southern California, along the Channel Islands (Reiss et al. 2004; Foote et al. 2006). Following recruitment, mature squid aggregate in shallow coastal waters, where females lay egg cases in clutches for approximately 2–3 days and die soon after spawning (Jackson 1998; Macewicz et al. 2003). A female squid off California can produce approximately 20 egg capsules each containing around 200 eggs and are attached individually to the sea floor. The sustainability of the California market squid population is highly dependent on seasonal recruitments. In California, commercial fisheries target adults during spawning events.

Squid feed on copepods as juveniles gradually changing to euphausiids, other small crustaceans, small fish and other squid as they grow (Karpov and Cailliet 1987). They are also an important part of the food web and are food for many species including pinnipeds, cetaceans, sea birds, and fish (Morejohn et al. 1978).

Commercial Fishery

The California fishery for market squid was established over 130 years ago in Monterey Bay, central California (Vojkovich 1998). The fishery expanded into southern California after the 1950s, but remained relatively minor until the late 1980s, when worldwide demand for all squid species increased. Landings in California prior to 1987 rarely exceeded 20,000 metric tons (mt) (22,046 short tons (st)). Since then, landings have increased fourfold, and squid is now one of the state's largest fisheries in both tons landed and market value (Vojkovich 1998; CDFG 2012b).

There are two major fishery areas in California. The northern fishery consists of Monterey Bay and areas near Half Moon Bay with most squid landed at Monterey and Moss Landing. The southern fishery covers multiple port regions including Channel Islands and coastal areas from Point Conception to La Jolla. The major southern ports include Santa Barbara area (Ventura and Port Hueneme) and the Los Angeles area (San Pedro and Terminal Island). Since the 1993-94 season, much of the revenue has come from the Santa Barbara and Los Angeles port complexes, with the highest revenue from San Pedro, Port Hueneme and Ventura (PFMC 2011a). In the Monterey area, the fishery is most active during the summer months; whereas in southern California, the majority of market squid landings take place during winter months (CDFG 2012b). Landings in the southern region typically exceed the north (CDFG 2005; CDFG 2008). In 2011, the market squid fishery was the largest in California, both in terms of volume and value (CDFW 2012b). In 2012, over 97,076 mt (107,007 st) of market squid were landed in the calendar year, with an ex-vessel value of $68.3 million (Figure 1) (personal communication). In 2012-13 season, the commercial fishery was closed mid-season for the third season in a row.

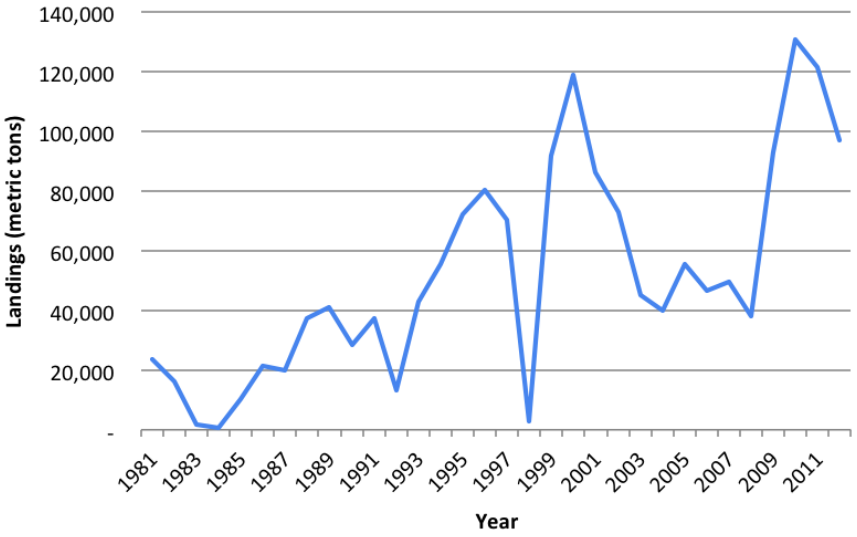

Figure 1. Market squid landings (northern and southern fisheries combined) by fishing season (1 April-31 March) from 1980-81 to 2011-12 seasons (personal communication).

The presence of market squid is strongly correlated with environmental factors, such as water temperature and nutrient availability (CDFG 2011a). In warm water years and during El Niño conditions, squid become scarce and landings decline. However, when water temperatures cool, even after severe warm water events, market squid numbers can rebound quickly and dramatically.

Fishing for market squid typically occurs on shallow-water spawning aggregations. Gear used in the fishery includes purse and drum seines, and less frequently brail gear, including dip and scoop nets (Table 1; CDFG 2005). Lampara gear has been used historically in the fishery but became obsolete once the use of purse and drum seines was legalized, thus it is not being considered in the rapid assessment (CDFG 2005). Light boats are used in tandem with the seiners to attract and aggregate spawning squid to surface waters (CDFG 2005). A light boat is typically a smaller vessel with several high-powered lights located at various levels around the vessel. In 2012, 42 brail permits, 36 light boat permits, 77 vessel permits and zero experimental permits were issued (CDFW 2013b).

Table 1. Market squid gear type description. (CDFG 2005)

Gear type	Description
Purse seine	A round haul net with a "purse" line to close the bottom of the net. One end is attached to a skiff and the deploying vessel encircles the squid. The other end of the net is brought to the deploying vessel and the purse line is drawn, closing the bottom of the net to prevent escaping squid.
Drum seine	Like a purse seine, but a large drum stores, deploys and retrieves the net.
Lampara	A round haul net with the sections of netting made and joined to create bagging. The net is pushed beneath squid to encircle it from each side. The "wings" of the net are pulled back to the boat and the squid end up in the bag portion of the net. This gear has no arrangement for pursing.
Brail	A large dip net sometimes used with the assistance of the vessel's hydraulics.

Market squid are also taken by the commercial live bait industry to supply the California recreational fishing industry, primarily in southern California (CDFG 2005). Live bait catch is largely dependent on local availability, and is sold by vessels either at sea or at live bait dealerships in several harbors statewide. Since the sale of live bait in California is not documented in a manner similar to that used for the commercial sale of squid, estimates of tonnage and value are only available via voluntary live bait logs. Present market squid regulations do not require a squid permit when fishing for live bait. It is assumed the take of live bait is minor, but the actual amount of squid taken as live bait is unknown.

Recreational Fishery

Market squid may be taken recreationally with hand-held dip nets (CDFW 2013a). There is no limit, closed seasons, closed hours or minimum size limits. Sport fishing vessels and privately owned skiffs catch squid for bait by using attracting lights and brail nets and/or rod and reel. Recreational landings records are not kept.

MSC Principle 1: Resource Sustainability

*Sustainability of Target Stock

The status of the population is not fully understood (CDFG 2008). Market squid live on average only 6–9 months (Butler et al. 1999), and the population fluctuates markedly from year to year, largely in apparent response to environmental factors. During El Niño events, the fishery has declined precipitously by an order of magnitude and more. However, it recovers typically within a few years, particularly in response to La Niña events (Zeidberg et al. 2006). Because market squid are a short-lived and highly fecund species, it seems to be able to recover from dramatic decreases in the population in a short period of time. The preponderance of evidence indicates that these dramatic fluctuations are more likely due to changes in abundance than mere shifts in availability to the fishery (Reiss et al. 2004). Evidence from studies on paralarvae, egg beds, behavior, genetics, and catch data suggest biomass is large, and at times, may constitute the largest population of any single marketable species in California's coastal environment. Genetic analyses have indicated no significant differences between the southern California and Monterey populations, suggesting that there are not two distinct stocks between the two fisheries (CDFG 2008).

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

The Egg Escapement Method has been used as an assessment tool, to evaluate population dynamics and biological reference points for market squid (Dorval et al. 2008). The estimates of egg escapement are evaluated in the context of a “threshold” that is believed to represent a minimum level that is considered necessary to allow the population to maintain its level of abundance into the future (i.e., allow for “sustainable” reproduction year after year). In practical terms, the Egg Escapement approach can be used to evaluate the effects of fishing mortality (F) on the spawning potential of the stock, and in particular, to examine the relation between the stock’s reproductive output and candidate proxies for the fishing mortality that results in maximum sustainable yield (FMSY). ‘Escapement’ in this sense is defined as the proportion of a female squid’s lifetime fecundity that is spawned, on average, before the female is captured in the fishery (PFMC 2011a). Recent research efforts have developed an analytical approach for computing estimates of absolute abundance of the spawning population using relatively limited information, i.e. catch and biological time series data, and fishing mortality estimates inferred from the eggs-per-recruit methods (Dorval et al. 2013). Although time demanding, this per-recruit analysis represents a potentially effective approach for monitoring reproductive outputs and for aiding stock status determinations of harvested market squid (Dorval et al. 2013). At maximum peaks of abundance, the total spawning stock, including both female and male market squid, may range between 215,000 and 254,000 mt (236,996 and 279,987 st) in a single quarter in southern regions (Santa Barbara and San Diego). In some cases, stock biomass varied by region from one to two orders of magnitude. The current state-imposed catch limit of 107,048 mt (118,000 st) represents an annual quota for the entire California fishery in a fishing season (CDFG 2005).

There are concerns about overexploitation during the periodic downturns of the population (Zeidberg et al. 2006). Catch per unit effort (CPUE), a relative measure of abundance, has been relatively steady, but CPUE is generally unreliable as a proxy for stock biomass, particularly for a fishery with evolving gear technology (greater efficiency over time) and that targets spawning aggregations (Hilborn and Walters 2001). The impact of the fishery on the population has been recently modeled (Dorval et al. 2013). Increasing fishing mortality (F) was estimated to decreases in proportional egg escapement. In cases when F was kept constant, an increase in natural mortality (M) resulted in an increase in catch fecundity and proportional egg escapement. Studies indicate that market squid endure very high natural mortality rates, and the adult population is composed almost entirely of new recruits made up of multiple cohorts. Even in the absence of fishing, the entire stock replaces itself semi-annually, so the stock is entirely dependent on successful spawning from each generation coupled with good survival of recruits to adulthood.

Evaluation against MSC Component 1.1: Sustainability of Target Stock

MSC Performance Indicators	Rating	Justification
1.1.1 Stock Status		Biomass has been recently estimated for some seasons (Dorval et al. 2013), however populations fluctuate markedly from year to year due to environmental variables making it difficult to determine the status of the stock
1.1.2 Reference Points		Proxies for a limit reference point* and a target reference point*.
1.1.3 Stock rebuilding		Did not assess

*MSC evaluations define a Limit Reference Point (LRP) and a Target Reference Point (TRP). These represent the minimum biomass of a stock, below which might endanger self-renewal, and the maintenance of the stock at levels consistent with BMSY, respectively. For market squid, a proxy for the LRP could be the maximum fishing mortality threshold (MFMT), set at: FMSY resulting in egg escapement ≤ 30%; a proxy for TRP is the MSY, set at: FMSY resulting in egg escapement ≥ 30% (PFMC 2011b).

Harvest Strategy (Management)

Market squid is managed by the state, consistent with federal fishery management guidelines (Coastal Pelagic Species Fishery Management Plan (CPS FMP)). In 2005, the Fish and Game Commission (FGC) adopted the Market Squid Fishery Management Plan (MS FMP), which implemented a series of fishery control rules and a restricted access program that limits the number of fishing permits. The fishery control rules currently in place under the California MS FMP are thought to preclude the need for active management under the CPS FMP (PFMC 2011a).

The goals of the MS FMP are to provide a framework that will be responsive to environmental and socioeconomic changes and to ensure long-term resource conservation and sustainability (CDFG 2005). The tools implemented to accomplish these goals include:

1. setting a fixed seasonal catch limit of 107,048 mt (118,000 st) to prevent the fishery from over-expanding (based on an average catch over a 3 year period from 1999-00 to 2001-02 seasons) (Restrepo et al. 1998; CDFG 2005),

2. maintaining monitoring programs designed to evaluate the impact of the fishery on the resource,

3. continuing weekend closures that provide for periods of uninterrupted spawning,

4. continuing gear regulations regarding light shields and wattage used to attract squid,

5. establishing a restricted access program that includes provisions for initial entry into the fleet, permit types, permit fees, and permit transferability that produces a moderately productive and specialized fleet, and

6. creating a seabird closure restricting the use of attracting lights for commercial purposes in any waters of the Gulf of the Farallones National Marine Sanctuary. Under this framework, the MS FMP provides the Commission with specific guidelines for making management decisions.

The following are the harvest control rules for market squid (CDFG 2005; PFMC 2011b):

MFMT	F_{MSY} Resulting in Egg Escapement ≤ 30%
MSY	F_{MSY} Resulting in Egg Escapement ≥ 30%
ABC	F_{MSY} Resulting in Egg Escapement ≥ 30%
California State Seasonal Catch Limit	118,000 st (107,047 mt)

MFMT: Maximum Fishing Mortality Threshold; the level of fishing mortality (F), on an annual basis, above which overfishing is occurring.
MSY: Maximum Sustained Yield; the largest long-term average catch that can be taken from a stock under prevailing ecological, environmental and fishing conditions.
ABC: Acceptable Biological Catch; the range of allowable catch for a species
ACL: Annual Catch Limit

Regulations state that commercial fishing for market squid is not allowed between noon on Friday and noon on Sunday of each week; however, vessels taking squid for live bait purposes are exempt. Vessels using light to attract squid can use a maximum of 30,000 watts and must use shields that cast light directly downward. Use of lights is prohibited for all vessels taking squid in the Gulf of the Farallones National Marine Sanctuary. The Commission has established a statewide seasonal catch limitation based on a multi-year recent average catch. The California Department of Fish and Wildlife (CDFW) will estimate, given current landing trends, when the catch limit will be reached and will publicly announce a date of fishery closure.

The Commission has decided to continue the existing squid monitoring programs, including fishery-dependent sampling efforts and ongoing monitoring of catch information, especially those focused on developing management models. The adopted project also maintains CDFW logbook system for squid vessels and light boats. These records provide valuable catch information other than landing data. These monitoring programs (port sampling and logbooks) are designed to enable learning more about the fishery and resource and are intended to aid in the development of population models to sustain harvests (CDFG 2005).

Evaluation against MSC Component 1.2: Harvest Strategy

MSC Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Fixed seasonal catch limit - fishery is shut down once limit is projected to be reached; Management structure and strategy is robust
1.2.2 Harvest Control Rules and Tools		Egg escapement threshold used as a proxy for F_{MSY}; Restricted access, seasonal catch limit, weekend closures, area closures, gear restrictions
1.2.3 Information/Monitoring		Fishery dependent and independent sampling, ongoing catch monitoring data available (logbooks, observers, port sampling); Data collected to aid stock status determinations
1.2.4 Assessment of Stock Status		No stock assessment (inherent difficulties in assessing a stock that is short-lived); Recent research has developed an approach for computing estimates of the spawning population, though approach is not fully utilized to date

MSC Principle 2: Impact on Ecosystem

Retained Species

Purse and Drum Seines

Roundhaul gear consists of encircling type nets, which are deployed around a school of fish or part of a school (PFMC 2011a). When the school is surrounded, the bottom of the net may be closed, then the net drawn next to the boat. The area including the free-swimming fish is diminished by bringing one end of the net aboard the vessel. When the fish are crowded near the fishing vessel, pumps are lowered into the water to pump fish and water into the ship's hold.

Roundhaul fishing results in small quantities of unintentionally caught fish, primarily because the fishermen target specific schools, which usually consists of one species. The load is pumped out of the hold at the dock, where the catch is weighed and incidentally-caught fish can be observed and sorted. Because pumping at sea is so common, any incidental catch of small fish would not be sorted at sea. The presence or absence of incidental catch has been documented through CDFW's port sampling program (all gear types combined) but actual amounts of incidental catch are not quantified with this monitoring (PFMC 2011c). Market squid typically school with similarly sized fish, and the most common incidental catch in the coastal pelagic species (CPS) fishery is another CPS (e.g., Pacific mackerel, Pacific sardine fishery, northern anchovy and jack mackerel). None of these species, including Pacific sardine, Pacific mackerel, are considered overfished or otherwise jeopardized by the market squid fishery (PFMC 2011a).

During a pilot observer program conducted by National Marine Fisheries Service Southwest Region (NMFS-SWR) on seine vessels from 2004-08, the most incidentally caught species, Pacific mackerel, was less than 2% of total squid landings during that time (Table 3). In 2010, less than 1% of roundhaul market squid landings (by tonnage) included reported incidental catch of CPS (PFMC 2011c). Similar to previous years, most of this catch was other pelagic species, including Pacific sardine and mackerel, and kelp was also observed frequently.

While not specifically impacting the ecosystem, a concern in the market squid fishery is incidental catch of market squid egg capsules, which may affect the stock itself. In 2011, approximately 8.4% of sampled landings contained squid egg cases (PFMC 2011d). Under the proposed management strategy, the fishery is monitored by evaluating escapement of squid eggs from the fishery. If the fishery damages squid spawning beds, and this damage is a significant source of egg mortality, the monitoring program will be biased unless this additional source of mortality is accounted for.

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		Retained species catch is low and primarily consists of other CPS
2.1.2 Management		Coastal pelagic species (see 2.1.1 Outcome) are managed or monitored under the PFMC's CPS FMP
2.1.3 Information		CDFW port sampling, logbooks, landing receipts; NMFS-SWR CPS pilot observer data (2004-08)

Brail

The brail fleet produces only a small fraction of the overall take of market squid. The hydraulic brail (scoop) net is used onboard vessels that are usually smaller than seiners. Because brail vessels are compact and more maneuverable, they are used in shallower depths that are closer to shore and in areas where seiners are prohibited (e.g., Santa Monica Bay and the mainland side of Catalina Island) (Brady 2008).

CDFW's port sampling program documents the presence of incidental catch. As stated above, the majority of incidental catch in the squid fishery are other coastal pelagic species (e.g., Pacific mackerel, Pacific sardine, northern anchovy and jack mackerel) (PFMC 2011d). None of these species, including Pacific sardine or Pacific mackerel, are considered overfished or otherwise jeopardized by the market squid fishery (PFMC 2011c). Since the brail fleet is responsible for a small portion of total market squid landings in California, along with data to suggest most incidental catch consists of other CPS (managed under the CPS FMP), it is unlikely that the brail fishery poses a risk of serious or irreversible harm to retained species.

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		Retained species catch is low and primarily consists of other coastal pelagic species
2.1.2 Management		Coastal pelagic species (see 2.1.1 Outcome) are managed or monitored under the PFMC's CPS FMP
2.1.3 Information		CDFW port sampling, logbooks, landing receipts, NMFS-SWR CPS pilot observer data (2004-08)

Bycatch Species

Purse and Drum Seine

During a CPS pilot observer program conducted by NMFS-SWR on seine vessels from 2004-2008, the majority of non-target species consisted of other CPS (anchovy, jack and Pacific mackerel, sardine), but also infrequently included benthic (bottom-dwelling) species such as stingrays, bat rays, brittle stars, and croaker (Table 2; PFMC 2011c; PFMC 2011d). If larger fish are in the net, they can be released alive before pumping by lowering a section of the cork-line or by using a dip-net. Grates can be used to sort larger non-CPS from the catch.

Since many bycatch species can be discarded live at sea, along with some observed data to suggest bycatch is low, it is unlikely that the seine fishery poses a risk of serious or irreversible harm to bycatch species.

Evaluation against MSC Component 2.2: Bycatch

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch is low, can be discarded live
2.2.2 Management		Bycatch is low, many species covered under the groundfish FMP
2.2.3 Information		Logbooks, NMFS SAFE reports, NMFS-SWR CPS pilot observer data (2004-08)

Brail

NMFS-SWR pilot observer data from seine vessels suggests the majority of non-target species consisted of other CPS, but also infrequently included benthic species (PFMC 2011c). Because brail vessels often fish in areas closer to shore, the pilot observer data may not be representative of the brail fleet. However since the brail fleet produces only a small fraction of the overall take of market squid, it is unlikely that the brail fishery poses a risk of serious or irreversible harm to bycatch species though more data may be necessary if the fishery were to pursue MSC certification.

Evaluation against MSC Component 2.2: Bycatch

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch is likely low, species can be discarded live, but more data is necessary for the brail fleet
2.2.2 Management		Bycatch is likely low, many bottom-dwelling species are covered under the groundfish FMP
2.2.3 Information		Logbooks

Table 2. Catch summary for seine vessels targeting market squid from NMFS-SWR coastal pelagic species pilot observer program, 2004-2008. (NMFS 2011d)

Target species - Squid					
Species	Target Catch	Incidental Catch	Bycatch Returned		
			Alive	Dead	Unknown
Squid	1274 mt		28 mt	350 lbs	2 mt
Anchovy		100 lbs	120 lbs		
Jack Mackerel		2 mt	18 lbs	2 lbs	
Pacific Mackerel		20 mt	20 mt	180 lbs	1 lb
Sardine		12 mt	13 mt	1077 lbs	3 lbs
Spanish Mackerel		20 lbs			
Bat Ray			53		1
Bat Star			1		
Blue Shark			2		
Common Mola			1		
Pelagic Stingray			60		
Pacific Butterfish		19			1
Sunstar		30	4		
Squid Eggs					505 lbs
Lobster			3		
Brittle Star				3000	
Unid. Batfish				2 lbs	
Unid. Crab		1	1		93
Unid. Croaker		3	2	16 lbs	
Unid. Flatfish		1	1	6	2
Unid. Jellyfish		4			
Unid. Mackerel		2 lbs	102 lbs		
Unid. Octopus		1			
Unid. Rockfish		1	1	4	
Unid. Ray			4		1
Unid. Sanddab		4	3		4
Unid. Seastar		1			
Unid. Seaslug					21
Unid. Scorpionfish		1			
Unid. Surfperch				3	
Unid. Skate		3		1	
Unid. Smelt		49			
Unid. Stingray		9	17		
Unid. Shark					1
Thresher Shark		1			
CA Sea Lion			98		
Harbor Seal			3		
Common Dolphin				1	
Unid. Gull			16	1	

*Endangered, Threatened, and Protected Species

Purse and Drum Seine

NOAA National Marine Fisheries Service (NMFS) classifies all U.S. commercial fisheries into one of three categories (I, II, III) based on the level of incidental serious injury and mortality of marine mammals that occurs in each fishery (NMFS 2012). The California squid purse seine fishery has occasional interactions with endangered, threatened and protected species, including long-beaked common dolphin, California short-beaked common dolphin, California sea lions, and harbor seals (Table 2; NMFS 2012); however, it is listed as a category III fishery (remote likelihood of/no known incidental mortality or serious injury of marine mammals). Given the NMFS's 2012 LOF classification it is unlikely that the California seine fishery poses a risk of serious or irreversible harm to endangered, threatened and protected species.

Evaluation against MSC Component 2.3: Endangered, Threatened & Protected Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		NMFS category III fishery, ETP species impacts are low, though occasional interactions with dolphins, sea lions and seals
2.3.2 Management		Measures exist, including Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act, to protect ETP species
2.3.3 Information		Observer data from 2004-2008; logbooks; NMFS SAFE reports; NMFS LOF

Brail

NOAA National Marine Fisheries Service (NMFS) classified the California market squid brail (dip net) fishery as category III, indicting no documented interactions with marine mammal species (NMFS 2012). Given the NMFS's 2012 LOF classification, it is unlikely that the California brail (dip net) fishery poses a risk of serious or irreversible harm to endangered, threatened and protected species.

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Evaluation against MSC Component 2.3: Endangered, Threatened & Protected Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		NMFS category III fishery, ETP species impacts are low, no documented interactions with marine mammals
2.3.2 Management		Measures exist, including Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act, to protect ETP species
2.3.3 Information		NMFS SAFE reports; NMFS LOF

Habitats

Purse and Drum Seine

The east-west geographic boundary of essential fish habitat (EFH) for market squid is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the exclusive economic zone (EEZ) and above the thermocline where sea surface temperatures range between 10˚ C to 26˚ C (50˚ to 79˚ F) (CPSMT 2010). The southern boundary of the geographic range of all CPS is consistently south of the US-Mexico border, indicating a consistency in sea surface temperatures (SSTs) below 26˚ C (79˚ F), the upper thermal tolerance of CPS. Therefore, the southern extent of EFH for CPS is the US-Mexico maritime boundary. The northern boundary of the range of CPS is more dynamic and variable due to the seasonal cooling of the SST. The northern EFH boundary is, therefore, the position of the 10˚ C (50˚ f) isotherm, which varies both seasonally and annually.

Appendix D of the CPS FMP (PFMC 1998) notes that contact between roundhaul gear (purse seines) and substrate is rare in fishing for CPS finfish and market squid, because fishing usually occurs in water deeper than the height of the net. Thus, the only opportunity for damage to benthos or essential fish habitat for any species in fishing for CPS finfish is from lost gear. There is potential for fishing to impact squid spawning grounds because market squid attach their egg cases to the bottom substrate at spawning sites that include shallow, nearshore areas. Such damage is not believed to be extensive and is transitory with regard to the habitat.

Evaluation against MSC Component 2.4: Habitat

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Habitat damage from roundhaul gear is not believed to be extensive
2.4.2 Management		Temporal and spatial area closures, gear restrictions
2.4.3 Information		Logbooks, observer information

Brail

Unable to assess habitat impacts from brail gear – lack of data.

Evaluation against MSC Component 2.4: Habitat

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		No data, however likely green since brail gear only scoops from the surface of the water
2.4.2 Management		Temporal and spatial area closures, gear restrictions
2.4.3 Information		Logbooks

Ecosystem

Market squid are an integral part of the food web to many marine vertebrates (Figure 2). Fish, seabirds, and marine mammals all utilize squid as a prey item. Squid has been documented as an important dietary component of the northern elephant seal, northern fur seal, California sea lion (Lowry and Carretta 1999), Dall's porpoise, Pacific striped dolphin, Risso's dolphin, toothed whales such as the short-finned pilot whale (Hacker 1992), the sperm whale, and the bottlenose whale (Fields 1965). In addition, seabirds such as the common murre, ashy storm-petrel, black storm-petrel, fork-tailed storm-petrel, and rhinoceros auklets feed on market squid (Morejohn et al. 1978). In Monterey Bay, 19 species of fish were found to feed upon market squid, including many commercially important species such as Pacific bonito, salmon, halibut, and tuna (Fields 1965, Morejohn et al. 1978). These fishes include all depleted, threatened, and endangered salmon stocks along the coast. In fact predators from many trophic levels utilize both small pelagic fishes, such as northern anchovy and sardine, and squid as either a primary or supplementary food source (CDFG 2005).

Market squid feed on a variety of prey during their life cycle (CDFG 2005). As larvae and juveniles, squid consume copepods and euphasiids. These fast-moving prey items are a challenge to young squid; they enhance the development of prey-capture and escape skills (Preuss and Gilly 2000). As adults, market squid feed on fish, polychaete worms, squid (cannibalism), and crustaceans such as shrimp and pelagic red crab. Also, squid are found in commercial catches of anchovies, sardines, herring, mackerel, and sauries where they feed with and most likely upon these fish (Fields 1965).

Under the Marine Life Management Act (MLMA), CDFW must consider ecosystem impacts of a fishery, namely the conservation of not only the exploited species, but the other species that depend on that resource. At present, the dynamics of many of these trophic relationships for squid are not well understood. In addition, the FGC has a Forage Fish Policy that envisions management of forage species that (1) optimizes their ecological, economic and social values, (2) accounts for the benefits rendered by forage species to other species, fisheries, wildlife, and the overall ecosystem, and (3) considers recreational and commercial fishing interests and other economic sectors. The Commission intends to provide adequate protection for forage species through management goals. At this stage however, more information is needed to understand how or if the current management measures protect the ecosystem structure and function.

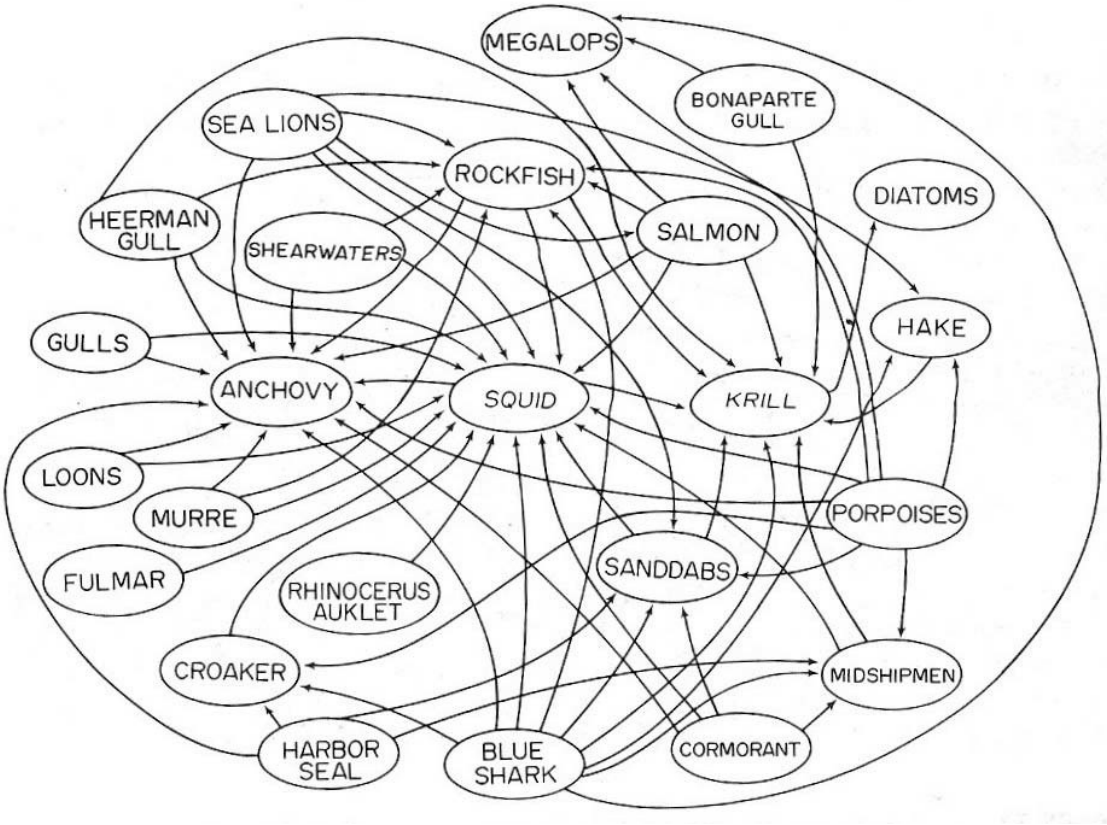

Figure 2. Food web for market squid, *Loligo (Doryteuthis) opalescens*, involving commercially important or abundant fish, birds, and marine mammals (Morejohn et al. 1978).

Evaluation against MSC Component 2.5: Ecosystem

MSC Performance Indicators	Rating	Justification
2.5.1 Outcome		Squid are an important forage species, more information is needed to determine how current harvest levels impact the ecosystem; annual catch limit is currently fixed based on a 3 year average catch
2.5.2 Management		MLMA; The FGC has a Forage Species policy
2.5.3 Information		Trophic interactions are not fully understood

MSC Principle 3: Management System

Governance and Policy

In state waters (0-3 miles offshore), the FGC manages various fisheries through measures that include but are not limited to determining seasons, catch limits, and methods of take. In each case, the FGC holds regular open public meetings throughout the state to receive and consider individual and group input prior to adoption of new or changed regulations. Recommendations also come from CDFW. Once the FGC votes to adopt a regulation, CDFW is responsible for enforcing it. CDFW implements management plans, provides technical expertise, manages fishery regulations and coordinates the implementation of policy state-wide. CDFW is responsible for providing recommendations to the FGC and carrying out research that informs these recommendations or other management decisions by the Legislature. CDFW is also responsible for enforcing the fish and game regulations mandated by the FGC, the Legislature, and the federal government. The Legislature can increase the FGC's powers by delegating further regulatory and management authority. The MLMA governs the way the majority of FGC fisheries are managed.

Market squid is included in the Federal CPS FMP as a monitored species. The Pacific Fishery Management Council is one of eight regional fishery management councils established by the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSA). The Guidelines for Fishery Management Plans (FMPs) published by the National Marine Fisheries Service (NMFS) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each FMP (PFMC 2011c). SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries being managed under federal regulation. Regional Fishery Management Councils use this information to determine annual harvest levels for each stock, document significant trends or changes in the resources, marine ecosystems, and fishery over time, and assess the relative success of existing state and federal fishery management programs.

Evaluation against MSC Component 3.1: Governance and Policy

MSC Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		The FGC must operate under the MLMA; PFMC and NMFS must operate under Magnuson-Stevens Act
3.1.2 Consultation, Roles and responsibilities		The FGC holds public meetings prior to adoption of new regulations; CDFW responsible for implementing and enforcing both state and federal regulations
3.1.3 Long-term Objectives		Goals and objectives detailed in MLMA, Magnuson-Stevens Act and FMPs
3.1.4 Incentives for Sustainable Fishing		Sustainability is an underlying goal of the MLMA, MSA

Fishery Specific Management System

In 2001, legislation transferred the authority for management of the market squid fishery to the FGC. Legislation required that the FGC adopt a market squid fishery management plan and regulations to protect and manage the resource. In August and December of 2004, the FGC adopted the MSFMP, consistent with the federal management by the Pacific Fishery Management Council. The goals of the MSFMP are to provide a framework that will be responsive to environmental and socioeconomic changes and to ensure long-term resource conservation and sustainability.

Under this framework, the MSFMP provides the FGC with specific guidelines for making management decisions. The FGC has the ability to react quickly to changes in the market squid population off California and implement management strategies without the need for a full plan amendment. The MSFMP framework was also designed to achieve the goals and objectives of the MLMA. The MLMA of 1998 created policies, goals, and objectives to govern the conservation, sustainable use and restoration of California's living marine resources. The MLMA gave the FGC and CDFW specific authorities, goals, objectives, and mandates for managing marine resources (CDFG 2005). The MSFMP must also be consistent with the management outlined in CPS FMP Amendment 10.

The FGC established that the Director of CDFW may create an advisory committee when necessary to assist CDFW with development and review of fishery assessments, management options and proposals, and Plan amendments (CDFG 2005). This squid fishery advisory committee must include representatives from industry, science, and the environmental community. The committee can assist CDFW by providing recommendations regarding the effectiveness of adopted squid management.

The MLMA requires periodic review of management measures because environmental, social, and economic changes may lead to consideration of regulatory changes under the framework described above (CDFG 2005). If CDFW determines that current management of the market squid fishery is not meeting the goals of the MSFMP, CDFW will present the results of this review to the advisory committee(s) established under the MSFMP to seek their views and recommendations. CDFW will then present its recommendations and views of the advisory committee(s) to the FGC regarding the need for changes in management of the market squid fishery. CDFW needs to present the rationale, data and analyses in support of its recommendations for regulatory changes. The advisory committee(s) may also make management recommendations to CDFW. The FGC will then determine whether to consider an amendment to the MSFMP or a full rulemaking action for the regulations implementing it.

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

MSC Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		Outlined in the CPS FMP and MSFMP
3.2.2 Decision-making Processes		MLMA gave the Commission and CDFW specific authorities, goals, objectives, and mandates for managing marine resources
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		CPS FMP and MSFMP detail monitoring plans, however they have not been fully implemented to date
3.2.5 Management Performance Evaluation		MLMA requires periodic review of management measures; the Commission may create advisory committee to review and develop management options and amendments

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available.

Recommendations

Because market squid are short lived and highly fecund species it seems to be able to recover from dramatic decreases in the population in a short period of time; however, if harvest was

reduced during such low productivity periods the stock may be able to recover even faster when conditions improved.

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Appendix A

MSC Assessment Tree			Market Squid	
			Round Haul	Brail
Principle	**Component**	**Performance Indicator**	**All**	**All**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status		
		1.1.2: Reference points		
		1.1.3: Stock rebuilding	*Did not assess*	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy		
		1.2.2: Harvest control rules		
		1.2.3: Info/ monitoring		
		1.2.4: Stock assessment		
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status		
		2.1.2: Mgmt strategy		
		2.1.3: Information		
	By-catch species	2.2.1: Status		
		2.2.2: Mgmt strategy		
		2.2.3: Info		
	ETP species	2.3.1: Status		
		2.3.2: Mgmt strategy		
		2.3.3: Info		
	Habitats	2.4.1: Status		
		2.4.2: Mgmt strategy		
		2.4.3: Info		
	Ecosystem	2.5.1: Status		
		2.5.2: Mgmt strategy		
		2.5.3: Info		
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework		
		3.1.2: Consultation, roles, and responsibilities		
		3.1.3: Long term objectives		
		3.1.4: Incentives for sustainable fishing		
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives		
		3.2.2: Decision making process		
		3.2.3: Compliance & enforcement		
		3.2.4: Research plan		
		3.2.5: Management performance evaluation		

Pacific Herring (*Clupea pallasi*)

Certification Units Considered Under this Species:

- San Francisco Bay gill net

Summary

Pacific herring are found throughout the coastal zone, from northern Baja California, around the rim of the North Pacific Basin, to Korea on the Asian coast. California's herring fisheries occur in the Crescent City Harbor area, Humboldt Bay, Tomales Bay, and San Francisco Bay. Historically the roe-fishery has been a very small export market to Japan; however, in San Francisco Bay herring as fresh fish has been gaining local market interest due to a desire for locally produced seafood. The commercial fishery is one of the few fisheries in California that undergo annual population assessments and subsequent regulatory change. This allows management to integrate new information and set harvest targets on a timely basis. Fishery managers are currently working to develop a fishery model to ensure harvest targets are appropriate and further safeguard the spawning stock so that overfishing does not occur.

Strengths:

- Annual assessments are conducted using fishery independent data
- Conservative annual harvest quotas; set at ≤5% of spawning biomass since 2010
- Strong collaborative working relationship between fishery managers and fishing industry (industry funded the "Herring Research Association" which assists fishery managers)

Weaknesses:

- Assessment methods need to be reviewed to ensure they are appropriate for managing the stock
- No information on retained, bycatch or ETP species
- No information on habitat impacts from the fishery

History of the Fishery in California

Biology of the Species

[From CDFG 2006]: Pacific herring are found throughout the coastal zone (waters of the continental shelf) from northern Baja California on the North American coast, around the rim of the North Pacific Basin and Korea on the Asian coast. In California, herring are found offshore during the spring and summer months foraging in the open ocean. Beginning as early as October and continuing as late as April, schools of adult herring migrate inshore to bays and estuaries to spawn. Schools first appear in the deep water channels of bays to ripen (gonadal maturation) for up to two weeks, then gradually move into shallow areas to spawn. Historically, known spawning areas in California include San Diego Bay, San Luis River, Morro Bay, Elkhorn Slough, San Francisco Bay, Tomales Bay, Bodega Bay, Russian River, Noyo River, Shelter Cove, Humboldt Bay, and Crescent City Harbor. The largest spawning aggregations in California occur in San Francisco and Tomales Bays. Most of these spawning areas are characterized as having reduced salinity, calm and protected waters, and spawning-substrate such as marine vegetation or rocky intertidal areas. Spawning occurs in the intertidal and shallow subtidal zones, when males release milt into the water column.

Fecundity is 226 eggs per gram of body weight, and a large female herring may lay 40,000 to 50,000 eggs. Spawn depth distribution is generally shallower than 30 ft (9 m), but has been found to a depth of 60 ft (18.3 m) in San Francisco Bay. Immediately after spawning the adult herring leave the bay, returning to the open ocean. Embryos (fertilized eggs) hatch in approximately 10 days, depending on temperature and salinity. During the incubation period, embryos are vulnerable to predation by marine birds, fish, and invertebrates. They may also die from desiccation or freezing if exposed during low tidal cycles. Human induced causes of mortality at this stage include smothering caused by suspended sediments from dredging, and toxic anti-fouling agents such as creosote on pier pilings. Herring embryos hatch into larvae, which metamorphose into juvenile herring. The distribution of larval herring in bays and estuaries is not well documented, but juvenile herring in San Francisco Bay are usually found throughout the central portion of the bay by mid-water trawl research vessels. Juveniles typically remain in the bay until summer or early fall, when they migrate to the open ocean.

Herring distribution while in the ocean is not well understood, though Canadian research conducted on herring in Georgia Straight, British Columbia (BC) suggests that 1- and 2-year old herring occupy inshore waters and older herring occupy shelf waters. Some herring reach sexual maturity at age two when they are about 7 in (18 cm) in length; all are sexually mature at age three. California herring can live to 9 years old and reach a maximum length of about 10 in (25 cm). However, it is extremely rare to find fish that are older than 7 years of age.

While in the ocean, adult herring feed on macroplankton such as copepods and euphausiids. Larval and juvenile herring are believed to feed on molluscan larvae and other zooplankton while in bays and estuaries. Herring are a forage species for a diverse group of marine fishes, birds, and mammals. Spawning events in particular provide an opportunity for feeding. As herring move into shallow water to spawn, a feeding frenzy may commence which can last for several days. Gulls, cormorants, pelicans and other marine birds; California and Stellar sea lions, harbor seals, invertebrates and a variety of fishes (including sturgeon in San Francisco Bay) feast on adult herring and embryos.

Commercial Fishery

The herring fishery is primarily a sac-roe fishery in California; however a portion of the annual quota is allocated to the fresh fish fishery and herring eggs on kelp (HEOK) fishery each year. The herring fishery is regulated through a variety of mechanisms, including an annual spawning biomass assessment to set quotas, limited entry permitting, seasonal closures, separation of the fishery into platoons, and gear restrictions (see Harvest Strategy section for more information on gear restrictions).

In recent years a decline in the price of sac-roe has led to a decline in effort. Effort has remained relatively stable over the past five years (Ryan Bartling, personal comm., 2013). Historically there were as many as 400 permits issued to approximately 100 boats, but in recent years this has dropped to approximately 180 permits issued each year to 25-35 vessels (Ryan Bartling, personal comm., 2013; CDFW Commercial License Data 2000-2012[1]). Although herring sac-roe permits are still issued for San Francisco Bay, Humboldt Bay, Tomales Bay, and Crescent City Harbor, the sac-roe fishing effort has only occurred in San Francisco Bay in recent years. This is due to decreased product demand and lower price, which makes fishing effort in the other bays less economically viable (Ryan Bartling, personal comm., 2013). Historically San Francisco Bay has accounted for over 90% of the state landings, even when other bays were actively fished. Total sac-roe landings and quota for San Francisco Bay are in Figure 1.

The other two components of the fishery, the fresh fish fishery and HEOK, are much smaller and receive a minor portion of the annual quota. Currently, the fresh fish fishery season is open for a brief period before the sac-roe fishery opens and for a few of weeks after it closes. The HEOK fishery operates only in San Francisco Bay through the winter months. In general the fresh fish fishery has little to no effort. During the 2012-2013 herring fishing season no fresh fish were landed under this fishery quota (20 tons). The HEOK fishery is highly variable due to a variety of reasons (Ryan Bartling personal comm., 2013). The fishery can receive a much higher price per pound than the sac roe fishery, but is a much riskier investment since there is the possibility of not landing any herring roe. This fishery has a 10 permit limit and vessels in the gillnet fishery have the option to convert their sac-roe permits to a HEOK permit annually. Figure 2 shows landings data for the HEOK fishery. During the 2012-13 season, the fishery landed close to its entire quota of 176 tons (Ryan Bartling personal comm., 2013).

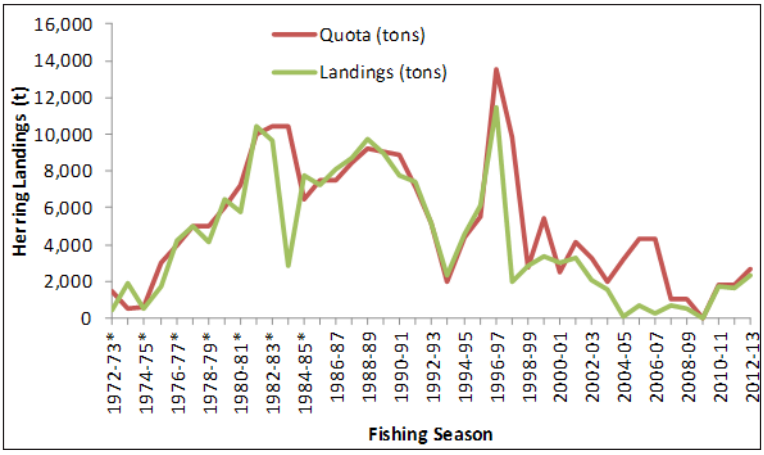

Figure 1. Quotas and landings in tons for the herring sac-roe fishery from 1972 to 2013 (Data from CDFW 2013). *Quotas and landings prior to the 1985-86 season include HEOK and fresh fish allocation and landings.

[1]CDFW commercial fishing license data can be found at: http://www.dfg.ca.gov/licensing/statistics/#Commercial Fishing Licenses & Permits

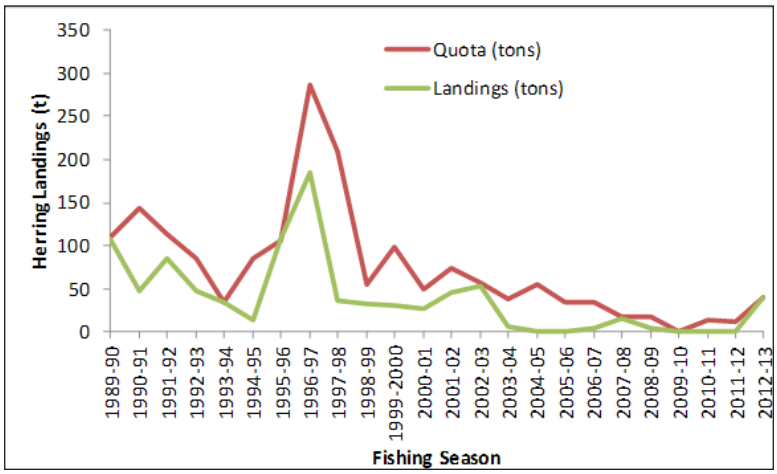

Figure 2. Quotas and landings in tons for the HEOK fishery in San Francisco Bay from 1989 to 2013 (from CDFW 2013).

Recreational Fishery

[Ryan Bartling, personal comm., 2013]: There is limited recreational take of herring during the spawning season only in San Francisco Bay. There is currently no daily bag limit, mostly due to low fishing effort and the amount of available fishing days. Recreational fishers typically use cast-nets to capture herring as they move inshore to spawn around pier pilings and jetties. Herring are typically used for human food or bait for other recreationally caught sport fish. Fishery managers will be looking at this fishery more closely in the future and possibly recommending regulatory changes should they see an effort shift or increased demand for fresh fish.

MSC Principle 1: Resource Sustainability

*Sustainability of the Target Stock

[From CDFW 2013]: The spawning biomass estimate for the 2012-13 season in San Francisco Bay is 79,500 tons, which exceeds the historical average (1979-80 season to present) of 52,000 tons. This is the fourth year of significant increase since the 2008-09 season record low estimate of 4,800 tons (Figure 3). Preliminary age composition data indicates that the increase in spawning biomass was due to a strong recruitment of 3-year old herring to the spawning population. Age 4- and 5-year old herring also continued to persist in the population. The increase in recruitment, returning 4- and 5-year old herring, as well as improved physical condition, is likely due to more favorable biological and environmental conditions, both in estuarine and oceanic ecosystems. DFW and the Fish and Game Commission's (FGC) long-term goals are to maintain healthy herring stocks in California by safeguarding herring as an important forage species; use precautionary principles when setting harvest targets; manage the commercial harvest of herring to achieve a sustainable fishery; maintain and/or restore healthy age structures to stocks; avoid and/or minimize the harvest of two and three-year-old herring, many of which are first-time spawners.

Pacific herring are found from Baja California, all the way up through the North American coast, around the Pacific Rim and down through the coasts of Asia to Japan. Globally (including the

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

California stock), Pacific herring experienced a stock collapse, around 1997-98, attributed to El Niño conditions that reduced ocean survival (CDFG 2006; CDFW 2013). Pacific herring stocks are typically defined by the primary spawning grounds and in California there are four separate stocks, San Francisco, Humboldt, Tomales Bay, and Crescent City Harbor. San Francisco Bay has the largest stock.

Currently, stock status in California is assessed annually only in San Francisco Bay. These spawning biomass surveys are used to set the quota for the herring fishery for the next season. The other fishing areas historically underwent annual assessments but were discontinued due to no fishing effort and staff reductions. Not much is known about the species during the open ocean phase so DFW uses spawning biomass estimates when they enter San Francisco Bay to assess the population (Figure 3). In 2003, a peer review of herring fishery management recommended that a harvest rate in the range of 10-15% would be sustainable and that a lower level would provide a desirable target for stock rebuilding. Since 2010, DFW has recommended harvest targets for Pacific herring at 5% or below the most current spawning biomass estimate, as a conservation safeguard. Actual harvest rates by the commercial fishery have equaled less than four percent of the total spawning biomass since the 2003-04 season and have equaled 10 percent or less of the spawning biomass since the 1979-80 season. An estimate of the unexploited spawning biomass has not been produced; however a formal stock assessment is currently being developed by the Centre for Environment, Fisheries and Aquaculture Science (Cefas; Ryan Bartling personal comm., 2013).

The quota is set annually by the FGC based on recommendations by DFW. Like other short-lived coastal pelagic species, Pacific herring abundance fluctuates widely due to variable recruitment, making annual population assessments necessary for effective management. This allows DFW and the FGC to integrate new information into management of the fishery on a timely basis. For example, in 2008-2009 the herring population fell to a new low of 4,800 tons and DFW recommended no take for the 2009-2010 season (CDFW 2013). When recommending a quota to the FGC, DFW takes into consideration not only the modeling results of the spawning biomass estimates, but other factors such as ocean and bay conditions, age structure, growth rates, strength of individual year-classes, and predicted size of incoming year classes (recruitment) (CDFW 2013).

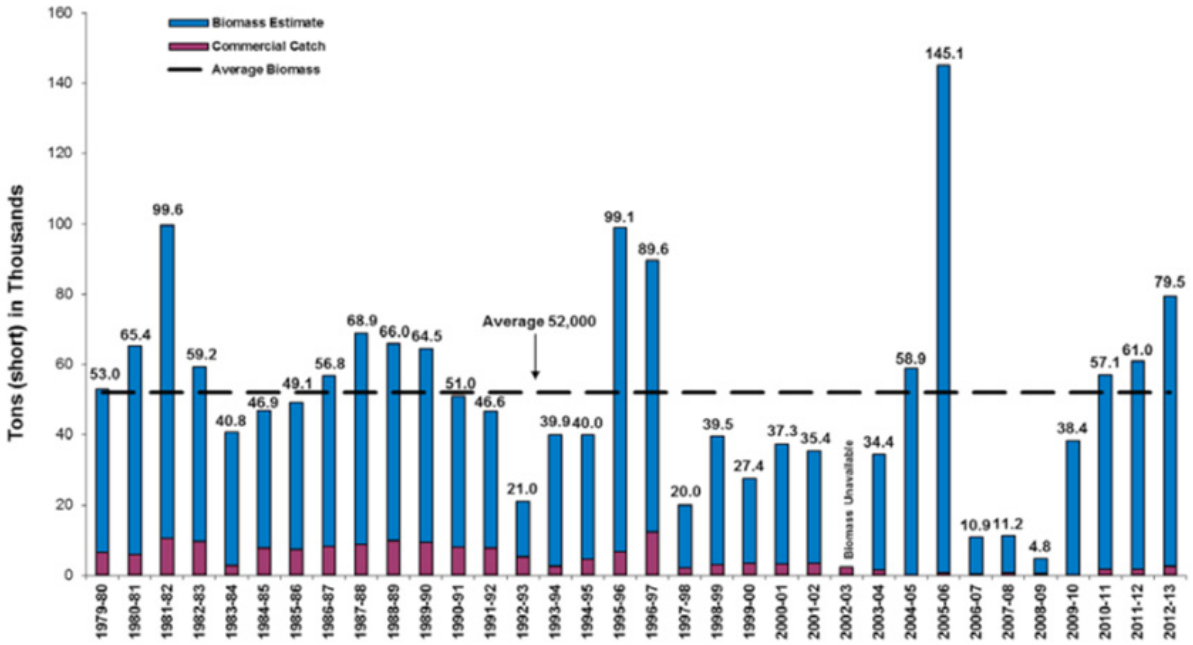

Figure 3. San Francisco Bay spawning biomass estimates and commercial catch (from CDFW 2013).

Evaluation against MSC Component 1.1: Sustainability of Target Stock

Performance Indicators	Rating	Justification
1.1.1 Stock Status		Managed to prevent recruitment overfishing; stock has been increasing in recent years
1.1.2 Reference Points*		Conservative reference points are used (5% of spawning biomass); although it is unclear what the unexploited spawning biomass level is
1.1.3 Stock rebuilding		Not triggered

*For an LTL species, MSC states that the default TRP should be 75% of the unexploited spawning biomass level.

Harvest Strategy (Management)

DFW has managed the commercial Pacific herring sac-roe fishery in San Francisco Bay since the opening in 1972. DFW's biological and enforcement staff have worked closely with the fishing industry throughout this period to provide for a sustainable and orderly fishery. This has been achieved through annual population assessments, California Environmental Quality Act review, evolving regulatory changes (fishery regulations) and oversight by the FGC.
The FGC has regulatory responsibility for management of this fishery with DFW providing recommendations and managing the fishery directly. This management structure allows the stock to be managed closely since the population can vary greatly due to annual recruitment success. The spawning biomass is assessed each year and is used along with other biological and environmental data to set quotas for the fishery. The fishery is also managed by seasonal closures that are set every year, gear restrictions such as a minimum mesh size of 2 inches,

and a limited entry (LE) permit system. The fishery is only open in state waters; open ocean fishing was prohibited in 2009. See Section 3.2: Fishery Specific Management System for more information.

Evaluation against MSC Component 1.2: Harvest Strategy

Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Annual assessments, conservative harvest measures, annual quota, gear restrictions, seasonal closures, and LE permits.
1.2.2 Harvest Control Rules and Tools		Annual quotas are responsive to the state of the stock, several restrictions in place to limit harvest
1.2.3 Information/Monitoring		Not much information is available on their life history in the ocean or the actual size of the stock.
1.2.4 Assessment of Stock Status		There is an annual assessment, but it is not clear if the method accurately assesses the size of the stock.

MSC Principle 2: Environment

Retained Catch

[Ryan Bartling, personal comm., 2013]: We do not currently have retained catch data for this fishery, although it may be accessible by analyzing landings receipts for the commercial fishery.

Evaluation against MSC Component 2.1: Retained Catch

Performance Indicators	Rating	Justification
2.1.1 Outcome		No data publicly available on catch of retained species
2.1.2 Management		No data publicly available on catch of retained species
2.1.3 Information		No data publicly available on catch of retained species

Bycatch

[Ryan Bartling, personal comm., 2013]: The gill net gear specified in regulations specifically targets Pacific herring based on a minimum mesh size and maximum overall net length. Based on the DFW commercial sampling data and staff observations, there is very little incidental take of non-target species. By-catch is typically limited to Jacksmelt (Atherinops californiensis) and sardines (Sardinops sagax); however, these species do not frequent areas targeted by the commercial herring fleet during the winter months and incidence as by-catch is minimal.

Evaluation against MSC Component 2.1: Bycatch

Performance Indicators	Rating	Justification
2.2.1 Outcome		No data publicly available on bycatch species, however internal DFW data shows bycatch is likely minimal
2.2.2 Management		No data publicly available; Sardine are federally managed with annual stock assessments; Jacksmelt are not actively managed
2.2.3 Information		No data publicly available; more information is needed on bycatch amounts and species

*Endangered, Threatened, & Protected Species

[Ryan Bartling, personal comm., 2013]: We do not currently have data for this fishery. Current harvest targets allow 95 percent or more of the spawning stock to remain available as forage for a variety of species which should minimize potential impacts to ETPs.

Evaluation against MSC Component 2.3: Endangered, Threatened & Protected Species

Performance Indicators	Rating	Justification
2.3.1 Outcome		No data publicly available on ETP species
2.3.2 Management		No data publicly available on ETP species
2.3.3 Information		No data publicly available on ETP species

Habitat

[Ryan Bartling, personal comm., 2013]: The Pacific herring fishery uses set gillnets which are weighted and anchored to the bottom, thus depending on the substrate, they can impact habitat. Most herring fishing areas in San Francisco Bay are mud bottom, however DFW staff acknowledges there is potential for impacts to subtidal vegetation due to anchoring and lead line chaffing on benthic habitat. Eelgrass (*Zostera marina*) and red algae (*Gracilaria sp.*) are commonly found in San Francisco Bay and could be removed or disturbed during fishing operations. Historically, most fishing occurs in areas that do not contain eelgrass and, as a result, potential disturbance would be minimal. Disturbance to Gracilaria would also be negligible due to its growth characteristics. It does not attach to benthic substrate and is subject to water and tidal movement in many areas of the bay. The small size of the current fishery, however, likely limits overall habitat impact (CDFW 2013).

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Evaluation against MSC Component 2.4: Habitat

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Unlikely that irreversible harm is caused because the fishery is small, but more data is needed to properly assess
2.4.2 Management		Limited entry permits and seasonal closures likely help limit habitat impacts
2.4.3 Information		No information is available on the risk posed to habitat types by the fishery

Ecosystem

Herring are an integral component to a healthy functioning marine ecosystem, making up a large portion of the diet of marine organisms from California to Alaska. Herring are a low-trophic level species that play an important role in sustaining a wide array of other species and maintaining the wider ecosystem. [CDFW 2013]: As a key forage species, low biomass levels of herring could impact important recreational and commercial species as well as threatened and endangered fish, marine mammals, and sea birds that rely upon them as a food source. Changes in abundance and age structure of a forage species such as herring and variability in the size and timing of herring spawn events can lead to changes in the abundances and behaviors of the variety of organisms that depend on herring and their eggs for food. Additionally, variability in large-scale oceanic conditions such as coastal upwelling and the El Nino Southern Oscillation cycle can affect both the timing of spawn events and recruitment success.

In general the fishery in California is strictly regulated to avoid overfishing of this species. One of the management objectives is to "Safeguard herring as an important forage species for all living resources of marine and estuarine ecosystems that utilize herring as a food source (CDFW 2013)."

Evaluation against MSC Component 2.5: Ecosystem

Performance Indicators	Rating	Justification
2.5.1 Outcome		Herring are considered a low trophic level species; however, the fishery is conservatively managed and it is unlikely the fishery causes serious harm to the ecosystem
2.5.2 Management		The fishery is managed conservatively; need more information to determine if current strategy has been effective
2.5.3 Information		Not enough information to understand impacts on habitat, bycatch, retained and ETP species.

MSC Principle 3: Management System

Governance and Policy

This fishery is regulated by the California Fish and Game Commission and managed by the California Department of Fish and Wildlife (DFW). It is subject to and managed under all relevant US federal laws as well as California state regulations pertaining to fisheries management. DFW works closely with constituent advisory groups to carefully design and evaluate restricted access plans for submission to the Commission. The Commission conducts hearings for public input. The restricted access plan is then returned for any necessary revision to DFW and advisory groups before returning to the Commission for a final decision.

Evaluation against MSC Component 3.1: Governance and Policy

Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		FGC and DFW manage the fishery within an effective framework for delivering sustainable fisheries
3.1.2 Consultation, Roles and responsibilities		Roles and responsibilities are clearly laid out; FGC meetings are open to the public and to public comments
3.1.3 Long-term Objectives		Magnuson-Stevens Act, Marine Life Management Act
3.1.4 Incentives for Sustainable Fishing		Magnuson-Stevens Act, Marine Life Management Act

Fishery Specific Management System

DFW has managed the commercial Pacific herring sac-roe fishery in San Francisco Bay since the opening in 1972. The fishery is managed through annual population assessments, California Environmental Quality Act review, evolving regulatory changes (fishery regulations) and oversight by the FGC. The FGC has regulatory responsibility for management of this fishery with DFW providing recommendations and managing the fishery directly. This management structure allows the stock to be managed closely since the population can vary greatly due to annual recruitment success.

[From Ryan Bartling, personal comm., 2013]: In San Francisco Bay, once the quota is set based on the previous seasons spawning biomass estimate, it is allocated between sac-roe, fresh fish, and HEOK. It is then further subdivided by platoons in the sac-roe fishery that fish on alternating weeks. Fishermen can own permits in both platoons; the division of the fishery was created when the fishery was much more active and there was a need to organize the large participation. Historically over 400 permits were issued and 100 vessels actively participated in the fishery. In recent years DFW has issued approximately 180 permits with only 25-35 vessels actively participating. The quotas for Tomales Bay, Humboldt Bay and Crescent City Harbor area are currently set to not exceed 350 tons, 60 tons, and 30 tons, respectively. No commercial fishing activity has taken place in Tomales Bay since 2007, in Humboldt Bay since 2005 and in Crescent City Harbor since 2002. For the 2012-2013 season, Tomales Bay had 10 permit

renewals and Humboldt Bay and Crescent City Harbor had four renewals.

The fishery is also managed by seasonal closures that are set every year, gear restrictions such as a minimum mesh size of 2 inches, and a limited entry (LE) permit system. The fishery is only open in state waters; open ocean fishing was prohibited in 2009. Management objectives for the herring fishery include:

- Safeguard herring as an important forage species for all living resources of marine and estuarine ecosystems that utilize herring as a food source
- Use precautionary principles when setting harvest targets
- Manage the commercial harvest of herring to achieve a sustainable fishery
- To the extent possible, maintain and/or restore healthy age structures to stocks
- Avoid and/or minimize the harvest of two and three-year-old herring, many of which are first-time spawners
- Set commercial harvest targets that conserve sufficient herring to support recreational take

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division. Additionally tools such as port sampling, landing receipts, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		Mgmt objectives are listed in CDFW (2013), however they do not address retained, bycatch and ETP species or habitat impacts.
3.2.2 Decision-making Processes		DFW provides recommendations that are vetted through the FGC
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		Annual research plans are developed by DFW but are internal; can be obtained if requested
3.2.5 Management Performance Evaluation		There is annual monitoring and evaluation of the stock, however it is unclear how often assessment methods are evaluated.

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available

Recommendations

[Ryan Bartling, personal comm., 2013]: DFW is currently proposing a change to existing regulations to allow the commercial take of herring for both the sac-roe and fresh fish market fisheries under one quota and one season. This would mean the fresh fishery season and quota would be moved into the sac-roe fishery and all fish landed during the regular herring season could be sold for sac-roe or fresh fish purposes. At this time, the fresh fish fishery operates outside of the sac-roe fishery season. However, herring are very difficult to catch during non-spawning season. Historically the Pacific herring commercial fishery has primarily harvested sac-roe for export to other countries. However, DFW has noted an increase in demand in the Bay area for locally caught fresh herring. This anecdotal evidence (a Pacific Herring festival and the appearance of fresh herring on restaurant menus) leads DFW to believe that herring caught during the sac-roe season are being sold whole (as it normally is), but that purchasers are using the herring locally. DFW is recommending that the Commission amend regulations to make fresh fish available during what has historically been the sac-roe season by the gill-net fleet. This change is also being proposed in response to public requests to provide increased fishing opportunities for the higher value fresh fish market.

The growing demand for locally caught Pacific herring could benefit OPC's program since there would be a larger incentive for the fishery to participate if consumers were interested in supporting sustainable California seafood. Generally the herring fishing industry has supported conservation safeguards proposed by DFW managers and they would also likely support efforts for a sustainable labeling program through MSC certification.

Additionally, there has been growing interest in the HEOK fishery. At this point in time, the fishery is very small (limited to 10 permits) and is managed by one operator. However, it is presumed that this fishery is sustainable since it does not remove adult fish from the population. If this portion of the fishery does grow in the future, it may be useful to either include it in a certification of the whole fishery, or try to better understand the fishery impacts for management purposes.

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Appendix A

MSC Assessment Tree			Pacific Herring
			Gill net
Principle	**Component**	**Performance Indicator**	**SF Bay**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status	
		1.1.2: Reference points	
		1.1.3: Stock rebuilding	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy	
		1.2.2: Harvest control rules	
		1.2.3: Info/ monitoring	
		1.2.4: Stock assessment	
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status	
		2.1.2: Mgmt strategy	
		2.1.3: Information	
	By-catch species	2.2.1: Status	
		2.2.2: Mgmt strategy	
		2.2.3: Info	
	ETP species	2.3.1: Status	
		2.3.2: Mgmt strategy	
		2.3.3: Info	
	Habitats	2.4.1: Status	
		2.4.2: Mgmt strategy	
		2.4.3: Info	
	Ecosystem	2.5.1: Status	
		2.5.2: Mgmt strategy	
		2.5.3: Info	
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework	
		3.1.2: Consultation, roles, and responsibilities	
		3.1.3: Long term objectives	
		3.1.4: Incentives for sustainable fishing	
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives	
		3.2.2: Decision making process	
		3.2.3: Compliance & enforcement	
		3.2.4: Research plan	
		3.2.5: Management performance evaluation	

Pacific Sardine (*Sardinops sagax*)

Certification Units Covered Under this Species

- Purse seine

Summary

Pacific sardine is currently one of the most abundant forage fish species along the west coast of North America, extending from the tip of Baja California to British Columbia. Populations undergo natural fluctuations over periods of approximately 60 years; these fluctuations are likely related to oceanic conditions. Sardine is federally managed under the Pacific Fishery Management Council's Coastal Pelagic Species Fishery Management Plan, which includes annual stock assessments, harvest guidelines, and limited entry permits.

Strengths:

- Well managed fishery with annual stock assessments, harvest guidelines, and limited entry permits
- Long history of monitoring data; fishery independent and dependent data collected
- Bycatch is minimal; most incidental catch is retained and consists of other coastal pelagic species

Weaknesses:

- There are extreme natural population fluctuations
- More information is needed to determine if current harvest levels impact the ecosystem as a whole

History of the Fishery in California

Biology of the Species

Pacific sardine are small, pelagic, schooling fish from the family Clupeidae, which include other coastal pelagics such as herring and menhaden. Sardine feed on plankton and help form the base of the marine food web as important forage for marine mammals, birds, and fish of higher trophic levels. Sardines exhibit counter-shading; they have silver bellies and blue-green coloring on their dorsal surface with distinctive dark spots on their side, above the lateral line. Typically sardines are found in large schools during the day (often with jack mackerel, Pacific mackerel, and northern anchovy) and disperse at night (Love 2011). Maximum size of sardines is about 41 cm in length and 0.32 kg, although most are captured below 30 cm in length (Hill et al. 2012). Sardines are generally mature at about 18 cm in length or between 2-3 years of age, however this can be dependent on biomass, latitude, and temperature (Butler 1987; Hill 1999). At relatively low biomass levels, sardine appear to be fully mature at age one, whereas at very high biomass levels only some of the two-year-olds are mature (MacCall 1979). Pacific sardine can live 13-25 years, although most captured in California are below 5 years of age (Hill et al. 2012).

Sardine populations exhibit extreme natural variation in abundance. For example, in the 1930's Pacific sardine supported the largest fishery in the Eastern Pacific ocean; however by the 1950s the fishery collapsed and caused economic ruin to canneries along the U.S. West coast. After several decades of ecological absence, the west coast sardine population rapidly started to rebuild again in the 1980s. As a result of the sardine collapse, in 1949 the California Cooperative Oceanic Fisheries Investigations (CalCOFI) was formed to study the ecological reasons behind the collapse. CalCOFI research has led to the development of quantitative fisheries models and insight into climate/fisheries interactions. Some of this research has shown that sardine populations undergo cyclical fluctuations over a period of about 60 years (Baumgartner et al. 1992). The reason for the fluctuating nature of Pacific sardine populations is still unknown, but is hypothesized to be associated with changes in sea surface temperature and upwelling (Chavez et al. 2003; Emmett et al. 2005; Herrick et al. 2007; Lluch-Belda et al. 1991; Norton and Mason 2005). Over the last 100 years, sardine populations have increased during periods of warmer than average ocean temperatures and decreased during periods of colder than average ocean temperatures. During population increases associated with warmer water, sardines can be found from the tip of Baja California to British Columbia, Canada; however, during population declines associated with colder water, sardines are rarely found north of Point Conception.

The largest spawning biomass of Pacific sardines in California occurs offshore between Monterey and Ensenada, Mexico in the transition zone between inshore upwelled waters and the offshore California Current. Recent spawning has been concentrated in the region offshore and north of Point Conception (Lo et al. 2005 & 2010 & 2013). Sardines are batch spawners, releasing about 9,000 – 100,000 eggs at a time and spawn between February and August off the California coast. Peak spawning temperatures off California are between 13°C – 15°C (Hill et al. 2012). As juveniles and sub adults, sardine reside primarily nearshore, but as they grow older and larger they move further offshore, ultimately initiating seasonal migratory behavior north in summer months to feed. Despite large-scale movements, adult sardine return to previously mentioned offshore spawning areas in the fall for spawning in spring months. Pacific sardine have been observed from the surf zone out to 350 miles offshore.

Along the West coast of North America, there is a generally accepted hypothesis that sardines belong to three separate stocks (Vrooman 1964; Felix-Uraga et al. 2004; Felix-Uraga et al. 2005; Garcia-Rodriguez et al. 2011): a southern, “warm” stock found in the Gulf of California and Southern Baja California; a central “temperate” stock found off of Central Baja California; and a northern “cold” stock found north of Northern Baja California. All landings from California are assumed to come from the northern, “cold” stock.

Commercial Fishery

[From Hill et al. 2012]: The sardine fishery was first developed in response to demand for food during World War I. Landings increased from 1916 to 1936, peaking at over 700,000 metric tons (mt). Pacific sardines supported the largest fishery in the western hemisphere during the 1930s and 1940s, with landings in British Columbia, Washington, Oregon, California, and México. The population and fishery declined in the late 1940s, with some short-term reversals, to extremely low levels in the 1970s. During this time a 2-year moratorium on targeting sardines was enacted in 1967, followed by a partial lifting of the moratorium in 1969 (allowed 250 tons of sardines to be targeted annually as bait), followed by a final moratorium in 1974 where no targeted sardine fishing could occur until the sardine spawning biomass reached 20,000 tons (Wolf 1992). In the early 1980s, sardines started showing up as incidental catch with Pacific and jack mackerel in the southern California mackerel fishery. As sardines continued to increase in abundance, a directed fishery was reestablished and the incidental fishery ended (in 1991). Besides San Pedro and Monterey, California, substantial Pacific sardine landings are now made in the Pacific Northwest and in Baja California, Mexico.

In California, the principal port areas for landing sardine are Monterey and Los Angeles. Landings increased in the mid 1990s, but declined from 2008 - 2011 because of decreased quotas as result of estimated stock declines (Figure 1). Landings and ex-vessel revenue for the entire West coast from 1981-2012 are shown in Figure 1. In 2010, over 85% of the annual sardine catch was exported overseas; the primary export countries were Japan, Thailand, China, Malaysia and South Korea (PFMC 2011). Domestically, sardines are mainly used as bait. There is an active commercial live bait fishery that operates primarily in southern California (PFMC 2011). The commercial live bait fishery for sardine provides an important source of bait to both commercial passenger fishing vessels and private boats. Landings data from this fishery are currently available through a voluntary logbook program.

Pacific sardine are primarily captured by purse seine, although since the 1990s, purse seiners began converting to drum seines which are easier to deploy and retrieve. There is also some incidental catch by mid-water trawl fisheries.

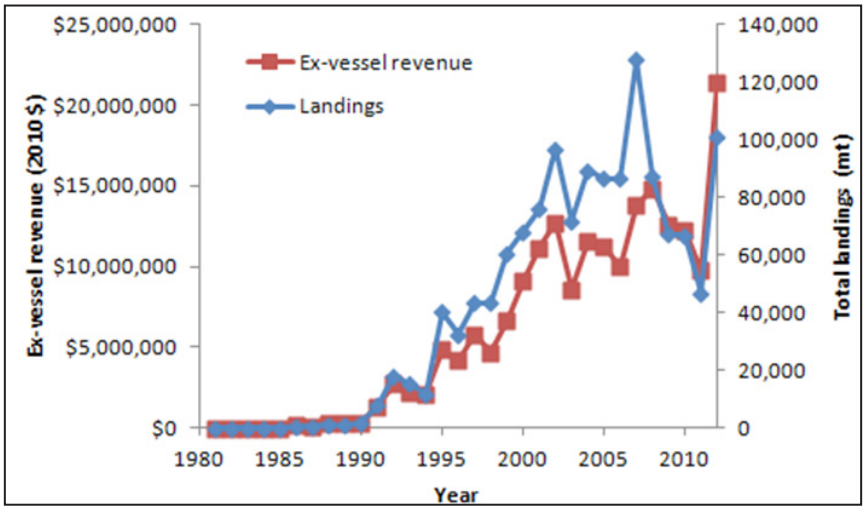

Figure 1. Total landings and ex-vessel revenue of Pacific sardine along the U.S. West coast 1981-2012 (data from PFMC 2011, PacFIN 2013).

Recreational Fishery

There is a recreational fishery for sardine by anglers who capture them primarily for consumption. The majority of fish landed are from man-made structures, such as piers and jetties, where no sports fishing license is required. If fishing from anything other than a man-made structure, a sport fishing license is needed. There are no limits on the recreational take of Pacific sardine.

The 2012 CA recreational Pacific sardine catch estimate as sampled from the California Recreational Fisheries Survey (CRFS) was 62.1 metric tons, or 853,791 fish. This was an increase from 2011 of 183% in metric tons, and 82% in numbers of fish (http://www.recfin.org/data/estimates/tabulate-recent-estimates-2004-current; catch types A+B1, all modes/areas, query date 7-5-13).

MSC Principle 1: Resource Sustainability

*Sustainability of Target Stock

[From PFMC 2011]: Sardine populations started to rebuild in the 1980s and by the 1990s, stock biomass was rapidly increasing. Sardine biomass peaked at 1.33 mmt in 1999 and 1.37 mmt in 2006 (Figure 2). As of July 2012, stock biomass was estimated at 659,539 mt (Hill et al. 2012). Recruitment is highly variable and it appears both density-dependent and environmental factors play an important role. Recruitment peaked in 1997, 2003, 2007 and 2009. Both recruitment and biomass have been declining since 2009 and 2006, respectively. Despite this recent decline, populations are considered healthy and management measures are in place to respond to changing population levels (see Harvest Strategy). Since the time federal harvest guidelines were set in 2000, sardine catch has been below or very close to the harvest guideline (Figure 3). The U.S. exploitation rate (annual catch divided by biomass) has been declining since 2002, although the total (Mexico, U.S., Canada) exploitation rate has increased in recent years (Figure 4).

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

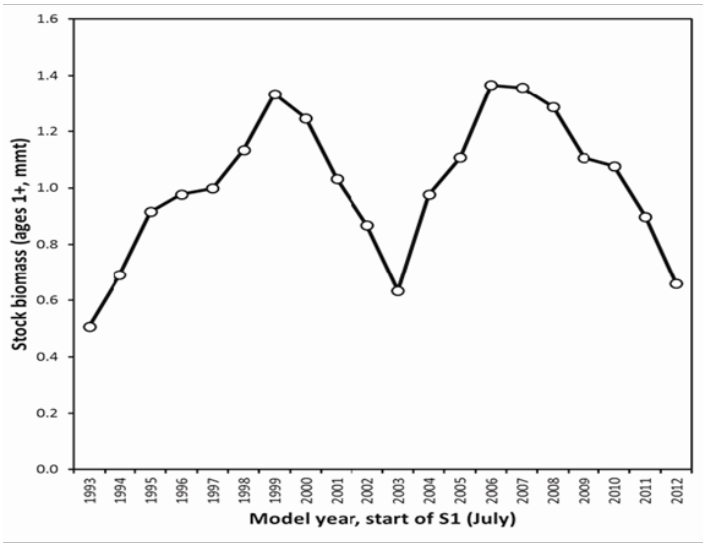

Figure 2. Stock biomass of Pacific sardine from 1993 – 2012 (figure from Hill et al. 2012).

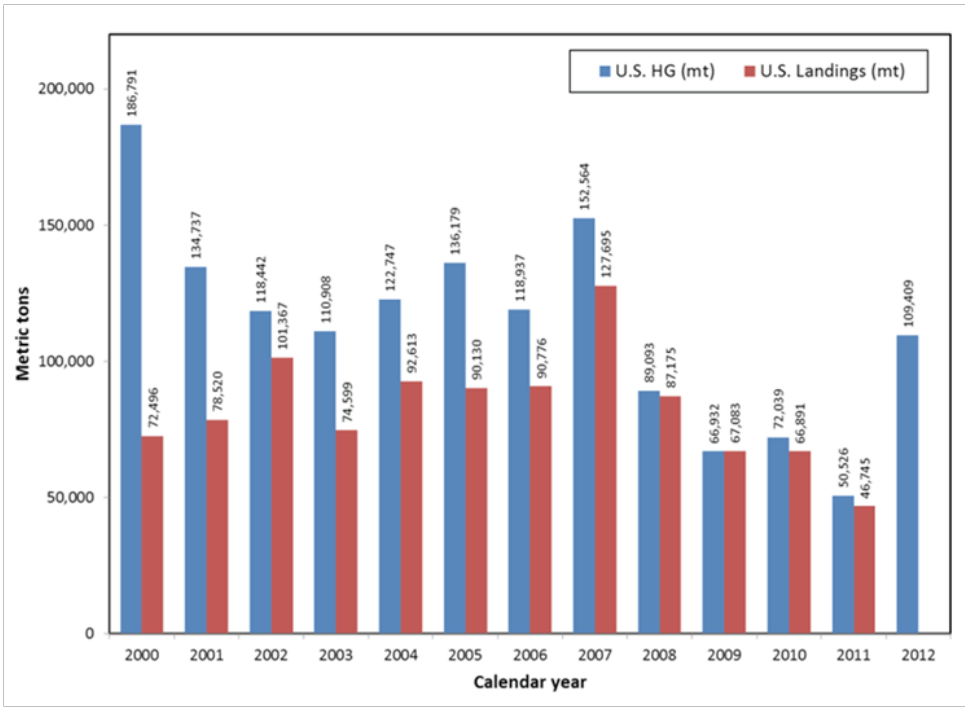

Figure 3. U.S. harvest guideline values and catches since the onset of federal management (figure from Hill et al. 2012).

Figure 4. Exploitation rate (annual catch divided by biomass) of Pacific sardine from 1993 – 2011 (figure from Hill et al. 2012).

Evaluation against MSC Component 1.1: Sustainability of Target Stock

Performance Indicators	Rating	Justification
1.1.1 Stock Status		Stock is well above the LRP* and has been consistently above the TRP* since 2000; annual stock assessments are available
1.1.2 Reference Points		Explicit reference points are used and evaluated during annual stock assessments
1.1.3 Stock rebuilding		Not triggered; stock is considered healthy

*MSC evaluations define a Limiting Reference Point (LRP) and a Target Reference Point (TRP). In the case of Pacific sardine, the cutoff point of 150,000 qualifies as the LRP and the fraction of sardine allowed to be harvested above the cutoff point (capped at 15%) qualifies as the TRP.

Harvest Strategy (Management)

The Pacific sardine population overlaps three countries: Canada, the U.S. and Mexico. No formal fishery management agreement exists among Canadian, U.S. and Mexican governing agencies; however, representatives from government, academia and industry from each country meet each year at the Trinational Sardine Forum to collaborate on improving the coast-wide stock assessment. The U.S. and Mexico harvest the majority of Pacific sardine (Figure 5).

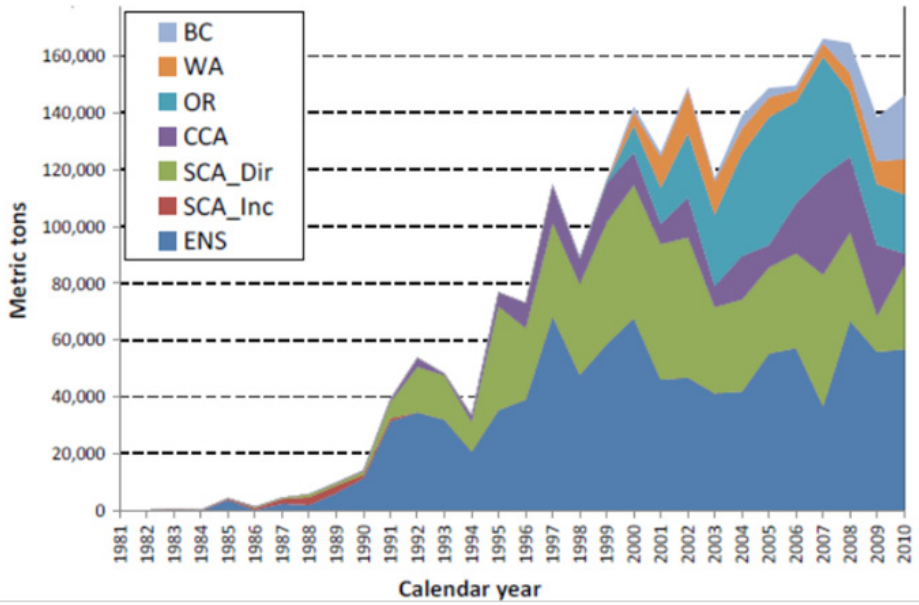

Figure 5. Sardine landings by fishing region and calendar year (from Hill et al. 2011, Fig. 1). Legend: BC= British Columbia; WA= Washington state; OR= Oregon state; CCA = central California; SCA_Dir and SCA_Inc = southern California directed and incidental fishing, respectively; ENS =Ensenada (Baja Mexico).

Prior to 2000, Pacific sardine were managed by individual states, but in January 2000, management authority was transferred to the Pacific Fishery Management Council (PFMC). Pacific sardine are now managed under the federal Coastal Pelagic Species-Fishery Management Plan (CPS-FMP; PFMC 1998). The CPS-FMP includes a limited-entry fleet and an annual coast-wide stock assessment that sets annual overfishing (OFL) and harvest guideline (HG) levels for sardine (PFMC 2011). The HG is based on a harvest control rule that accounts for scientific and management uncertainty and includes a biomass estimate informed by fishery and survey data from Mexico, the U.S. and Canada. There are several components that go into the HG calculation, including (Hill et al. 2012):

- The estimated average percentage of sardine biomass that occurs in U.S. waters; this is set at 87%[1].
- A cutoff point of 150,000 mt of sardine biomass; below this point no harvesting of sardines, except as live bait, is allowed.
- A maximum HG of 200,000 mt, regardless of how high the sardine biomass goes.
- A temperature-dependent[2] fraction of sardine biomass, above the cutoff point, that can be harvested. In recent years this has been 15%, but the fraction can vary between 5% and 15%.

Since 2006, the annual coastwide Pacific sardine HG has been divided into three allocation periods. In addition, a portion of the HG is typically set aside for incidental take in other fisheries and for exempted fishing permits (to use for industry-sponsored research).

[1]This distribution term is based on historical spotter pilot data from 1963-1992 (PFMC 1998). There have been recent discussions about updating this term, as the sardine stock has shifted with changing environmental conditions, but more recent data have not yet been synthesized to arrive at a refined estimate (PFMC 2013).

[2]In recent years the basis for the temperature data has been called into question, and subsequent analyses have supported using an offshore temperature time series (from CalCOFI cruises) over the previous static pier temperature index (from Scripps pier)(McClatchie et al 2010, PFMC 2013).

Stock assessments for sardine are informed by both fishery-dependent data and fishery independent data. Fishery dependent data includes 1) landings from Ensenada, Mexico to British Columbia, Canada and 2) biological data from port sampling programs. All three U.S. states (CA, OR, WA) monitor the commercial sardine catch utilizing port sampling programs which provide data such as age (using otoliths), length, sex, maturity, species composition of the CPS catch, and by-catch and incidental catch. Fishery-independent data includes 1) Daily Egg Production Method (DEPM) and Total Egg Production (total spawning biomass) data collected on the annual CalCOFI cruise (1994 – 2012), 2) aerial photogrammatic surveys of sardine biomass (2009 - 2012) and 3) acoustic trawl method (ATM) surveys of sardine biomass (2006 – 2012).

In Canada, the sardine fishery is managed by the Department of Fisheries and Oceans, which sets an annual quota for Pacific sardine. [From DFO 2012]: The Fishery Management Framework harvest control rules for setting the annual maximum available commercial harvest are based on the product of three factors: 1) the current population biomass estimate in the NE Pacific ocean (from Ensenada, MX to B.C.) resulting from the annual U.S. assessment; 2) the three-year running average seasonal migration rate, determined as the ratio of sardine biomass in B.C. waters (based primarily on observations from the west coast of Vancouver Island) to the population biomass estimate from the stock assessment, and 3) an annual harvest rate (ranging from 5-15%) approximating what is applied in the U.S. (15% since 2002). The estimated three-year average sardine migration rate into B.C. waters (for 2012) is 18.4%.

In Mexico, the sardine fishery is managed by the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA). Harvest of Pacific sardine is not regulated by a quota system, but there is a minimum legal size requirement of 150 mm standard length and measures to control the size of the fishing fleet.

Evaluation against MSC Component 1.2: Harvest Strategy

Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		A precautionary harvest strategy is in place which includes an annual harvest guideline and harvest control rules
1.2.2 Harvest Control Rules and Tools		Precautionary harvest control rules are in place and evaluated annually; Catch has been close to or below the HG.
1.2.3 Information/Monitoring		Fishery dependent and independent data are collected to support the harvest strategy; control mechanisms are in place to respond to changes in the fishery
1.2.4 Assessment of Stock Status		Annual stock assessments are conducted using reliable methods

MSC Principle 2: Environment

Retained Species

Purse Seine

[From PFMC 2011]: Most incidental catch in the sardine fishery is retained. In the purse seine fishery, fish are pumped from the sea directly into fish holds aboard the vessel. Fishermen

do not sort catch at sea or what passes through the pump. Unloading of fish at the dock also occurs with pumps. The fish are pumped into ice bins and trucked to processing facilities in another location or to a conveyor belt in a processing facility, where fish are sorted, boxed, and frozen. CDFW port samples indicate minimal incidental catch in the California sardine fishery and the catch that is observed is primarily other coastal pelagic fish species managed under the CPS FMP. Information on retained catch is available from port sampling data, observer data, and logbook data.

Retained catch in California from 2006-2010 primarily* consisted of: northern anchovy, jack mackerel, bat ray, jellyfish, and market squid. Incidental catch has not been quantified in California. In Oregon, incidental catch was primarily* Pacific mackerel, jack mackerel, Pacific herring, northern anchovy, market squid and jellyfish; incidental catch made up 0.2% of total sardine landings in Oregon in 2010. In Washington, incidental catch was primarily* mackerel and Pacific herring. Pacific mackerel, jack mackerel and Northern anchovy are all managed under the CPS FMP (although jack mackerel and northern anchovy are only monitored by the CPS FMP). Market squid is managed under the state market squid FMP. Pacific herring is managed by the individual states.

Evaluation against MSC Component 2.1: Retained Catch

Performance Indicators	Rating	Justification
2.1.1 Outcome		Retained species catch is low and primarily consists of other coastal pelagic species
2.1.2 Management		Coastal pelagic species are managed under the PFMC's CPS FMP
2.1.3 Information		Port sampling data, observer data, logbooks; Retained species catch is not quantified in CA, only frequency of appearance is recorded.

Bycatch Species

Purse Seine

[From PFMC 2011]: Bycatch is defined as incidental catch that is not retained. Bycatch is low in the sardine fishery because most species are retained; fish are pumped directly into holding tanks and not sorted until they reach the processing facility. Bycatch primarily consists of protected species (see next section). Information on bycatch is collected from logbooks and observer coverage.

Evaluation against MSC Component 2.2: Bycatch

Performance Indicators	Rating	Justification
2.2.1 Outcome		SAFE reports state that bycatch is very low
2.2.2 Management		Low bycatch
2.2.3 Information		Observer data, logbooks

*Endangered, Threatened, & Protected Species

Purse Seine

[From PFMC 2011]: In Oregon, Washington and California, nine evolutionarily significant units (ESU) of Chinook salmon are listed as either threatened or endangered and four ESUs of Coho

*Observed at a frequency of >5.0% in any one year from 2006-2010 in California, or at > 2 mt in any one year from 2000-2010 in Oregon and Washington (PFMC 2011).

* For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

salmon are listed as either threatened or endangered. As vessels move north of Monterey, CA, the potential for taking Chinook and Coho salmon as bycatch increases, although salmon bycatch primarily occurs in Oregon and Washington. In Oregon, salmon bycatch (as reported in logbooks) ranged between 186 – 519 individuals per year from 2006 to 2010; between 53% to 67% of these fish were released alive. In Washington, salmon bycatch ranged between 267 – 1,774 individuals per year from 2000 through 2010. From 2000 to 2004 between 22% and 73% of the fish were released alive (observer data), but after 2004, between 18.4% and 18.7% were released alive (logbook data).

In 2010, NMFS SWR Protected Resources Division completed a formal Section 7 Biological Opinion (BO) and determined that fishing activities conducted under the CPS FMP and its implementing regulations are not likely to jeopardize the continued existence of any endangered or threatened species under the jurisdiction of NMFS or result in the destruction or adverse modification of critical habitat of any such species. Specifically, the current status of the Lower Columbia River Chinook, Snake River Fall Chinook, Upper Willamette Chinook, Puget Sound Chinook, Lower Columbia River Coho and Oregon coast Coho, were deemed not likely to be jeopardized by the Pacific sardine fishery.

Evaluation against MSC Component 2.3: Endangered, Threatened & Protected Species

Performance Indicators	Rating	Justification
2.3.1 Outcome		Bycatch of salmon was determined unlikely to jeopardize populations in a Section 7 BO
2.3.2 Management		Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act, etc.
2.3.3 Information		Section 7 BO , SAFE reports, observer data

Habitat

Purse seine

Essential fish habitat (EFH) for coastal pelagic species (CPS) was defined in 1998 as all marine and estuarine waters in California, Washington and Oregon to the limits of the exclusive economic zone (EEZ) and above the thermocline where sea surface temperatures range between 10°C to 26°C (PFMC 1998). A recent review of the EFH in 2010 determined that no changes were necessary to the 1998 definition (CPSMT 2010).

Purse seines are the primary gear used to catch Pacific sardines. A purse seine is a movable net used to encircle fish. The top of the net is a float line with corks, or buoys. The net is held in a vertical position by a weighted lead line. The net also has a wire cable, run through rings on the bottom, which is used to draw the net together. Purse seine fishers often use spotter planes and sonar to locate the fish. Once the school is located, a small skiff takes one end of the net and then circles the fish with the net. The wire cable is winched in to close off the bottom of the seine. Then the other lines are pulled in as well to bring the captured school of fish closer to the mother ship, where the fish are pumped out of the net and put into fish holds filled with refrigerated sea water (Goblirsch and Theberge 2003). Drum seines are similar to purse seines except a horizontally mounted drum hauls and stores the net instead of a power block.

Appendix D of the CPS FMP (PFMC 1998) notes that contact between roundhaul gear (purse seines) and substrate is rare in fishing for CPS finfish, because fishing usually occurs in water deeper than the height of the net. Thus, the only opportunity for damage to benthos or essential

fish habitat for any species in fishing for CPS finfish is from lost gear. There is potential for fishing to impact squid spawning grounds because market squid attach their egg cases to the bottom substrate at spawning sites that include shallow, nearshore areas. Such damage is not believed to be extensive and is transitory with regard to the habitat.

Evaluation against MSC Component 2.4: Habitat

Performance Indicators	Rating	Justification
2.4.1 Outcome		Limited impact with substrate because fishing usually occurs in water deeper than the height of the net.
2.4.2 Management		Limited entry permits limit the number of vessels with purse seines
2.4.3 Information		Appendix D of CPS FMP

Ecosystem

Pacific sardine are filter feeders and prey on crustaceans, copepods, fish larvae and phytoplankton. Larval sardines feed extensively on the eggs, larvae, and juvenile stages of copepods, as well as other zooplankton and phytoplankton. Sardines provide important forage for marine mammals, birds, and fish of higher trophic levels. A concern with low trophic level fisheries is the impact population fluctuations may have on species of higher trophic levels that depend on them for forage (Smith et al. 2011, Kaplan et al. 2013). More information is needed to determine if current harvest levels impact the ecosystem.

To address this concern, several management agencies have adopted policies regarding forage fish species. In April of 2013, the PFMC adopted the Pacific Coast Fishery Ecosystem Plan (FEP) to help inform FMPs with more ecosystem science. Additionally, the Council adopted the objective to prohibit the development of new, directed fisheries on forage species that are not currently managed by the Council or states, until the impacts of any proposed fishery can be fully understood. In California, the California Fish and Game Commission (FGC) also voted in November of 2012 to prevent the development of new or expanded forage fisheries until essential fishery information needed for ecosystem based management is available and applied to management. In Washington, the Washington Fish and Wildlife Commission adopted a forage fish policy in 1998 to consider ecosystem science in the management of forage fish species and to use the precautionary approach to management. Oregon does not appear to have a specific policy for forage fish species.

Evaluation against MSC Component 2.5: Ecosystem

Performance Indicators	Rating	Justification
2.5.1 Outcome		Sardine are considered a low trophic level species; more information is needed to determine if current harvest levels impact the ecosystem
2.5.2 Management		The PFMC and the FGC recently adopted policies regarding ecosystem management of forage fish species.
2.5.3 Information		Observer data on bycatch

MSC Principle 3: Management System

Governance and Policy

Fisheries in the U.S. are governed by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976. The MSFMCA requires managing at or below MSY levels, rebuilding overfished stocks and ending overfishing, minimizing bycatch and bycatch mortality, identification of essential fish habitat and mitigation of adverse fishing impacts. In addition, the Endangered Species Act, the Marine Mammal Act, the Migratory Bird Treaty Act, the Coastal Zone Management Act, and the Clean Water Act apply to or provide protection for species and/or habitat that may be affected by the target fishery.

The MSFCMA established eight regional fishery management councils to manage fishery resources in the U.S. Exclusive Economic Zone (EEZ). Along the U.S. west coast, the EEZ extends from 3 to 200 nautical miles offshore. Each council is comprised of Federal, State, and stakeholder representatives. Additionally, advisory bodies provide expert advice on matters related to the purpose of the council. The council process emphasizes public participation and involvement in fisheries management; meetings are open to the public and to public comment. Management measures developed by each council are recommended to the Secretary of Commerce through NOAA's National Marine Fisheries Service (NMFS). Along the west coast, management measures are implemented by NMFS Northwest and Southwest Regional offices and enforced by the NOAA Office of Law Enforcement, the U.S. Coast Guard 11th District, and local enforcement agencies.

Each council develops fishery management plans (FMPs) for the stocks in their region specifying how a fishery will be managed. The Guidelines for Fishery Management Plans (NMFS 1997) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each FMP. SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries being managed under federal regulation. Regional fishery management councils use this information to determine annual harvest levels for each stock, document significant trends or changes in the resources, marine ecosystems, and fishery over time, and assess the relative success of existing state and federal fishery management programs. In California, the Pacific Fishery Management Council (PFMC) is the regional council that makes recommendations to NMFS on federal fisheries.

Evaluation against MSC Component 3.1: Governance and Policy

Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		PFMC and NMFS operate under Magnuson-Stevens Act
3.1.2 Consultation, Roles and responsibilities		PFMC meetings are public and public participation is encouraged
3.1.3 Long-term Objectives		Magnuson-Stevens Act and FMPs
3.1.4 Incentives for Sustainable Fishing		Magnuson-Stevens Act

Fishery Specific Management System

Prior to 2000, Pacific sardine were managed by individual states, but in January 2000, management authority was transferred to the Pacific Fishery Management Council (PFMC).

Pacific sardine are now managed under the federal Coastal Pelagic Species-Fishery Management Plan (CPS-FMP; PFMC 1998) Management tools include a limited-entry permit system and annual quotas. The CPS-FMP outlines fishery specific objectives, an annual coast-wide stock assessment that sets annual overfishing (OFL) and harvest guideline (HG) levels for sardine, and discusses future research needs (PFMC 2011).

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

For further information, please see the Harvest Strategy section under Principle 1.

Evaluation against MSC Component 3.2: Fishery Specific Management System

Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		Outlined in the CPS FMP
3.2.2 Decision-making Processes		PFMC has an appropriate decision-making process in place
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		CPS FMP
3.2.5 Management Performance Evaluation		Annual stock assessments are reviewed by the stock assessment review (STAR) panel

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available

Recommendations

Additional research can further refine or improve the sardine stock assessment model. Hill et al. (2012) cited some of the following research recommendations:

- Information on temperature-at-catch could be used to differentiate between the northern and southern subpopulatons, since it is believed the southern stock inhabits warmer waters.
- Explore models that use a longer time period; this may provide a better context for evaluating changes in productivity. This broader context can also be used to test environmental time series for use in simulations that evaluate sardine harvest control rules.
- Examine fishery targeting when developing appropriate fishery selectivities.
- Look at the sex structure of the population and the catch.
- Consider using age composition instead of length and conditional age-at-length composition data.
- Explore a model that has separate fleets for Mexico, California, Oregon-Washington, and Canada.
- Considering an alternate spawner-recruit relationship that is both biologically realistic and that will stabilize the model.

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Appendix A

MSC Assessment Tree			Pacific Sardine
			Purse seine
Principle	**Component**	**Performance Indicator**	**All**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status	
		1.1.2: Reference points	
		1.1.3: Stock rebuilding	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy	
		1.2.2: Harvest control rules	
		1.2.3: Info/ monitoring	
		1.2.4: Stock assessment	
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status	
		2.1.2: Mgmt strategy	
		2.1.3: Information	
	By-catch species	2.2.1: Status	
		2.2.2: Mgmt strategy	
		2.2.3: Info	
	ETP species	2.3.1: Status	
		2.3.2: Mgmt strategy	
		2.3.3: Info	
	Habitats	2.4.1: Status	
		2.4.2: Mgmt strategy	
		2.4.3: Info	
	Ecosystem	2.5.1: Status	
		2.5.2: Mgmt strategy	
		2.5.3: Info	
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework	
		3.1.2: Consultation, roles, and responsibilities	
		3.1.3: Long term objectives	
		3.1.4: Incentives for sustainable fishing	
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives	
		3.2.2: Decision making process	
		3.2.3: Compliance & enforcement	
		3.2.4: Research plan	
		3.2.5: Management performance evaluation	

Pink (Ocean) Shrimp (*Pandalus jordani*)

Certification Units Covered Under this Species:

- Otter Trawl, Northern California
- Otter Trawl, Southern California

Summary

The West Coast pink shrimp stock extends from southeast Alaska to California. The Pacific Fishery Management Council (PFMC) prepared a draft management plan for California, Oregon, and Washington ocean shrimp in 1981, although it was never formally adopted; in 2004, management authority over the California fishery was granted to the Fish and Game Commission. It is suggested that pink shrimp populations are largely influenced by environmental conditions and less so by fishing pressure. Bycatch has been drastically reduced in the fishery since the mandatory implementation of bycatch reducing devices. As of 2007, the Oregon Pink (Ocean) Shrimp Trawl Fishery has been certified sustainable by the Marine Stewardship Council (MSC).

Strengths:

- Bycatch reducing devices (BRDs) have drastically reduce discards
- Observer coverage
- Part of the Individual Fishing Quota (IFQ) program along with West Coast Groundfish

Weaknesses:

- Population abundance is highly variable seasonally, difficult to estimate stock biomass
- No formal FMP or stock assessments

History of the Fishery in California

Biology of the Species

[From DFG "Status of the Fishery Report" 2006, unless cited otherwise]:

Pink shrimp are found in waters from Unalaska in the Aleutian Islands to San Diego, California, at depths from 150 to 1200 feet (45 to 366 meters). Off the coast of California, this species is generally found from depths of 240 to 750 feet (73 to 229 meters). Spawning may occur throughout the range, but commercial quantities are limited to the area between Queen Charlotte Sound, British Columbia and Point Arguello, California. High concentrations of ocean shrimp typically occur in well-defined areas from year to year, most commonly referred to as beds. Pink shrimp beds are generally characterized by green mud or muddy-sand bottoms. It is assumed that there are no genetically distinct subpopulations of ocean shrimp off the coast of western North America.

Pink shrimp are protandric hermaphrodites, functioning as males during the first year and a half of their life, then passing through a transitional phase to become females. Mating takes place during September and October. The peak hatching period occurs during late March and early April. Pink shrimp go through a larval period which lasts 2 to 3 months. The developing juvenile shrimp occupy successively deeper depths as they grow, and often begin to show up in commercial catches by late summer. Growth rates vary according to region, sex, age, and year class (Dahlstrom 1970). Annual recruitment success has been linked to the strength and timing of "spring transitions" (Hannah 1993; 1999). An early, strong transition is thought to be necessary to produce a large year class.

Pink shrimp undergo diel vertical migration by inhabiting deeper waters near the bottom during the day and ascending in the water column during the night to feed. Stomach contents of shrimp taken at night consist of primarily smaller planktonic animals, such as euphausiids and copepods. Pink shrimp have been reported as prey for many fish species, including Pacific hake, *Merluccius productus*; arrowtooth flounder, *Atheresthes stomias*; sablefish, *Anoplopoma fimbria*; petrale sole, *Eopsetta jordani*; spiny dogfish, *Squalus acanthias*; and several species of rockfish and skates.

Commercial Fishery

The California pink shrimp fishery was consistently more productive in the late 1980s and early 1990s compared to any other period in the 55 years of the fishery (Figure 1, Table 1; DFG 2007). Pink shrimp ex-vessel ladings values have ranged from an average of approximately $4.4 million in the 90's, a significant decrease to an average of $951,000 from 2000-06, and the most recent value is represented in Table 1 (DFG 2007; DFW Commercial Landings Data 2007-11).

A combination of factors may explain the decline in landings since the 90's, such as a weak market attributed to competition from other warm and cold water shrimp fisheries, competition from aquaculture production of warm water species worldwide, the federal groundfish vessel buyback program in 2003, and environmental conditions negatively affecting recruitment (Roberts 2005; MSC 2007; NMFS 2007; DFG 2007). Pink shrimp are very short-lived species, recruit to the fishery at age one and contribute to the fishery for just 3 years (Dahlstrom 1973; Hannah and Jones 1991). Recruitment from year to year can greatly affect the catch, and has

been negatively correlated with ENSO, strong upwelling events and sea level height causing excessive offshore transport of larvae (Hannah 2010). The most recent increase in landings may be due to particularly successful recruitment years due to favorable ocean conditions paired with opportunity to fish under the new federal IFQ program (Pete Kalvass, pers. comm.). Other invertebrate species such as Dungeness crab also saw increases in recruitment for the same time period.

The number of active vessels in the northern region has steadily decreased each year from 2002 through 2006 (Table 2; DFG 2007). Between 2007-12, the number of permits sold has leveled out at between 32-34 permits for the northern trawl, and 15-21 for the southern (declining trend for southern region (DFW, California Commercial Licensing reports 2007-12).

Historically, the majority of pink shrimp fishing off the west coast of the United States occurred in federal waters (DFW 2007). Since 2007, essentially all of the pink shrimp landings have been in the Eureka area off the coast of Northern California (DFW Commercial Landings Reports 2007-11). Although in recent years the southern beds have been productive, they do not appear to have been fished (Pete Kalvass pers. comm.; DFW, Commercial Landings Reports 2007-11). It is unclear as to why this may be, but it may be due to low value of the fishery itself and/or the inability to land pink shrimp at southern ports due to the lack of buyers (Pete Kalvass, pers. comm.). There are no enhancements on the west coast to the pink shrimp stock. ODFW estimates the number of vessels and amount of catch caught in federal waters off California and landed in Oregon ports, from logbooks. In recent years this catch and effort was considerably larger than California landings. In 2011, the estimated catch originating in federal waters off California was 10.3 million pounds from 20 vessels and in 2012 it was 9.5 million pounds from 31 vessels. This catch category was under 3.0 million pounds from 2008 through 2010 (Bob Hannah, pers.comm.). CDFW does not currently have an estimate of the amount of shrimp caught off Oregon and landed in California ports.

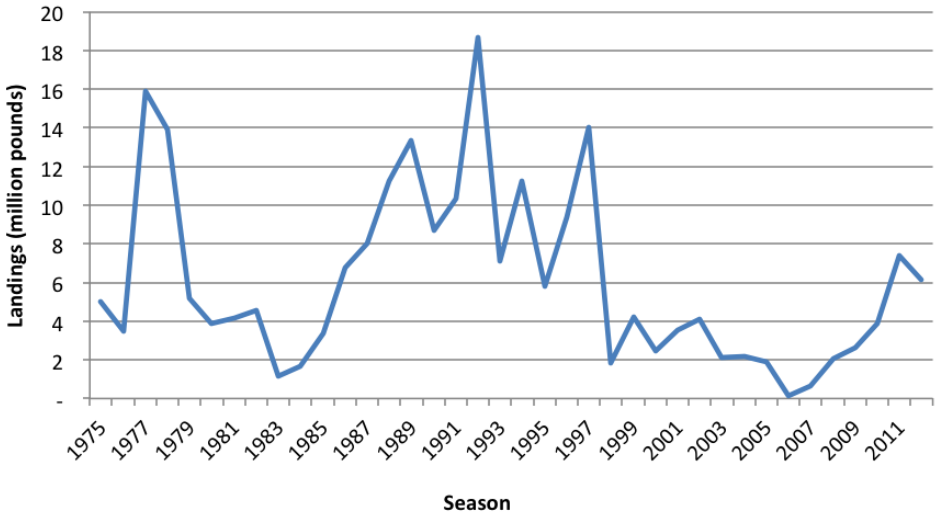

Figure 1. Pacific pink shrimp commercial landings from 1975 to 2012 based on commercial landing receipts.

Table 1. Pacific pink shrimp commercial landings and ex-vessel value for the years 2007-2012 (DFW Commercial Landings Reports 2007-11; *Unpublished, preliminary estimate, pers. comm. Pete Kalvass, DFW)

Year	Landings in pounds	Ex-vessel Value
2007	636,944	$301,695
2008	2,084,404	$1,094,707
2009	2,609,170	$782,876
2010	3,904,052	$1,274,496
2011	7,375,139	$3,684,168
2012	6,152,197*	$2,740,417*

Table 2. Pacific pink shrimp permits sold and active for the years 2001-2006 (From DFG "Information Concerning the Pink Shrimp Trawl Fishery off Northern California," 2007).

Year	Southern region[1]		Northern region[2]	
	Permits sold	Active vessels	Permits sold	Active vessels
2001	56	6	78	32
2002	57	7†	80	26†
2003	46	4	78	9
2004	38	0	47	7
2005	35	1†	43	12†
2006	21	1†	40	4†

[1] Refers to waters south of Point Conception.
[2] Refers to waters north of Point Conception.
† In 2002, 2005, and 2006, one vessel landed pink shrimp in both southern and northern waters.

Recreational Fishery

There is no recreational fishery for pink shrimp.

MSC Principle 1: Resource Sustainability

*Sustainability of Target Stock

The age class structure of the pink shrimp has not been assessed in California since the 1990s, though in Oregon catch is typically dominated by age-1 shrimp (ODFW, 2012) while in some years age-2 can dominate if there was a particularly strong recruitment. Growth rates vary according to region, sex , age, and year class (Dahlstrom 1970), however there is clear pattern

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

of seasonal growth despite the variations mentioned with very rapid growth during spring and summer and slower growth during winter (Frimdog et al. 2009).

Historically, population estimates of shrimp beds were done by DFW sea surveys (1959-1969) then mathematical population models (1969-1975), however its use was discontinued due to variable recruitment, growth and natural mortality rates associated with pink shrimp (DFG 2006). In California, no further attempts to estimate the population have been made. Status determinations of high turnover species are rarely possible due to the constraints of most traditional stock assessment models. Many of these species appear to be sustainably managed with regulatory actions (Field and Francis 2006). California implements regulations such as seasonal closures, maximum count per pound, etc. to manage the pink shrimp population (DFG 2006, 2007).

Environmental factors have been shown to explain most of the variation in the pink shrimp population (Hannah 1993; 1995; 1999; 2010; 2011). In Oregon, environmentally based models have been shown to be the most accurate for predicting and explaining the variation in pink shrimp recruitment. These models suggest that there is not a consistent impact of the pink shrimp fishery on stock abundance in Oregon. Although, overfishing may be possible if intensive fishing occurs on a failed year class (Frimodig et al. 2009).

No stock assessment has been completed for the entire west coast and fishing patterns and pressure may change as a result of the new groundfish IFQ program. Many fishing permits for pink shrimp in California have remained latent (DFW 2007; Pete Kalvass pers. comm.). In Oregon, there was a resurgence of the pink shrimp fishery under IFQ where latent effort was redirected to the fishery leading to higher pink shrimp fishing effort largely due to high shrimp abundance and higher price per pound (ODFW 2012). This could continue in the future and the behavior of the pink shrimp fishery under the IFQ program needs to be understood.

Evaluation against MSC Component 1.1: Sustainability of Target Stock

MSC Performance Indicators	Rating	Justification
1.1.1 Stock Status		No stock assessments have been conducted for CA, but have been in OR; stocks are influenced more by environmental conditions than by fishery; seasonal landings are highly variable
1.1.2 Reference Points		Implicit reference points; same measures as OR and WA – may need more data specific to CA; Changes may occur with new IFQ program
1.1.3 Stock rebuilding		Unable to assess

Harvest Strategy (Management)

The pink shrimp fishery off the west coast of the United States is principally state-managed, although some federal regulations apply. Historically there were federal regulations including daily and monthly trip limits for incidental catches of federally managed groundfish species. Now pink shrimp are part of a federal West Coast Groundfish Trawl Individual Fishing Quota (IFQ)

program. This changed the regulations from bimonthly trip limits to individual quota shares and still includes a vessel monitoring system and area restrictions protecting groundfish Essential Fish Habitat (EFH) (Code of Federal Regulations Title 50).

The Pacific Fishery Management Council (PFMC) created a draft Fisheries Management Plan (FMP) in 1981 (Abramson et al. 1981). The plan remains a draft, however the three west coast states – California, Oregon, and Washington – agreed on several management measures and work together with PFMC through a Memoranda of Understanding and/or reciprocal rulemaking to manage the west coast fishery (DFW 2007).

In 2004, the California State Legislature approved Senate Bill 1459, adding Fish and Game Code (FGC) §8841 to statute, granting the Fish and Game Commission (Commission) management authority over California's commercial bottom trawl fisheries and amending FGC §8842, which pertains to management of the pink shrimp trawl fishery. In 2001, the regulatory areas were eliminated and the fishery was divided into northern and southern management regions, requiring a separate permit Ito fish in each region (California Code of Regulations (CCR) Title 14 §120). The northern region extends from the California-Oregon border to Point Conception and is a limited entry fishery. The southern region extends from Point Conception to the California-Mexico border and it is an open access fishery. Trawling is not permitted in California State waters at this time and the pink shrimp fishery operates in federal waters only.

The stock in California is primarily managed through the following regulations:

- Closure of various state and federal waters to trawling
- Use of bycatch reduction devices (BRDs)
- Closed season from November 1 through March 31 to protect egg-bearing females
- Maximum count-per-pound of 160 to prevent overfishing juvenile shrimp
- Minimum mesh size of 1 3/8 inches to allow escapement of juvenile shrimp
- State and federal incidental catch limits to minimize mortality of non-target species

Oregon and Washington employ similar regulations for BRDs, size, and count similar to recommendations made in the PFMC draft FMP. In addition, the new federal west coast trawl IFQ program (implemented in 2012) monitors all catch of species though on board observers, including pink shrimp. Currently, California does not conduct a stock assessment of pink shrimp, but Oregon does. Modeling efforts have increased our ability to forecast stock abundance (Hannah 2010). Pink shrimp recruitment, and therefore populations, are thought to be more affected by environmental factors like ENSO, upwelling events and sea level height than fishing effort (Hannah 2010). However, this could change if fishing effort were high during a bad recruitment year. Oregon saw an increase in fishing effort in the pink shrimp fishery with the implementation of the new IFQ program. It is unknown whether this increase will continue or if it was seen in other Pacific states.

Evaluation against MSC Component 1.2: Harvest Strategy (Management)
Northern California fishery

MSC Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Restricted access fishery, Included in West Coast Groundfish IFQ program - may be new changes in fishery; harvest rules not responsive to changes in the stock; need to better understand the Memorandum of Understanding between states
1.2.2 Harvest Control Rules and Tools		Managed via minimum mesh size, size limits, catch limits, seasonal closures; no evaluation of methods; Shared management with OR and WA; no CA-specific data
1.2.3 Information/Monitoring		Currently using OR-specific data, unclear whether information can be extrapolated to CA
1.2.4 Assessment of Stock Status		

Evaluation against MSC Component 1.2: Harvest Strategy (Management)
Southern California fishery

MSC Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Open access; harvest rules not responsive to changes in the stock; need to better understand the Memorandum of Understanding between states
1.2.2 Harvest Control Rules and Tools		Managed via minimum mesh size, size limits, catch limits, seasonal closures; no evaluation of methods; Shared management with OR and WA; no evaluation of methods, no data collection in CA
1.2.3 Information/Monitoring		Currently using OR-specific data, unclear whether information can be extrapolated to CA
1.2.4 Assessment of Stock Status		

MSC Principle 2: Environment

Retained Species

According to observer data from 2008 - 2011, there is no retained catch in the California pink shrimp trawl fishery, although it is unclear how representative these values are for the entire California fishery, or if changes will occur with the IFQ program (NWFSC 2011). Since 2004, the West Coast Groundfish Observer Program (WCGOP) has observed California Northern Pink Shrimp Trawl Vessels, with relatively stable coverage of around 6% coastwide, and approximately 13% for California alone in 2011 (average from WA, OR, and CA) (NWFSC 2012). In 2007, the WCGOP combined California and Oregon pink shrimp fisheries into one sampling population for the period Mar-June 2007. Due to regulation differences between Oregon and California, the pink shrimp trawl fisheries were again split into two sampling populations by state for the period July-December 2007. Since 2008, Oregon pink shrimp and California pink shrimp licenses have been observed as two separate fisheries (NWFSC 2011; Bellman et al. 2010).

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		All non-target catch was discarded on observer covered vessels from 2008-2011
2.1.2 Management		Area and seasonal closures; mandatory bycatch reducing devices (BRDs)
2.1.3 Information		Observer data from the West Coast Groundfish Observer program, landings receipts

Bycatch Species

Percent of bycatch that is discarded relative to total landings in the California pink shrimp fishery has been less than 6% from 2008 - 2011, mostly consisting of other shrimp species, Pacific hake, squid and smelt, with minor amounts of rebuilding species (Table 3; NWFSC 2012). Bycatch is minimal for the US west coast pink shrimp fishery compared to other shrimp trawl industries worldwide since the implementation of mandatory bycatch reducing devices (BRDs), including the Nordmøre grate (rigid-grate excluder), a soft-panel excluder, and fisheye excluder (Frimodig et al. 2009).

Evaluation against MSC Component 2.2: Bycatch Species

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch is <6% of total catch
2.2.2 Management		BRDs are mandatory and drastically reduce bycatch rates
2.2.3 Information		Observer data from the West Coast Groundfish Observer program, landings receipts

Table 3. West Coast Groundfish Observer data on bycatch from trawl vessels targeting California pink shrimp from 2008 to 2011 (NWFSC 2011).

	2011		2010		2009		2008	
Discarded Species	Amount of Discard (mt)	% discard relative to total landings	Amount of Discard (mt)	% discard relative to total landings	Amount of Discard (mt)	% discard relative to total landings	Amount of Discard (mt)	% discard relative to total landings
Non-rebuilding species								
Pacific Hake	3.52	0.81%	6.45	2.29%	0.70	0.53%	4.75	3.37%
Flatfish Unid	0.35	0.08%	0	0%	--		0	0%
Non-groundfish species								
Shrimp Unid	8.55	1.96%	7.24	2.57%	5.06	3.84%	2.11	1.50%
Squid Unid	1.48	0.34%	0.97	0.35%	0.01	0.01%	0.01	0.01%
Smelt Unid	1	0.23%	0	0%	--		0	0%
Slender Sole	0.60	0.14%	0.54	0.19%	0.42	0.32%	0.23	0.16%
Rebuilding species								
Arrowtooth Flounder	0.14	0.03%	0.04	0.01%	0.24	0.18%	0.04	0.03%
Darkblotched Rockfish	0.07	0.02%	--	--	0	0%	--	--

*Observer coverage: 2011 = 13%, 2010 = 15%, 2009 = confidential data, 2008 = confidential data.

*Endangered, Threatened, & Protected Species

There have been no significant interactions identified between the pink shrimp fishery and threatened or endangered marine species of birds, mammals, or fish in California (Roberts 2005; MSC 2007). The pink shrimp fishery is classified as a Marine Mammal Protection Act category III fishery with no observed or documented take of marine mammals (Federal Register: Vol. 72, No. 124). Other biologically sensitive species in near pink shrimp trawling grounds in California include canary rockfish, bocaccio, widow rockfish, and yelloweye rockfish (NMFS 2005; MSC 2007). The bycatch of these rockfish species has been minimized due to BRDs (Hannah et al. 1996; ODFW 2006; Hannah and Jones 2007; MSC 2007). Recently the listing of Pacific eulachon has resulted in the first and only interaction of the pink shrimp trawl fishery with ETP.

Evaluation against MSC Component 2.3: ETP Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		ETP species impacts are low
2.3.2 Management		BRDs; Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act, etc.
2.3.3 Information		Observer data from the West Coast Groundfish Observer program, landings receipts, logbooks

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Habitats

Pink shrimp beds are generally characterized by green mud or muddy-sand bottoms (Frimodig et al. 2009). Although soft bottom seafloor habitats on the continental shelf where pink shrimp fishing occurs are considered to have a low sensitivity to trawl gear, their recovery times from gear impacts may be longer compared to other substrate types. Several studies examining gear effects on soft bottom indicate that mud substrates are more stable and have longer recovery times than sand substrates (NRC 2002; Hannah et al. 2010). A mean recovery time for trawl gear impacts in pink shrimp fishing grounds is estimated to be less than one year in the absence of bottom trawl fishing (NMFS 2005).

Trawling is prohibited in all state waters in addition to Essential Fish Habitat Conservation Areas. The closure of the pink shrimp trawling fishery from November through March allows some recovery time to pink shrimp beds benthic habitats.

Evaluation against MSC Component 2.4: Habitats

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Muddy bottoms have low sensitivity to trawl gear
2.4.2 Management		Area closures (no trawling in state waters, EFH areas)
2.4.3 Information		Observer data; logbooks; OR research available – may need more CA-specific research in the future

Ecosystem

An ecosystem approach to fisheries management in the California Current 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 (DFW 2007).

Intensive trawling has been shown to have effects on some types of seafloor habitats (NRC 2002). Some research of shrimp trawling effects on ocean floors has been done off the coast of Oregon by Hannah et al. in 2010 in four mud-habitat areas with different types of trawling history. Overall, they found measureable decreases in macroinvertebrate density and diversity in heavily trawled grounds. It is assumed that there would be similar effects of trawling off the coast of California.

In California pink shrimp trawl grounds there is the potential for coral habitats to be affected. Trawling may cause substantial damage to coral habitats (Auster and Langton 1999; Koslow et al. 2001; Fosså et al. 2002; Roberts et al. 2006) and coral habitats may occur in State trawling grounds. However, trawling in California state waters is currently prohibited. The structure and habitat type of federal pink shrimp trawling grounds has not been mapped.

Current state and federal pink shrimp management measures were not implemented to

specifically address ecosystem management (DFW 2007). The current management measures in place may collectively foster a sustainable fishery and indirectly promote a healthy ecosystem by reducing potential fishery impacts on the system. These measures include:

- Limited entry pink shrimp permitting system to control fishing capacity
- Reduction of fleet capacity due to vessel buyback programs
- Logbook program to monitor catch location, effort, and gear information
- Maximum count per pound of landed catch to avoid overfishing juvenile shrimp
- Closed fishing season to protect egg-bearing females
- Minimum mesh-size required to allow for escapement of juvenile shrimp
- Bycatch reduction device required on the net to minimize groundfish bycatch
- Area restrictions (Essential Fish Habitat, Marine Preserves, MPAs)
- Federal at-sea observer coverage mandated by law
- State and federal incidental trip limits to minimize mortality of non-target species

PFMC has written a draft Fishery Ecosystem Plan (FEP) for the US portion of the California Current Ecosystem. The goal of a FEP is to enhance the Council's species specific management programs with more ecosystem science, broader ecosystem considerations and management policies that coordinate Council management across FMPs and the California Current Ecosystem. This plan is set to be adopted as final during April 6-11, 2013. At this stage however, more information is needed to understand how or if the current management measures protect the ecosystem structure and function.

Evaluation against MSC Component 2.5: Ecosystem

MSC Performance Indicators	Rating	Justification
2.5.1 Outcome		Management measures may indirectly reduce ecosystem impacts, though no quantitative measures are in place to assess
2.5.2 Management		Gear and area restrictions; MPAs; The PFMC recently drafted the Fishery Ecosystem Plan
2.5.3 Information		More information is necessary

MSC Principle 3: Management System

Governance and Policy

The California pink shrimp fishery operates within federal and state waters off of California on

the west coast of the US. A permit is required to land pink shrimp in California, which can be obtained from DFW under specified conditions. In State waters the fishery is regulated by the Commission and regulations are implemented and the fishery is managed by DFW. California works to manage with the other west coast states, Washington, and Oregon as well as the PFMC through Memorandums of Understanding (MOU) and other agreements. In addition, the pink shrimp trawl fishery is now part of the West Coast Groundfish Trawl IFQ program.

Evaluation against MSC Component 3.1: Governance and Policy

MSC Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		FGC and DFW manage the fishery within an effective framework for delivering sustainable fisheries
3.1.2 Consultation, Roles and responsibilities		Roles and responsibilities are clearly laid out; FGC meetings are open to the public and to public comments
3.1.3 Long-term Objectives		Magnuson-Stevens Act, Marine Life Management Act
3.1.4 Incentives for Sustainable Fishing		Magnuson-Stevens Act, Marine Life Management Act

Fishery Specific Management System

Currently the fishery has a draft FMP from 1981 developed by the PFMC. However, the three west coast states, California, Oregon, and Washington utilize recommendations from the draft FMP and work together through MOUs to implement similar regulations across state borders. Trawling in California State waters is closed.

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

MSC Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		Some objectives outlined in 1981 FMP
3.2.2 Decision-making Processes		MOUs between states, but no clear explicit process
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		Oregon has a research plan but not specifically for CA; CA may need to establish more biological monitoring
3.2.5 Management Performance Evaluation		Regulations are relatively static, though bycatch reduction devices have been evaluated; no formal review of management system in CA

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available.

Recommendations

OPC may want to consider working with Oregon (whose pink shrimp fishery is already certified) and Washington as well as MSC to certify the fishery for the entire west coast. This may result in reduced costs for certification and recertification in the future for all three states. If California pursues certification, Oregon will serve as an excellent example. There has been a very successful and trusting partnership between the pink shrimp fishing fleet and the State. This

has resulted in a recertification of the fishery earlier this year on more researching on the pink shrimp fishery.

The implementation of the IFQ program, of which pink shrimp is a part may change the way that the fishery is fished and the impacts. California should consider these changes. In the first year of the IFQ program in Oregon they saw a marked increase in pink shrimp landings over previous years. It is possible that the IFQ program may result in latent permits in California entering the fleet again when the conditions are right.

In addition, ODFW 2012 pink shrimp newsletter mentions that MSC certification may require a Target and Limit reference point system in the future. Basing a system like this on formal stock assessment and monitoring could be quite costly for CDFW to implement (Kalvass, pers. comm.).

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Appendix A

MSC Assessment Tree			Pink Shrimp	
			Otter trawl	
Principle	**Component**	**Performance Indicator**	**Northern**	**Southern**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status		
		1.1.2: Reference points		
		1.1.3: Stock rebuilding	*Did not assess*	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy		
		1.2.2: Harvest control rules		
		1.2.3: Info/ monitoring		
		1.2.4: Stock assessment		
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status		
		2.1.2: Mgmt strategy		
		2.1.3: Information		
	By-catch species	2.2.1: Status		
		2.2.2: Mgmt strategy		
		2.2.3: Info		
	ETP species	2.3.1: Status		
		2.3.2: Mgmt strategy		
		2.3.3: Info		
	Habitats	2.4.1: Status		
		2.4.2: Mgmt strategy		
		2.4.3: Info		
	Ecosystem	2.5.1: Status		
		2.5.2: Mgmt strategy		
		2.5.3: Info		
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework		
		3.1.2: Consultation, roles, and responsibilities		
		3.1.3: Long term objectives		
		3.1.4: Incentives for sustainable fishing		
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives		
		3.2.2: Decision making process		
		3.2.3: Compliance & enforcement		
		3.2.4: Research plan		
		3.2.5: Management performance evaluation		

Sablefish (*Anoplopoma fimbria*)

Certification Units Considered Under this Species:

- Trawl IFQ
- Longline IFQ
- Trap IFQ

Summary

Sablefish are the highest valued finfish per pound in the west coast commercial fisheries as of 2013. In 2011, National Marine Fisheries Service (NMFS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries implemented a new management system for a section of the West Coast Groundfish Trawl Fishery known as the Catch Share or Individual Fishing Quota (IFQ) Program, in which area specific annual catch limits are allocated among limited entry trawl permit holders (though multiple gear types may be used). The 2011 West Coast sablefish stock assessment indicates that the stock is in decline. Although not considered overfished, it is in the precautionary zone which causes more restrictive harvest levels to be implemented. Note: The West Coast limited entry groundfish trawl fishery is currently undergoing MSC assessment, which includes the IFQ sector.

Strengths:

- Individual fishing quota must cover all target species catch in additional to bycatch species
- High observer coverage
- Tightly managed (limited entry, depth limit, annual catch limits, gear restrictions, area closures)
- Stock assessments frequently prepared (began in 1984, most recent in 2011)

Weaknesses:

- Food web and ecosystem impacts are currently unknown at this time, however the PFMC recently drafted a new Fishery Ecosystem Plan
- More information is needed on habitat impacts of gear
- Stock is below the healthy target level (the stock is on a downward trajectory according the 2011 stock assessment)

History of the Fishery in California

Biology of the Species

[From CDFG 2008 unless cited otherwise]:

Sablefish is one of two members of the fish family Anoplopomatidae. Sablefish can grow to 3-4 feet (91-122 centimeters) in length and are blackish-gray in color. The dark color earned them the common name of black cod, widely used among commercial fishers. The geographic distribution of sablefish ranges from southern Baja California, Mexico to the northern stretches of the Bering Sea and Japan. Sablefish spawn during winter months, laying eggs in water generally deeper than 1000 feet (300 meters). Eggs become more buoyant as they mature bringing them closer to the surface. These first few months of larval life are imperative to survivorship and are highly dependent on oceanic conditions to provide nutrients. Once hatched, juvenile sablefish will remain within inshore waters until reaching maturity, between 4 and 6 years, at which time they migrate offshore to deep water (greater than 1600 feet; 500 meters). They are commonly found on muddy bottoms and can be found as deep as 6500 feet (2000 meters). Examination of otoliths (inner ear bones) to determine age suggests that sablefish, much like other species of groundfish, are long lived and slow growing after maturity and both sexes reach maximum growth around age 10. Females grow larger and live longer than males; the largest female included in the most recent stock assessment (2011) measured 40 inches (102 centimeters) and was estimated to be between 80 and 92 years old. The largest male, at 35 inches (91 centimeters) was estimated to be 68 years old. Based on fishing depth information the older sablefish are caught in deeper water. As adults, carnivorous sablefish are effective predators that target crustaceans, cephalopods and other fish. Conversely, sablefish are preyed on by other fishes and marine mammals, such as Pacific cod, Pacific halibut, spiny dogfish, elephant seals, harbor seals and California sea lions.

Commercial Fishery

Sablefish is the most valuable species in the West Coast groundfish fishery. If the sablefish stock becomes overfished, it will likely impact the entire west coast fishery (Grebel, pers. comm.). The California Department of Fish and Wildlife (DFW, formerly California Department of Fish and Game) began recording commercial landings in 1900 (Figure 1). Since 1945, the sablefish fishery continued to grow gradually before a significant increase during the 1970s due to foreign vessels (Van Houten Lynde 1986, McDevitt 1987), then transitioning to a domestic fleet. A decline in domestic landings through the 1980s was likely due to a combination of reduced Asian market strength and increasing regulation of the fishery. Annual landings have remained below 10,000 mt in subsequent years (PFMC 2011b).

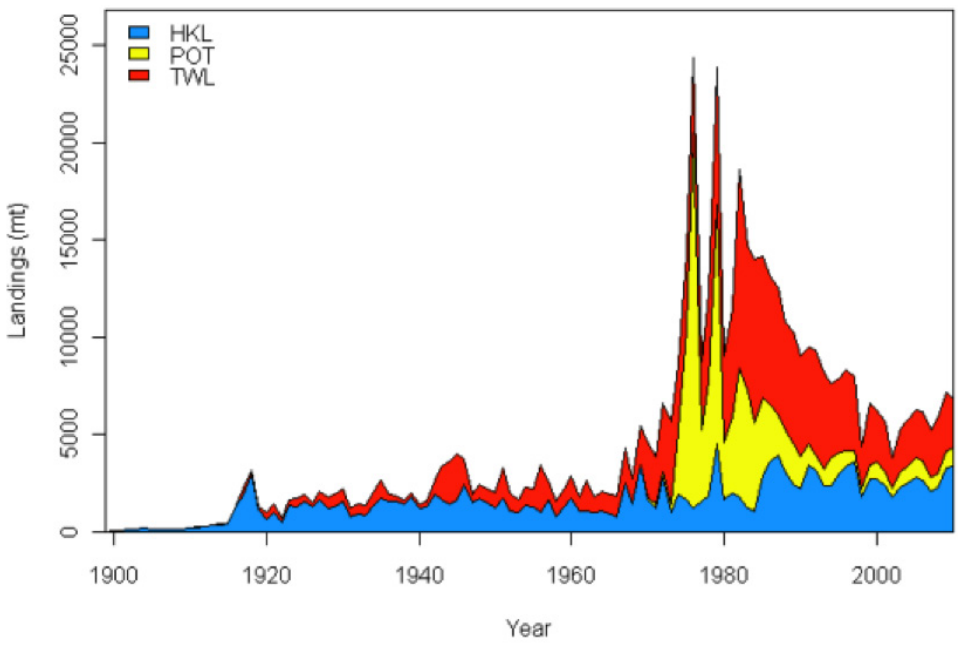

Figure 1. Sablefish landings history, 1900-2010. Fleet names indicate gear (HKL = Hook-and-line, POT = Pot, and TWL = Trawl). Foreign fleets are included and are largely responsible for the large values in 1976 and 1979 (PFMC 2011b).

The fishery is divided into the following management areas (Figure 2; PFMC 2011a):

Conception - Southern boundary of EEZ to 36^{0}00’ N. latitude

Monterey - 36^{0}00’ N. latitude to 40^{0}30’ N. latitude

Eureka - 40^{0}30’ N. latitude to 43^{0}00’ N. latitude

Columbia - 43^{0}00’ N. latitude to 47^{0}30’ N. latitude

Vancouver - 47^{0}30’ N. latitude to northern boundary of the EEZ

During the most recent decade, the commercial fishery has been split approximately 44% from hook-and-line, 14% from pot and 43% from trawl gear, although this is changing with the onset of the catch shares IFQ program (PFMC 2011). The IFQ program allocates a set quota of the allowed harvest to individual fishermen, allowing them the flexibility to harvest their share of the catch whenever they want and with a variety of gears. The annual catch limit (ACL) is allocated between northern and southern regions, approximately 74% and 26% respectively (Federal Register 2013). Within these regions, the ACL is reduced by some amount to account for research, tribal, incidental open access, leaving an amount for the “fishery harvest guideline.” That number is then split between the trawl and non-trawl sectors. The non-trawl allocation may be further sub-divided into limited entry fixed gear, open access fixed gear (PFMC 2011). As of 2013, approximately 31% of the Northern region and 29% of the Southern region ACL were allocated to the IFQ program (Federal Register 2013). Within the IFQ program, trawl is the dominant gear type, however preliminary data for the entire west coast fishery indicate the use of fixed gear increased for sablefish, due to hook□and□line gear landings increasing from 13 to 19 percent of IFQ sablefish landings from 2011 to the 2012 season (Matson 2013). The fixed gear fishery generally targets sablefish along with thornyheads and slope rockfish (very

little Dover sole or other flatfish), while the trawl fishery generally targets sablefish with other deepwater species such as Dover sole and thornyheads (NMFS 2011). All vessels participating in the 2011 established West Coast groundfish IFQ program are required to carry a NOAA Fisheries–certified observer during all IFQ fishing trips (with few exceptions), while vessels participating in the non-IFQ limited entry or open access fixed gear sablefish fisheries are subject to random observer coverage (Table 1).

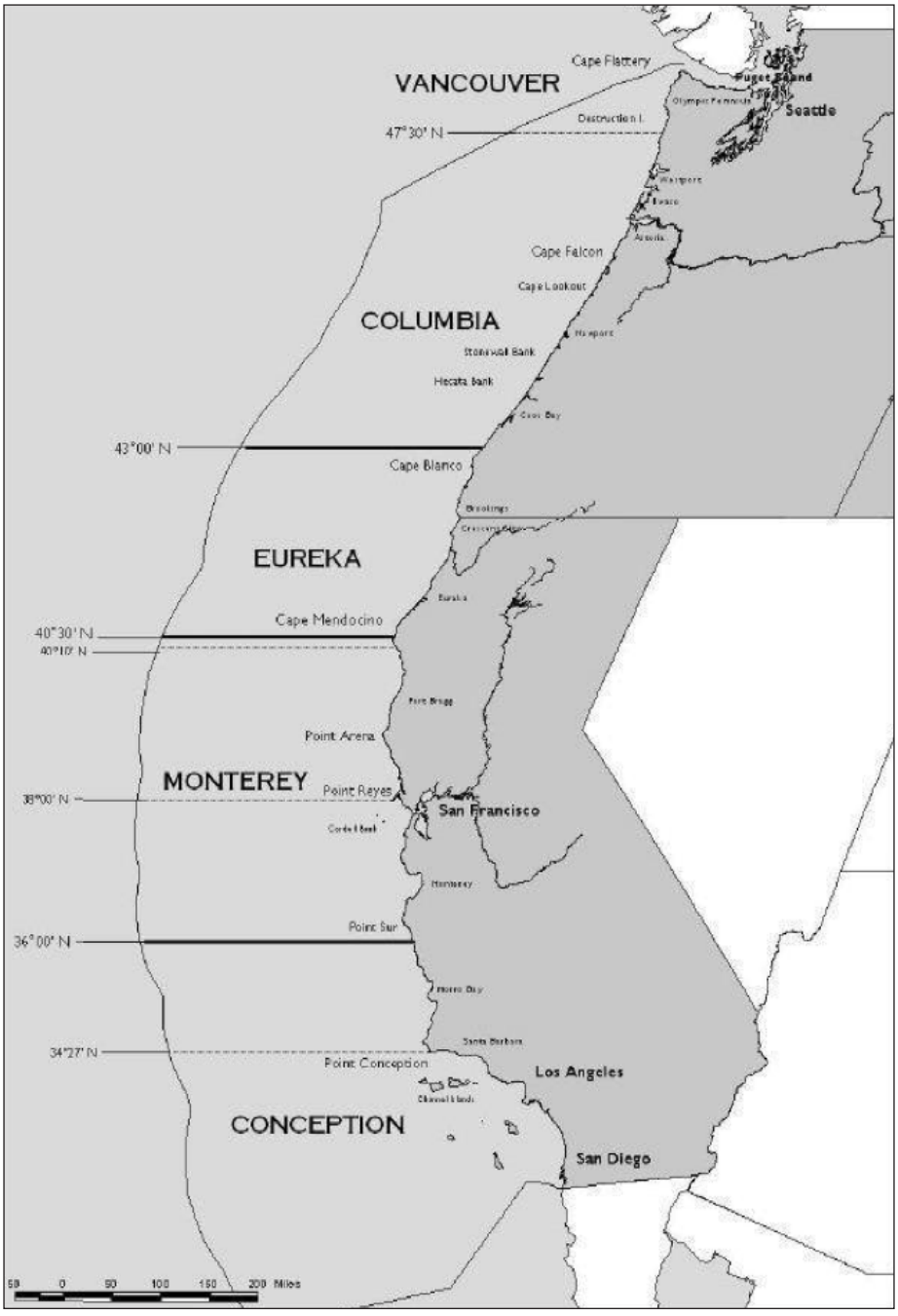

Figure 2. International North Pacific Fisheries Commission (INPFC) statistical areas in the U.S. exclusive economic zone seaward of WA, OR, and CA (PFMC 2011a).

Table 1. Sablefish vessel observer coverage by sector in 2011 (NWFSC 2011b).

Sector	% Coverage
IFQ	
Hook-and-Line	98.9%
Pot	99.7%
Trawl	94.8%
Non-IFQ	
Limited Entry Fixed Gear	25%
Open Access	6%

Recreational Fishery

Sport utilization of sablefish is considered negligible (Grebel, pers. comm.). The depth distribution of sablefish normally places them beyond most sport fishing activity; however, recreational anglers can land this species with a recreational fishing license if it is encountered while fishing in legal depths when groundfish fishing is open (CDFG 2001; CDFG 2008). The estimated recreational catch allocation was less than 0.2% of the ACL for the Northern region in 2013, although it is unclear whether records are kept to verify if these allocations are actualized (Matson 2013).

MSC Principle 1: Health of Fish Stock

*Sustainability of Target Stock

[From PFMC 2011b unless cited otherwise]

Previous analyses have suggested the existence of several 'stocks' of sablefish in the Eastern Pacific, including a southern California stock, a central California through Washington stock and a British Columbia to Gulf of Alaska (Schirripa 2007; and earlier assessments). Differences in maximum body size (larger to the north) and growth rates (slower to the north) are apparent; however environmental effects cannot easily be isolated from stock structure. The U.S. North Pacific sablefish fishery (Bering Sea and Gulf of Alaska longline fishery) has been certified sustainable by the Marine Stewardship Council (MSC)[1] since 2006 and the U.S. West Coast limited entry groundfish trawl fishery (including the IFQ sector) is currently undergoing MSC assessment[2].

Stock assessments of sablefish began in 1984 and have been conducted frequently since then. The most recent sablefish stock assessment was conducted in 2011. The coast-wide overfishing limit (OFL) for sablefish has ranged from 4,977 (2002), 9,914 mt (2009) and 6,621 mt (2013) during the last decade. Annual catch limits have ranged from 4,596 (2002), 8,423 mt (2009) and 5,451 (2013) over the same period. Landings are estimated to have been below the catch limits in all years. As of 2011, the relative spawning biomass for the West Coast sablefish

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment

[1]The U.S. North Pacific sablefish fishery MSC assessment is available at: http://www.msc.org/track-a-fishery/fisheries-search/us-north-pacific-sablefish/files/73d901a7528b54d02266102d2ab0d5221815c0f4/@@display-file/file_data

[2]Information for the West Coast groundfish limited entry trawl fishery currently in MSC assessment is available at: http://www.msc.org/track-a-fishery/fisheries-in-the-program/in-assessment/pacific/us-west-coast-limited-entry-groundfish-trawl

stock is at 34% of unfished levels. The stock is considered to be overfished when current SSB is less than 25% of unfished biomass, thus current estimates of SSB suggest that the stock is not overfished. However, the stock is in the precautionary level (meaning that it falls in between the healthy level of 40% of the overfished level of 25%). Given it is in the precautionary zone, the PFMC implemented more restrictive management measures, including an automatic precautionary reduction to the harvest limit that is set. According to the 2011 stock assessment the coast-wide abundance was estimated to have dropped below the healthy target level (SSB = 40%) in 2009 and is currently declining steeply in part due to poor recruitment. In addition, fishery independent data, including the NWFSC shelf and slope trawl survey time series from 2003-2010, indicates the biomass index shows a relatively precise and strongly declining trend.

Some groundfish have shown decadal changes in productivity linked to ocean conditions, including El Niño and La Niña regimes. For sablefish, recruitment success has been correlated with productivity in the California current (Schirripa et al. 2009). Future environmental conditions, changes in the timing, dynamics and productivity of the California current ecosystem may have potential to directly affect the sablefish stock through changes in recruitment success.

Life history characteristics of sablefish indicate sablefish generally grow rapidly reaching nearly asymptotic size and beginning to mature after 5-7 years and full size and maturity in their first decade of life. These traits show a strong latitudinal gradient, with slower growth and maturity schedules moving north along the distribution, as well a high degree of variability among studies. Female sablefish generally reach larger sizes than males; however, the sex-ratio tends to be skewed toward males at the oldest ages, implying a lower natural mortality rate for males relative to females. The fish are long-lived, regularly living over 40 years of age. The longest living sablefish on record was 114 years of age (Sigler et al. 2001). Females are highly fecund, and fecundity increases with size, however it is unclear whether there is a size or age-dependent effect on relative fecundity. A 28-inch, 7-year-old female is capable of producing 100,000 eggs, while a 40-inch, 20-year-old female is capable of producing 1 million eggs (Hanselman et al. 2006). Available data suggests that sablefish are determinate spawners (i.e. total advanced oocytes at the beginning of the spawning season is equivalent to total annual spawning output) and spawn 3-4 times per year (Hunter et al. 1989, Macewicz and Hunter 1994).

Evaluation against MSC Component 1.1: Sustainability of Target Stock

MSC Performance Indicators	Rating	Justification
1.1.1 Stock Status		The stock is in the precautionary zone, it is estimated at 33% of its unfished biomass (i.e. it falls between the healthy level of 40% and the overfished level of 25%); reference points are in place; the fishery is evaluated annually
1.1.2 Reference Points		There are well established reference points
1.1.3 Stock rebuilding		Not triggered; stock is not considered overfished

Harvest Strategy (Management)

From the early 1900s to the early 1980s, management of the sablefish fishery was the responsibility of the individual coastal states (California, Oregon, and Washington). Since the adoption of the Groundfish Fishery Management Plan by the Pacific Fishery Management Council (PFMC) in 1982, sablefish was designated a federal groundfish and responsibility has rested with the federal government and the PFMC. The first coast-wide-established regulations on the sablefish fishery off the U.S. Pacific coast were implemented as trip limits (total allowable amount of a groundfish by weight that may be landed per vessel from a single fishing trip) in October 1982 and has been followed by a rich history of management via seasons, size-limits, trip-limits, and a complex permit system (Figure 3; PFMC 2011b).

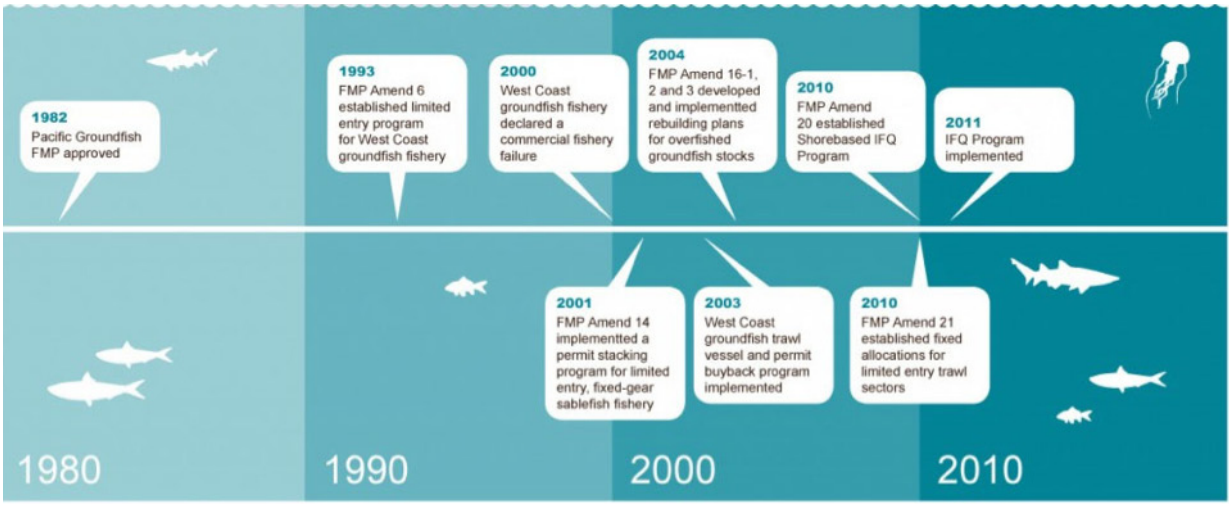

Figure 3. Management timeline for the West Coast groundfish fishery. (MRAG Americas 2013)

A federal limited entry permit (LEP) program was created in 1994. It was designated to control the capacity of the groundfish fishing fleet by limiting the number of fishing vessel permits, limiting the number of vessels using each of the three specified gear types (trawl, trap, and longline) and limiting increases in harvest capacity by limiting vessel length. In 2001, the PFMC adopted Amendment 14 to the Groundfish FMP known as the “tier program” for the northern fishery (PFMC 2011a). This program replaced the derby style fishery by creating permit stacking in the limited entry fixed gear (longline and trap) sector which allows permittees to combine multiple landings limits based on the number of permits (up to 3) stacked on a vessel. For the fixed gear sector, the tiered program extended fishing seasons and allowed commercial fishers greater flexibility and efficiency during the fishing season by maximizing individual business strategies and promoting safety.

In 2011, NMFS and NOAA Fisheries implemented a new management system for the West Coast Groundfish Trawl Fishery known as the catch shares system, trawl rationalization program, or the Individual Fishing Quota (IFQ) program. The new framework sets area specific catch limits which are allocated among limited entry trawl permit holders. The IFQ systems give each fisherman a share of the trawl allocation. Since the allocation can change from year to year, the IFQ is usually a percentage of the allocation. Fishermen can increase their share of the catch by buying or leasing IFQs from other fishermen. The program initially allocated IFQ as quota share (QS) based on fishery participants’ historic involvement in the fishery. Prior to the start of each fishing year, NMFS issues quota pounds (QP) to entities based on the amount of QS they hold. When a vessel goes fishing under the IFQ program, all catch (including discards)

must be recorded and counts against the vessel's QP account.

Groundfish sectors are observed by the West Coast Groundfish Observer Program (WCGOP), which was established in May 2001 as a Cooperative Agreement between PSMFC and NMFS in response to the West Coast Groundfish Fishery being declared a failure on January 19, 2000 (WCGOP 2013). This requires that all vessels that catch groundfish in the US EEZ from 3-200 miles offshore to carry an observer when notified to do so by NMFS or its designated agent. The IFQ program has close to 100% monitoring of the catch through at-sea observers and dockside catch monitors. Subsequent state rulemaking has extended NMFS's ability to require that California and Oregon vessels, which only fish in the 0-3 mile state territorial zone, also carry observers. WCGOP observers are stationed along the US west coast from Bellingham, Washington to San Diego, California (NMFS 2011a). In addition, trawl fishery logbook data have been collected by CDFG since the 1970s. These records provide tow-by-tow information regarding groundfish species including sablefish (PFMC 2011b).

Before the start of the sablefish primary season, all sablefish landings made by a vessel in the limited entry fixed gear (non-IFQ) are subject to daily, weekly and/or bi-monthly trip limits. Vessels participating in the catch shares/IFQ program are not subject to trip limits and can fish their QP throughout the year. Regulations state that traps or pots must have biodegradable escape panels constructed with 21 or smaller untreated cotton twine in such a manner that an opening at least 8 inches (20.3 cm) in diameter results when the twine deteriorates to prevent ghost fishing should traps become lost.

The PFMC approved Amendment 19 to the Groundfish FMP in 2006, designating Essential Fish Habitat (EFH) for groundfish (PFMC 2011a). EFH is described as all waters from the high tide line (and parts of estuaries) to 3,500 meters (1,914 fathoms) in depth. In addition to identifying EFH, the Council also adopted mitigation measures directed at the adverse impacts of fishing on groundfish EFH. Principal among these are closed areas to protect sensitive habitats. There are three types of closed areas: bottom trawl closed areas, bottom contact closed areas, and a bottom trawl footprint closure. The bottom trawl closed areas are closed to all types of bottom trawl fishing gear. The bottom trawl footprint closure closes areas in the EEZ between 1,280 m (700 fm) and 3,500 m (1,094 fm), which is the outer extent of groundfish EFH. The bottom contact closed areas are closed to all types of bottom contact gear intended to make contact with the bottom during fishing operations, which includes fixed gear such as longline and pots (PFMC 2008).

Evaluation against MSC Component 1.2: Harvest Strategy (Management)

MSC Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		A harvest strategy is in place which includes an annual harvest limits and harvest control rules; all discards must be covered by quota pounds; 100% observer coverage; area closures and gear restrictions
1.2.2 Harvest Control Rules and Tools		Harvest control rules and reference points are responsive to changes in the stock
1.2.3 Information/Monitoring		Fishery dependent and independent data are collected to support the harvest strategy; control mechanisms are in place to respond to changes in the fishery; observer data; logbooks
1.2.4 Assessment of Stock Status		Stock assessments are conducted regularly using independently reviewed methods

MSC Principle 2: Environment

Retained Species

Longline

The hook-and-line fishery generally targets sablefish, with minor incidental catch (<5% of total catch) of shortspine thornyhead and rougheye rockfish (Table 2). Incidental catch of rebuilding species is relatively low. Each retained species must be covered by a vessel's QP (NMFS 2011).

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		Retained catch levels are relatively low; all species are known and quantified
2.1.2 Management		Incidental catch must be covered by quota pounds; high observer coverage; Species are covered under the Groundfish FMP
2.1.3 Information		Observer data (98.9% coverage), logbooks, landings receipts

Trap

The trap gear fishery generally targets sablefish only, though lingcod is occasionally caught incidentally (Table 2). Each retained species must be covered by a vessel's QP (NMFS 2011).

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		None of the retained species are depleted and catch levels are low; all species are known and quantified
2.1.2 Management		Incidental catch must be covered by quota pounds; high observer coverage; Species are covered under the Groundfish FMP
2.1.3 Information		Observer data (99.7% coverage), logbooks, landings receipts

Trawl

The trawl fishery generally targets sablefish with other deepwater species such as Dover sole, arrowtooth flounder and thornyheads (Table 2). Each retained species must be covered by a vessel's QP (NMFS 2011).

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		Retained catch levels are relatively low; all species are known and quantified
2.1.2 Management		Incidental catch must be covered by quota pounds; high observer coverage; Most species are covered under the Groundfish FMP
2.1.3 Information		Observer data (94.8% coverage), logbooks, landings receipts

Table 2. West Coast Groundfish Observer data for top retained species from IFQ vessels targeting Sablefish in 2011 (NWFSC 2011a,b).

Sector	Species	Amount Retained (mt)	% of total catch (% retained)
IFQ Longline*	**Non-rebuilding species**		
	Sablefish	304.9	70.5 (97)
	Shortspine Thornyhead	19.5	4.6 (96)
	Rougheye Rockfish	6.7	3.3 (45)
	Rebuilding species		
	Darkblotched Rockfish	.04	0.08 (67)
	Pacific Ocean Perch	.01	0.01 (46)
IFQ Trap*	**Non-rebuilding species**		
	Sablefish	809	97.4 (99)
	Lingcod	2.95	0.3 (97)
IFQ Trawl*	**Non-rebuilding species**		
	Dover Sole	7687	39.4 (98)
	Arrowtooth Flounder	2262	12.6 (90)
	Sablefish	1677	8.5 (99)
	Longspine Thornyhead	901	4.7 (96)
	Longnose Skate	774	4.3 (90)
	Shortspine Thornyhead	700	3.5 (99)
	Rex Sole	358	1.9 (94)
	Rebuilding species		
	Petrale Sole	796	4.1 (98)

*Observer coverage in 2011: Longline: 98.9%; Trawl: 2011 = 94.8%; Trap: 99.7%

Bycatch Species

Longline

Under the IFQ program, discards have decreased dramatically compared to the pre-IFQ fishery (Grebel, pers. comm.). Top discards (by % of total catch by weight) in the longline fishery include spiny dogfish, some sharks and skates, and grenadier (Table 3; NWFSC 2011a). Bycatch may occasionally include rebuilding species, though this comprises <0.1% of the total catch. Amendment 18 to the groundfish FMP requires practicable means to minimize bycatch and bycatch mortality and a standardized bycatch reporting methodology. Management measures are in place to reduce bycatch of these species including Individual Bycatch Quotas (for Pacific halibut), area closures (rockfish conservation areas, EFH), and rebuilding plans for overfished species (PFMC 2006).

Evaluation against MSC Component 2.2: Bycatch Species

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch levels are relatively low; all species are known and quantified
2.2.2 Management		Bycatch must be covered by quota pounds or IBQ; high observer coverage; rebuilding plans for overfished species; area closures
2.2.3 Information		Observer data (98.9% coverage in 2011), logbooks

Trap

Discards in the trap fishery are low but include Pacific grenadier, tanner crabs, and Pacific halibut – most are not considered overfished (Table 3; NWFSC 2011a). Bycatch may occasionally include rebuilding species, though this comprises <0.1% of the total catch. Amendment 18 to the groundfish FMP requires practicable means to minimize bycatch and bycatch mortality and a standardized bycatch reporting methodology. Management measures are in place to reduce bycatch of these species including escape panels on traps to prevent ghost fishing, Individual Bycatch Quotas (for Pacific halibut), area closures (rockfish conservation areas, EFH), and rebuilding plans to help overfished species recover.

Evaluation against MSC Component 2.2: Bycatch Species

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch levels are low; all species are known and quantified
2.2.2 Management		Bycatch must be covered by quota pounds or IBQ; high observer coverage; rebuilding plans for overfished species; area closures
2.2.3 Information		Observer data (99.7% coverage in 2011), logbooks

Trawl

Discards in the trap fishery are approximately 11% of the total catch, a drastic decrease compared to the pre-IFQ fishery (Table 3; NWFSC 2011a; Grebel, pers. comm.). Bycatch may occasionally include rebuilding species, though this comprises <0.1% of the total catch. Amendment 18 to the groundfish FMP requires practicable means to minimize bycatch and bycatch mortality and a standardized bycatch reporting methodology. Management measures are in place to reduce bycatch of these species including trawl mesh size regulations, Individual Bycatch Quotas (for Pacific halibut), area closures (rockfish conservation areas, EFH), and

rebuilding plans for overfished species.

Evaluation against MSC Component 2.2: Bycatch Species

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch levels are ~11% of total catch; all species are known and quantified
2.2.2 Management		Bycatch must be covered by quota pounds or IBQ; high observer coverage; rebuilding plans for overfished species; area closures
2.2.3 Information		Observer data (94.8% coverage in 2011), logbooks

Table 3. West Coast Groundfish Observer data for top bycatch (discard) species from IFQ vessels targeting Sablefish in 2011 (NWFSC 2011a,b).

Sector	Species	Amount of discards (mt)	% of total catch (% discarded)
IFQ longline*	**Non-rebuilding species**		
	Spiny Dogfish Shark	26.8	6.0 (100)
	Longnose Skate	14.7	3.4 (97)
	Pacific Grenadier	8.23	1.9 (100)
	Non-groundfish species		
	Shark Unid	7.9	1.8 (100)
	Grenadier Unid	7.6	1.7 (100)
	Pacific halibut	6.1	1.4 (100)
	Blue Shark	4.2	0.9 (100)
	Giant Grenadier	3	0.7 (100)
	Filetail Cat Shark	1.5	0.3 (100)
	Rebuilding species		
	Petrale Sole	0.03	0.01 (97)
IFQ Trap*	**Non-rebuilding species**		
	Pacific Grenadier	1.4	0.2 (98)
	Non-groundfish species		
	Tanneri Tanner Crab	3.8	0.4 (100)
	Pacific halibut	3.3	0.4 (100)
	Shark Unid	2.2	0.4 (100)
	Giant Grenadier	0.7	0.1 (85)
IFQ Trawl*	**Non-rebuilding species**		
	Spiny Dogfish Shark	277.8	1.8 (78)
	Pacific Hake	188.7	1.1 (88)
	Pacific Sanddab	91.6	1.2 (40)
	Spotted Ratfish	67.5	0.3 (99)
	Pacific Grenadier	50.5	0.3 (100)
	Splitnose Rockfish	33.7	0.2 (70)
	Big Skate	30.2	0.3 (56)
	English Sole	28.5	0.7 (21)
	Mixed Species	16.3	0.2 (45)
	Non-groundfish species		
	Tanneri Tanner Crab	180.3	0.9 (100)
	Dungeness Crab	146	0.7 (99)
	Giant Grenadier	84.8	0.4 (100)
	Mixed Species	67.3	0.4 (93)
	Pacific halibut	63	0.3 (100)
	Brown Cat Shark	30	0.2 (99)
	Sandpaper Skate	30	0.1 (100)
	Shark Unid	25.2	0.1 (98)
	Black Skate	23.5	0.1 (98)
	Eelpout Unid	20.9	0.1 (100)

Endangered, Threatened, & Protected (ETP) Species

Longline

In a risk assessment conducted in 2011, the NWFSC concluded that the West Coast groundfish likely does not significantly impact Endangered Species Act (ESA) listed marine species found off the West Coast (Table 4; NWFSC 2011c). No ESA listed salmon were reported as bycatch in the IFQ longline fishery in 2011 (NWFSC 2011a).

Evaluation against MSC Component 2.3: ETP Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		All species are known and quantified
2.3.2 Management		Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act
2.3.3 Information		Observer data (98.9% coverage), logbooks; NWFSC risk assessment

Trap

One humpback whale entanglement is known to be from a West Coast sablefish pot fishery (Carretta et al. 2010), however a risk assessment conducted in 2011 by NWFSC concluded that the West Coast groundfish fisheries are likely not having a significant impact on ESA listed marine species found off the West Coast (Table 4; NWFSC 2011c). No ESA listed salmon were reported as bycatch in the IFQ trap fishery in 2011 (NWFSC 2011a).

Evaluation against MSC Component 2.3: ETP Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		Bycatch levels are low; all species are known and quantified
2.3.2 Management		Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act
2.3.3 Information		Observer data (99.7% coverage), logbooks; NWFSC risk assessment

Trawl

In 2011, 0.32 metric tons of ESA listed salmon (Chinook and Coho) were reported as bycatch in the IFQ trawl fishery, comprising less than 0.002 % of the total catch in the IFQ trawl sector by weight (NWFSC 2011a). Green sturgeon have also been taken in small quantities in the limited entry West Coast groundfish trawl fishery, however their shallow distribution relative to sablefish makes it an unlikely bycatch species in this fishery (Table 4; NWFSC 2011c). A risk assessment conducted by NWFSC in 2011 concluded that the West Coast groundfish likely does not

significantly impact ESA listed species found off the West Coast (NWFSC 2011c).

Evaluation against MSC Component 2.3: ETP Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		All bycatch species are known and quantified
2.3.2 Management		Magnuson-Stevens Act, CEQA, Migratory Bird Act, Marine Mammal Protection Act
2.3.3 Information		Observer data (94.8% coverage), logbooks; NWFSC risk assessment

Table 4. Risk assessment of impacts to threatened and endangered species by the West Coast groundfish trawl fishery (NWFSC 2011c).

Species	ESA listing	Impacts to species likely?	Conclusion	Citation
Whales				
Humpback whale (*Megaptera novaeangliae*)	Endangered	No	Observed take of 3.2 per year in WCGF fishery, however recent impacts from WCGF fishery are not substantially impacting this species	NWFSC 2011c
Sei whale (*Balaenoptera borealis*)	Endangered	No	Lack of observed interactions combined with the limited degree of spatial overlap between the species, impacts are likely to be negligible	NWFSC 2011c
North Pacific Right whale (*Eubalaena japonica*)	Endangered	No	Lack of any observed interactions and the very limited overlap between the species' range and the WCGF fisheries, current impacts appear to be negligible	NWFSC 2011c
Blue whale (*Balaenoptera musculus*)	Endangered	No	Over the period from 2002–2009, there were no observed fishery interactions with blue whales reported by observer programs	Jannot et al 2011; NWFSC 2011c
Fin whale (*Balaenoptera physalus*)	Endangered	No	Over the period from 2002–2009, there were no observed fishery interactions with Fin whales reported by observer programs	Jannot et al 2011; NWFSC 2011c
Sperm whale (*Physter macrocephalus*)	Endangered	No	No observed mortality of sperm whales from the WCGF fisheries, low level of observed non-lethal interactions, unlikely to have a significant impact on this species	NWFSC 2011c
Southern Resident Killer whale (*Orcinus orca*)	Endangered	No	WCGF are likely to have, at most, a negligible effect on the population growth rate of the Southern Resident killer whales	NWFSC 2011c
Pinnipeds				
Guadalupe Fur Seal (*Arctocephalus townsendi*)	Threatened	No	There are no reports of Guadalupe fur seal bycatch from the WCGF fishery	NWFSC 2011c
Stellar sea lion (*Eumetopias jubatus*)	Threatened	No	From 2002–2009, a total of 8 Steller sea lion serious injuries or mortalities were observed in the West Coast Groundfish Program, though recent impacts from fishing are not substantially impacting this species	NWFSC 2011c
Fish				
Eulachon (Thaleichthys pacificus)	Threatened (Southern DPS*)	No	Level of mortality in the WCGF (less than 1000 individuals annually) is very low compared to the probable abundance thus the fishery is likely to have a negligible effect on this species	NWFSC 2011c
Green Sturgeon (Acipenser medirostris)	Threatened (Southern DPS*)	Difficult to predict	Observed take of 9 individuals from 2002-2009 in the CA WCGF LE trawn fishery, however NWFSC concludes that lack of data make it difficult to predict impacts to this species	NWFSC 2011c
Marine Turtles				
Leatherback turtle (*Dermochelys coriacea*)	Endangered	Difficult to predict	Single reported take occurred in a non-nearshore open acesss fixed gear sector with very low observer coverage, NWFSC concludes that lack of data make it difficult to predict impacts to this species	NWFSC 2011c
Green turtle (*Chelonia mydas*)	Threatened	No	No observed bycatch of this species in WCGF fisheries, unlikely to impact this species	Jannot et al 2011; NWFSC 2011c
Olive ridley turtle (*Lepidochelys olivacea*)	Threatened	No	No observed bycatch of this species in WCGF fisheries, unlikely to impact this species	Jannot et al 2011; NWFSC 2011c
Loggerhead turtle (*Carretta carretta*)	Endangered	No	The fixed gear portion of the WCGF fisheries could encounter loggerhead turtles though there has been no observed bycatch of this species in WCGF fisheries, unlikely to impact this species	NWFSC 2011c
Seabirds				
Short-tailed albatross (*Phoebastria albatrus*)	Endangered	No	One lethal take over the period of 2002–2011, impacts likely to be small	NWFSC 2011c
California least tern (*Sterna antillarum browni*)	Threatened	No	No interactions have been recorded from 2002–2009, not likely impacting this species	NWFSC 2011c

Habitats

Longline

Longline fishing consists of baited hooks that are deployed by the fishing vessel, which sink to the ocean floor where sablefish forage (MSC 2011). Longlines are generally considered "fixed gear" because compared to other gears such as trawling, they do not operate by moving along the seafloor. For that reason, bottom longline gear is generally thought to have substantially less impact on bottom habitat compared to mobile gear (Chuenpagdee et al. 2003). Despite its classification as "fixed gear", the gear can move during soak time by ocean currents, and during gear retrieval. Consequently, the bottom line and the hooks can destroy some structural habitat, particularly biogenic habitats including sponges and corals. Sablefish longlining impacts corals by entangling and dislodging them (Hanselman et al. 2009a).

West coast sablefish inhabit deep water (greater than 1600 feet; 500 meters) and are commonly found on soft muddy or sandy bottoms. Studies in the Alaskan fishing grounds indicate sablefish longlining was estimated to have minimal impact on overall habitat (MSC 2011; NMFS 2005). For soft substrates in the Eastern Bering Sea, the index of relative impact was 0.1% for sand / mud biostructure and 0.7% for slope biostructure (i.e. current levels and distribution of fishing impact was estimated to reduce these biostructural habitats by 0.1 to 0.7 percent) (NMFS 2005). According to a risk assessment which drafted an index of adverse effects for fishing gears utilized on the west coast of the US according to habitat type, hook and line gear impacts on soft sandy/muddy habitats from 200-3000 m was given a sensitivity rating of 0.5-1 (i.e. no detectable to minor impacts, on a scale of 0 to 3). In addition, hook and line gear was associated with a 0-3 year recovery time for biogenic habitats, including corals and sponges.

Based on management measures that close off EFH, along with the data indicating minimal impacts from the Alaskan fishery, and modeling data suggesting low sensitivity of sablefish habitat to hook and line gear, longline fishing gear likely does not reduce habitat structure and function in the California fishery to a point where there would be serious or irreversible harm.

Evaluation against MSC Component 2.4: Habitats

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Moderate to low impacts
2.4.2 Management		Limited entry permits, gear restrictions, EFH area closures help limit habitat impacts
2.4.3 Information		Data from Alaskan fishery (NMFS 2005), Chuenpagdee et al. 2003, and MRAG Americas 2004 indicate minimal impacts to sablefish fishing grounds and soft bottom habitats; however, studies specific to sablefish habitat in CA may be necessary in the future

Trap

A 2005 review of habitat impacts to EFH for groundfish ranked gear types by relative impact level: dredges > trawls > nets > pots and traps > hook and line (PFMC 2012). Traps are

considered less damaging than trawls or dredges because they are not mobile, so although they are bottom gear, they have contact with a substantially smaller area of the seafloor than these more mobile gears. Traps can affect habitat, however, because they do not necessarily remain stable on the seafloor. Traps bounce off the seafloor in the presence of large swells, and get dragged across the seafloor when being removed, especially during a storm or if they are stuck in the sand (Morgan and Chuenpagdee 2003).

According to a risk assessment which drafted an index of adverse effects for fishing gears utilized on the west coast of the US according to habitat type and depth, pots and trap impacts on soft sandy/muddy habitats from 200-3000 m was given a sensitivity rating of 0.5-1 (i.e. no detectable to minor impacts, on a scale of 0 to 3). In addition, traps and pots were associated with a 0-3 year recovery time for biogenic habitats, including corals and sponges.

Given that there are management measures are in place that closes off EFH, and data to suggest that traps impose minor impacts to sablefish habitat, it is likely that sablefish traps do not reduce habitat structure and function in the California fishery to a point where there would be serious or irreversible harm.

Evaluation against MSC Component 2.4: Habitats

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Moderate to low impacts to habitat structure and function
2.4.2 Management		Limited entry permits, gear restrictions, and EFH area closures help limit habitat impacts
2.4.3 Information		Research suggest traps impart minimal impacts to soft bottom habitats; however, studies specific to sablefish habitat may be necessary in the future

Trawl

Trawling can impact sea-floor communities by scraping the ocean bottom causing: 1) sediment re-suspension (turbidity) and smoothing; 2) removal and/or damage to non-target species; and 3) destruction of three-dimensional habitat (biotic and abiotic) (Auster and Langton 1999). There is a perception that low-relief sand and mud environments, similar to those inhabited by sablefish, will recover more quickly following the cessation of trawling than harder substrates and the fauna associated them (NRC 2002). However, the existing data are conflicting and may be habitat specific. In the North Sea, a study of soft sediment infauna found a measurable impact from a single pass of a beam trawl, even in an environment that had been trawled for decades (Reiss et al. 2009), while a project in South Africa found no measurable impacts to a chronically trawled area (Atkinson et al. 2011). In a three year study conducted on the outer continental shelf of the central coast of California (160-170 meter depth using a small foot-rope bottom trawl), there were no significant differences observed between control and trawled plots with respect to densities of sessile (attached) macro-invertebrates, infaunal invertebrates, and mobile invertebrates (Lindholm et al. 2013). However, there was a small reduction in micro-topographic structure in the trawled plots and larger-scale alteration of the seafloor in the form

of trawl door scour marks that persisted for up to a year after low-intensity trawling.

Sablefish inhabit much deeper waters than the habitats surveyed in the above mentioned studies. According to a risk assessment which drafted an index of adverse effects for fishing gears utilized on the west coast of the US according to habitat type and depth, bottom trawling on soft sandy/muddy habitats from 200-3000 m was given a sensitivity rating of 2.5-3 (i.e. major changes evident, on a scale of 0 to 3). In addition, bottom trawls were associated with a 3.5-10.5 year recovery time for biogenic habitats, including corals and sponges.

While management measures are in place that closes off EFH from trawling, there is some data to suggest that trawling imposes long recovery times for sablefish habitat, though study results are conflicting. More data are necessary specific to sablefish habitat on the west coast of the U.S. in order to determine if trawl gear likely does or does not reduce habitat structure and function in the California fishery to a point where there would be serious or irreversible harm.

Evaluation against MSC Component 2.4: Habitats

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Trawl impacts can be damaging to soft biogenic habitats, and impose long recovery times for corals and sponges, however some studies suggest no significant impacts
2.4.2 Management		Limited entry permits, gear restrictions, and area closures help limit habitat impacts
2.4.3 Information		Many studies are available (modeling, ecological research) that assess the risk posed but are conflicting; more info specific to sablefish habitats are necessary

Ecosystem

According to the WCGOP data, retained and discard species caught in West Coast sablefish fisheries are well documented and likely do not cause serious or irreversible harm to key elements of ecosystem structure and function (NWFSC 2011a,b). Some of the sablefish grounds are currently inaccessible to the fishery due to EFH area closures, thus this likely helps limit the amount the fishery disrupts the food web or changes the state of the ecosystem (Grebel, pers. comm.), though more direct measures are still needed.

PFMC has written a draft Fishery Ecosystem Plan (FEP) for the US portion of the California Current Ecosystem. The goal of a FEP is to enhance the Council's species specific management programs with more ecosystem science, broader ecosystem considerations and management policies that coordinate Council management across FMPs and the California Current Ecosystem. This plan is set to be adopted as final during April 6-11, 2013. At this stage however, more information is needed to understand how or if the current management measures protect the ecosystem structure and function.

Evaluation against MSC Component 2.5: Ecosystem

MSC Performance Indicators	Rating	Justification
2.5.1 Outcome		Management measures may indirectly reduce ecosystem impacts; likely does not cause irreversible harm to ecosystem, but more quantitative measures are needed
2.5.2 Management		Area closures, ACLs, quotas, gear restrictions and EFH closures; the PFMC recently drafted a Fishery Ecosystem Plan but it is not currently implemented
2.5.3 Information		EFH well studied; Impacts on target, bycatch and ETP species are well known

MSC Principle 3: Management System

Governance and Policy

Fisheries in the U.S. are governed by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976. The MSFMCA requires managing at or below MSY levels, rebuilding overfished stocks and ending overfishing, minimizing bycatch and bycatch mortality, identification of essential fish habitat and mitigation of adverse fishing impacts. In addition, the Endangered Species Act, the Marine Mammal Act, the Migratory Bird Treaty Act, the Coastal Zone Management Act, and the Clean Water Act apply to or provide protection for species and/or habitat that may be affected by the target fishery.

The MSFCMA established eight regional fishery management councils to manage fishery resources in the U.S. Exclusive Economic Zone (EEZ). Along the U.S. west coast, the EEZ extends from 3 to 200 nautical miles offshore. Each council is comprised of Federal, State, and stakeholder representatives. Additionally, advisory bodies provide expert advice on matters related to the purpose of the council. The council process emphasizes public participation and involvement in fisheries management; meetings are open to the public and to public comment. Management measures developed by each council are recommended to the Secretary of Commerce through NOAA's National Marine Fisheries Service (NMFS). Along the west coast, management measures are implemented by NMFS Northwest and Southwest Regional offices and enforced by the NOAA Office of Law Enforcement, the U.S. Coast Guard 11th District, and local enforcement agencies.

Each council develops fishery management plans (FMPs) for the stocks in their region specifying how a fishery will be managed. The Guidelines for Fishery Management Plans (NMFS 1997) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each FMP. SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries being managed under federal regulation. Regional fishery management councils use this information to determine annual harvest levels for each stock, document significant trends or changes in the resources, marine ecosystems, and fishery

over time, and assess the relative success of existing state and federal fishery management programs. In California, the Pacific Fishery Management Council (PFMC) is the regional council that makes recommendations to NMFS on federal fisheries.

Evaluation against MSC Component 3.1: Governance and Policy

MSC Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		PFMC and NMFS must operate under Magnuson-Stevens Act, National Standard Guidelines, Marine Mammal Protection Act, Endangered Species Act, Migratory Bird Treaty Act, National Environmental Policy Act
3.1.2 Consultation, Roles and responsibilities		PFMC meetings are public and public participation is encouraged
3.1.3 Long-term Objectives		Objectives determined in Magnuson-Stevens Act and Groundfish FMP
3.1.4 Incentives for Sustainable Fishing		Magnuson-Stevens Act

Fishery Specific Management System

The National Marine Fisheries Service (NMFS) manages the fishery in partnership with the Pacific Fishery Management Council (PFMC), and the states of California, Oregon, and Washington. The Pacific Coast Groundfish Fishery Management Plan (FMP) was approved by the U.S. Secretary of Commerce (Secretary) on January 4, 1982, and implemented on October 5, 1982 (PFMC 2011a). Prior to implementation of the FMP, management of domestic groundfish fisheries was under the jurisdiction of the states of Washington, Oregon, and California. Since it was first implemented, the Council has amended the groundfish FMP 20 times in response to changes in the fishery, reauthorizations of the Magnuson-Stevens Act, and litigation that invalidated provisions incorporated by earlier amendments. The FMP includes sablefish and over 90 different species that, with a few exceptions, live on or near the bottom of the ocean. The FMP establishes the fishery management program, the process, and procedures the Council will follow in making adjustments to that program. It also sets the limits of management authority of the Council and the Secretary when acting under the FMP (PFMC 2011a).

The following goals for managing the Pacific Coast Groundfish Fishery have been established in order of priority (PFMC 2011a):

1. Conservation. Prevent overfishing and rebuild overfished stocks by managing for appropriate harvest levels and prevent, to the extent practicable, any net loss of the habitat of living marine resources.

2. Economics. Maximize the value of the groundfish resource as a whole.

3. Utilization. Within the constraints of overfished species rebuilding requirements, achieve the

maximum biological yield of the overall groundfish fishery, promote year-round availability of quality seafood to the consumer, and promote recreational fishing opportunities.

Proposals for management measures may come from the public, from participating management agencies, from advisory groups, or from Council members. If the Council wants to pursue these proposals, it asks for other possible solutions to the problem being addressed and then directs the Groundfish Management Team (GMT), the National Marine Fisheries Service (NMFS), and/or Council staff to prepare an analysis. The Council reviews the analysis and chooses a range of alternatives and possibly a preliminary preferred alternative. The analysis is then made available for public review, and the Council makes a final decision at the next meeting the item is scheduled.

A biennial management process was implemented in 2003 (Amendment 17 to the groundfish FMP). Under this biennial cycle, management measures are implemented for a two-year period, rather than just for one year. Separate harvest specifications (ABCs and OYs) are identified for each year in the two-year period. The Council reviews management performance and socioeconomic impacts relative to management objectives (e.g., rebuilding plans) during the two-year management period in order to consider modifying harvest specifications and management measures in the next biennial management period. New assessment results are also considered when deciding biennial harvest specifications and management measures. After considering Council recommendations and public comments, NMFS publishes the adopted regulations, thereby putting them into effect. For non-routine and annual management decisions, NMFS publishes a Federal Register notice and provides a public comment period before finalizing the recommendations.

The GMT is involved throughout the decision-making process. The team is made up of staff from the three state fishery management agencies (Washington, Oregon, and California), NMFS, and representatives for the tribes with a recognized treaty right to take federally managed groundfish. Traditionally, the GMT monitors catch rates, recommends harvest regulations and annual limits, and analyzes the impacts of various management measures. The GMT members presents information to the Council, Groundfish Advisory Subpanel (GAP), and other Council advisory bodies. GMT meetings are open to the public and public comment is generally accepted during the meetings.

The GAP advises the Council on policies and management decisions that affect the groundfish fishery and the public. The panel includes industry representatives of commercial and recreational groundfish sectors, tribal representatives, charterboat owners and operators, fishing organization representatives, processors, environmental organization representatives, and a public at-large representative. Each major commercial gear group is represented. Meetings are held at most Council meetings. The GAP operates by consensus and through majority and minority position statements that are offered as advice to the Council. GAP meetings are open to the public and public comment is generally accepted during the meetings.

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

MSC Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		Goals and objectives are outlined in the Groundfish FMP
3.2.2 Decision-making Processes		PFMC has an appropriate decision-making process in place, must be open and transparent
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		Research and data needs identified in 2011 stock assessment; Research needs and data gaps analysis for Groundfish Essential Fish Habitat (EFH) detailed in Appendix B to the groundfish FMP
3.2.5 Management Performance Evaluation		Stock assessments are reviewed by the Groundfish Management Team; **biennial management process;** Proposals for management measures may come from the public, from participating management agencies, from advisory groups, or from Council members; Groundfish Advisory Subpanel advises the Council

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80% instead of 60%) for two performance indicators (PI) of the MSC program: “Stock Status” (PI 1.1.1) and “By-catch of Endangered, Threatened, or Protected (ETP) Species” (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC’s peer review, thus bringing additional credibility, transparency, and independence to California’s certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available.

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Appendix A

MSC Assessment Tree			Sablefish		
			Bottom trawl IFQ	Longline IFQ	Trap IFQ
Principle	**Component**	**Performance Indicator**	**All**	**All**	**All**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status			
		1.1.2: Reference points			
		1.1.3: Stock rebuilding	*Did not assess*	*Did not assess*	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy			
		1.2.2: Harvest control rules			
		1.2.3: Info/ monitoring			
		1.2.4: Stock assessment			
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status			
		2.1.2: Mgmt strategy			
		2.1.3: Information			
	By-catch species	2.2.1: Status			
		2.2.2: Mgmt strategy			
		2.2.3: Info			
	ETP species	2.3.1: Status			
		2.3.2: Mgmt strategy			
		2.3.3: Info			
	Habitats	2.4.1: Status			
		2.4.2: Mgmt strategy			
		2.4.3: Info			
	Ecosystem	2.5.1: Status			
		2.5.2: Mgmt strategy			
		2.5.3: Info			
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework			
		3.1.2: Consultation, roles, and responsibilities			
		3.1.3: Long term objectives			
		3.1.4: Incentives for sustainable fishing			
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives			
		3.2.2: Decision making process			
		3.2.3: Compliance & enforcement			
		3.2.4: Research plan			
		3.2.5: Management performance evaluation			

Spiny lobster (*Panulirus interruptus*)

Certification Units Considered Under this Species:

- California Trap fishery

Summary

The California fishery for spiny lobster takes place south of Point Conception, California to the California-Mexico border. It is managed by the Fish and Game Commission and the California Department of Fish and Wildlife via a limited access program (limit on number of permits issued), seasonal closure, and gear and size restrictions. Based on the 2011 stock assessment, the spiny lobster population off southern California appears to be stable. Support for this determination includes consistently large harvest levels, harvest rates, and sizes of animals caught by both the commercial and recreational fisheries. Bycatch from lobster traps are low, but are generally reported and not quantified. A spiny lobster Fishery Management Plan (FMP), as required by the Marine Life Management Act, is currently being developed by the California Department of Fish and Wildlife and is expected to be adopted in 2015 and will contain harvest control rules. The spiny lobster trap fishery on the Pacific coast of Baja California is currently certified by the Marine Stewardship Council (MSC)[1].

Strengths:

- Stock assessment indicates population is currently stable
- Low impacts to incidental caught species, and endangered, threatened and protected species

Weaknesses:

- Currently no target or limit reference points (though likely presented in the FMP in 2015)
- Bycatch rates are unknown, although preliminary research is being conducted
- Habitat impacts from trap gear in California not well document

[1]The MSC Assessment for the Baja California spiny lobster trap fishery may be accessed here: http://www.msc.org/track-a-fishery/fisheries-in-the-program/certified/pacific/mexico-baja-california-red-rock-lobster/assessment-downloads-1/Final_-BC-Lobster_032704.pdf/at_download/file

History of the Fishery in California

Biology of the Species

The California spiny lobster, *Panulirus interruptus*, is endemic to the west coast of North America from Monterey, California southward at least as far as Magdalena Bay, Baja California (Wilson, 1948; Schmitt, 1921), with a small isolated population in the northwestern corner of the Gulf of California (Kerstitch, 1989).

Spiny lobsters are found in rocky areas often with plant communities dominated by giant kelp (Macrocystis sp.), feather boa kelp (Egregia sp.), coralline algae (Corallina sp.), and surf grass (Phyllospadix sp.) (Lindbergh, 1955). They are also associated with eel grass (Zostera sp.) which flourishes in sandy areas (CDFG 2001). Spiny lobsters are a major predator of benthic invertebrates and act as a keystone species preying on mussels along rocky shores (Robles et al., 1990) and on sea urchins in kelp forests (Tegner and Levin, 1983; Lafferty, 2004). Primary predators on lobster include sheephead (*Semicossyphus pulcher*) and black sea bass (*Stereolepis gigas*) (Loflen, 2007), horn shark, leopard shark, octopus, and sea otters (Loflen, 2007; CDFG and Sea Grant, 2008).

Spawning occurs once a year during late spring through summer (January – April) (Johnson, 1960) in which female eggs (approximately 50,000 to 800,000) are fertilized by a male spermatorphore and carried under the abdomen of the female until hatching (CDFG 2011b). Embryos hatch into planktonic larvae which spend approximately 10 months in the open ocean (Mai & Hovel, 2007), where they can be transported up to 350 mi (563 km) offshore, and are found from surface depths to greater than 400 ft (107 m). During planktonic development, larvae shed their outer skeleton (molt) 12 times until metamorphosing into puerulus larvae that swims inshore and settle as juveniles on mussel or surf grass beds which serve as a nursery for about 2 years (Booth et al., 1994). Lobsters typically reach sexual maturity in 5 to 6 years (or approximately 2.5 in / 6.35 cm carapace length), and reach legal size at 7 to 10 years. Males and females can live to 30 and 20 years, respectively.

Commercial Fishery

[From CDFW 2013a unless cited otherwise]:

California spiny lobster have been fished in southern California since at least 1872. The commercial fishery originated in Santa Barbara County and expanded as the number of fishermen increased. By 1900, the fishery encompassed the entire Southern California Bight (SCB) and most of the offshore islands. Today's lobster population is the product of a century of commercial fishing with few areas historically off limits to fishermen.

Each lobster fisherman typically uses from 300-400 traps on average (Barsky, pers. comm.). Lobster traps are typically constructed of wire and rectangular in shape that are baited with fish and placed on the sea floor in water less than 100 ft (30 m) in depth, or around rocky outcrops. Fishery boat size ranges from 15 to 50 ft vessels (5 to 15 m).

Individual landing receipts date back to 1969-70 season which include information on port of landing, business purchasing the catch, fisherman ID, pounds landed and where the catch originated (CDFW 2011b), and only seasonal or annual totals by port exist prior to 1969-70. Over the decades commercial landings have fluctuated, reaching a high in the early 1950s, followed by a decline until the mid 1970s (Figure 1). There were multiple reasons for this

decline, but a major contributing factor was the landing of sub-legal size (short) lobster. In 1957 the California Department of Fish and Wildlife (CDFW) implemented a minimum 2 in by 4 in (5 cm by 10.2 cm) mesh size requirement for commercial traps specifically to reduce the taking of short lobster. However, this gear requirement did not fully solve the problem. Consequently, in 1976, the Department required an escape port in all commercial traps. The size of this horizontal escape port enables a short lobster to freely exit the trap.

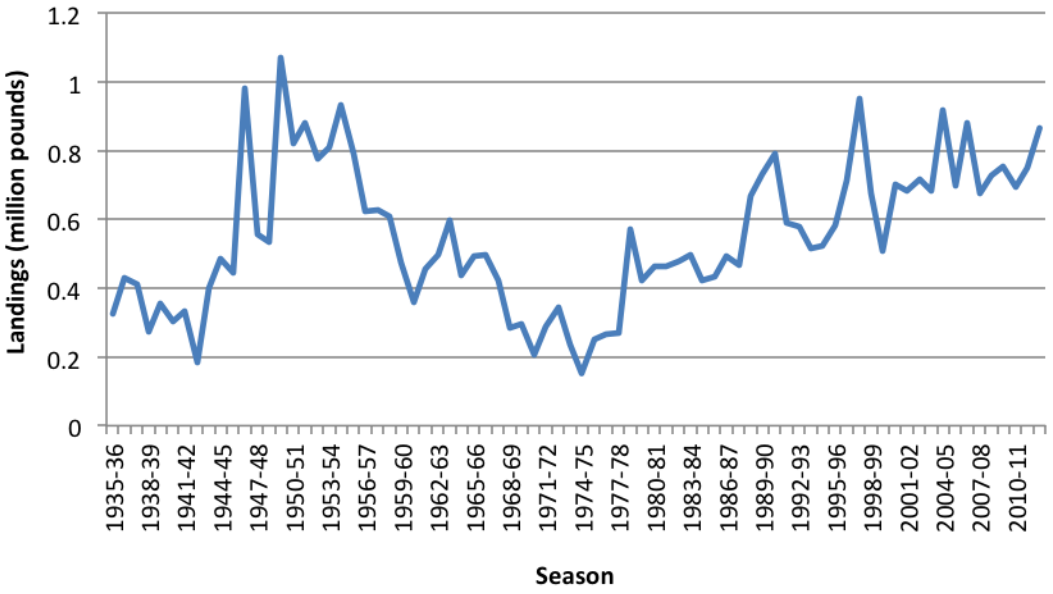

Figure 1. California spiny lobster commercial landings from 1935-36 to 2012-13 seasons based on commercial landing receipts, all gear types combined.

The abundance of California spiny lobster also fluctuates with broad-scale environmental changes caused by El Niño and La Niña events. Commercial catch data show inter-annual variations that correlate with changes in water temperature and oceanographic and weather patterns associated with these events (CDFG 2001; CDFG 2011a).

Since 2000, the total catch over time each season has accumulated at the same rate as each season progresses. The largest landings occur within the first two weeks of the 26-week season. Eighty percent of the season's total catch is landed by the fifteenth week of the season. The catch is usually evenly divided between three regions: Santa Barbara/Ventura counties, Los Angeles/Orange counties, and San Diego County. A relatively small area extending from Point Loma to La Jolla in San Diego has dominated the catch since at least 1975, consistently accounting for approximately 15 percent of the total southern California catch. The 10-year average catch for the commercial fishery through the 2010-11 season is 734,000 lbs (332,937 kg) (CDFW 2011c). The ex-vessel value of the 2012-13 lobster season was $14.3 million.

The average weight of an individual lobster in the catch has been fairly consistent over the last decade at 1.4 lbs (0.6 kg). CDFW lobster survey data shows that both recreational and commercial catch are composed mostly of lobster that have attained legal size within the last one or two years. Although larger sized lobster exist, the majority of the lobster catch consists of individuals that have just reached legal size. Further support for this is found in the number

of short lobster released each season. Over the last decade, fishermen have had to release 70 to 80 percent of the lobster caught within the SCB each season because they were undersized. Within each county, the percentage of lobster released has also remained fairly consistent over the last decade.

Recreational Fishery

The Fish and Game Commission (FGC) regulates the recreational fishery, which includes snorkelers, scuba divers and baited hoop netting, the latter which was first allowed in 1955 (CDFW 2011a; CDFW 2011b). The recreational fishery landings of lobster were approximately 33% (2008), 38% (2009) and 33% (2010), 34% (2011), and 28% (2012) of total lobster landings (recreational and commercial combined) (CDFW 2011a).

Landings data was not collected until fall 2008 where CDFW introduced a Recreational Spiny Lobster Report Card. Now, every recreational lobster fisher must have a Spiny Lobster Report Card in their possession and record the month, day, location, gear used, and number of lobsters harvested. All report cards must be returned to DFW even if no lobsters were taken. Approximately 30,000 report cards are sold each year, with 37,193 sold in 2012 (CDFW 2013a). Initially, report card returns were low; however, in 2012 CDFW doubled the returns to 32% by sending out a reminder post card (Barsky, pers. comm.). A non-return fee goes in effect in 2014 and CDFW are also involved in an educational campaign on the topic which will further increase returns.

The recreational fishery is open from the Saturday proceeding the first Wednesday in October through the first Wednesday after the 15th of March (CDFW 2013b). The bag limit is seven lobsters per day and no more than seven in possession. Lobsters must have a carapace length of 3 ¼ in (8.26 cm) or greater to meet minimum size restrictions. Each person may possess a maximum of five hoop nets, and no more than 10 per vessel and nets must be inspected every 2 hours.

MSC Principle 1: Health of Fish Stock

*Sustainability of Target Stock

In 2010 and 2011, CDFW performed a stock assessment of the spiny lobster population in southern California (CDFW 2013a). This assessment relied on Southern California Bight-wide (SCB) CDFW datasets, modeled results, and published life history parameters (e.g., growth rates). Based on this assessment, the spiny lobster population off southern California appears to be stable and the fisheries targeting this species can be considered sustainable at present. Support for this determination includes consistently large harvest levels, harvest rates, and sizes of animals caught by both the commercial and recreational fisheries. The sub-legal population appears large and robust. The number of short lobster released as a percentage of the total SCB-wide catch has remained consistent over the decade, regardless of the overall size of the seasonal harvest. This sub-legal population is also probably responsible for the majority of seasonal spawning.

Reference points (both target and limit/threshold), along with preventative measures (i.e. crossing a threshold or target reference point and thus triggering a management response) are currently being considered for the spiny lobster fishery and will be presented in the FMP (CDFG 2012a). Fishing mortality resulting in maximum sustainable yeield (Fmsy) was not quantifiable

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

in the stock assessment because of limitations of the model used, and should only be used as a relative measure to compare yearly F estimates against (Neilson, pers. comm.). There was an increase in the level of recreational take in the final years before the stock assessment, thus CDFW used the commercial level of effort since there is not a comparable effort for recreational. Because of this, there was evidence of a decreasing stock biomass in one of the modeling scenarios; however, despite exceeding Fmsy, there is no indication that fishing mortality (F) is unsustainable (Neilson, pers. comm.). Today, it appears that recreational hooping has stabilized relative to 2005-2010. All indications are that the fishery is currently sustainable (Neilson, pers. comm.).

Evaluation against MSC Component 1.1: Sustainability of Target Stock

MSC Performance Indicators	Rating	Justification
1.1.1 Stock Status		Stock assessment concluded that the population is currently sable; consistently large harvest rates, and sizes of animals caught by both the commercial and recreational fisheries; short lobsters released has been consistent over the last decade
1.1.2 Reference Points		F_{msy} not quantifiable due to model limitations; Reference points and preventative measures likely presented in 2015 FMP
1.1.3 Stock rebuilding		Not assessed

Harvest Strategy (Management)

The FGC manages the California Spiny Lobster commercial fishery, and CDFW creates and implements fishery regulations (CDFG 2001). Essential commercial fishery information is collected using fishermen log¬books and dealer landing receipts (CDFG 2011a). Logbooks record location and date of catch, number of traps pulled, and number of lobster kept and released. Landing receipts record catch location, size of catch in pounds, and the price paid per pound.

Management of the lobster fishery is based on:

- a restricted access program (currently 194 permits as of the 2012-13 season, with the goal of reducing the number to 141 participants)
- a minimum size limit
- a closed season to protect breeding and molting animals
- escape ports in traps to prevent the take of undersized lobster in the commercial fishery
- 96-hour requirement to pull traps in the commercial fishery
- destruct devices are required in traps to prevent ghost fishing

- daily logbook requirement
- daily bag and possession limits
- divers may only take lobsters by hand
- a limit on the number of hoop nets for the recreational fishery
- lobster report card requirement

Lobsters of both sexes may be taken commercially from the first Wednesday in October through the first Wednesday after March 15 the following year (CDFG 2012a). Current regulations do not limit the number of traps that can be used or set catch limits.

A spiny lobster Fishery Management Plan (FMP), as required by the Marine Life Management Act (MLMA), is currently being developed by CDFW and is expected in 2015. With the implementation of new marine protected areas (MPAs) in Southern California in 2012, the spiny lobster FMP will evaluate how MPAs might be incorporated into the management of the state's lobster fisheries. The FMP will review fishery management methods used in lobster fisheries in other parts of the world, and examine any other conservation and management measures that should be considered for the sustainability of the resource and its fisheries.

Evaluation against MSC Component 1.2: Harvest Strategy (Management)

MSC Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Limited entry fishery, gear restrictions, seasonal closure, minimum size limit, area closures; no limit or target reference points established
1.2.2 Harvest Control Rules and Tools		Currently, no designated limit or target reference points, though 2015 FMP will have a harvest control rule
1.2.3 Information/Monitoring		Fishery dependent data (logbooks, landings, CPUE) are collected to support the harvest strategy; Stock assessment is only informed by fishery-dependent data
1.2.4 Assessment of Stock Status		Stock assessment conducted in 2010-11

MSC Principle 2: Impact on Ecosystem

Retained Species

Traps

The only species allowed as incidental take in lobster traps are Kellet's whelk, octopus and crab

(except Dungeness). The commercial harvest of Kellet's whelks is regulated by a total allowable catch, while size limits restrict take of multiple crab species. The spiny lobster permittee is exempt from requiring a general trap permit to harvest Kellet's whelk (CDFG 2008).

Evaluation against MSC Component 2.1: Retained Species

MSC Performance Indicators	Rating	Justification
2.1.1 Outcome		Retained catch levels are low; whelk and crab management measures likely ensure harvest levels will not significantly impact populations
2.1.2 Management		Harvest strategy for whelk limited by total allowable catch per season; minimum size restrictions for crabs; octopus are allowed incidentally in several fisheries (no direct octopus fishery allowed)
2.1.3 Information		Logbooks, landings receipts

Bycatch Species

Traps

[From CDFG 2012b unless cited otherwise]:

The MLMA states that bycatch of marine animals should have no appreciable effect on the marine environment and calls for mitigation efforts when the amount or type is unacceptable. However, bycatch data in the spiny lobster fishery is limited. CDFG's understanding of the issue comes from three primary sources: commercial fishing logbooks, a sport hoop net study and incoming data from the California Lost Fishing Gear Recovery Project. CDFG also received preliminary bycatch information from the current at-sea lobster sampling research program that was funded by the MPA Monitoring Enterprise and is a collaborative project involving Drs. Carrie Culver, Steve Schroeter, and some commercial lobster fishermen. These sources suggest that the spiny lobster fishery appears to have relatively low bycatch. Bycatch occasionally involves sub-legal lobsters, Kellet's whelk, sheephead and other nearshore finfish, which can be released alive. Spiny Lobster traps generally allow undersize lobsters and other animals to escape. A recent study of the Mexican spiny lobster fishery recorded a small number of cormorants caught in commercial traps, but offered no information on trap specifics or the habitat where the traps were set in Mexico. Additionally, bycatch of California spiny lobsters in other fisheries is reported to be insignificant (CDFG 2001).

Evaluation against MSC Component 2.2: Bycatch Species

MSC Performance Indicators	Rating	Justification
2.2.1 Outcome		Several data sources suggest relatively low bycatch, though results are preliminary
2.2.2 Management		MLMA indicates bycatch of marine animals should not impact the environment though unclear if management measures to minimize bycatch are implemented to date beyond sub-legal lobster escape ports and trap door fittings (preventing ghost fishing)
2.2.3 Information		Logbooks, hoot net study, CA Lost Fishing Gear Recovery Project, at-sea sampling research program preliminary data – more info on bycatch rates needed

*Endangered, Threatened, & Protected (ETP) species

Traps

National Marine Fisheries Service (NMFS) classifies all U.S. commercial fisheries into one of three categories (I, II, III) based on the level of incidental serious injury and mortality of marine mammals that occurs in each fishery. In 2012, NMFS List of Fisheries (LOF) classified the California spiny lobster fishery as a category III, indicating remote likelihood of/no known incidental mortality or serious injury of marine mammals (NMFS 2012). Because the fishery is conducted close in shore it is likely that interactions with whales occur very rarely, though NMFS reports one incident with a Gray whale in the Eastern North Pacific (no specifics were given). Given this information, it is unlikely that the California spiny lobster fishery poses a risk of serious or irreversible harm to endangered, threatened and protected species.

Evaluation against MSC Component 2.3: ETP Species

MSC Performance Indicators	Rating	Justification
2.3.1 Outcome		NMFS LOF category III fishery - likely does not pose a threat to ETP
2.3.2 Management		Unlikely to impact ETP species, but management measures exist - CEQA, Migratory Bird Act, Marine Mammal Protection Act
2.3.3 Information		Logbooks

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Habitats

Traps

Lobster traps are set along depth contours or around rocky outcrops on the seafloor at depths up to 210 ft (64 m) (CDFG 2001). The effect of a pot on the seabed is related to its weight and structure as well as to how far and fast it moves along the seabed before ascending. Observations of lobster and crab pots being hauled from rocky substrates in southern England revealed that the habitats and their communities appeared relatively unaffected by potting (Eno et al. 2001). In the Baja fishery, lobster traps did not appear to cause any short-term changes to benthic habitat cover when set for a 24-hour period, and damage to soft corals (the majority of the benthic cover in the study) was minimal (Shester 2008). Since corals are not the majority of benthic cover in southern California, more local studies are necessary to better understand habitat impacts from trap gear in the California spiny lobster fishery. An objective of the MLMA includes habitat conservation and minimizing damage from fishing; several management measures are currently in place (limited access permits, MPA/area and seasonal closures, 96 hr service requirement) to limit habitat impacts from trap gear.

Evaluation against MSC Component 2.4: Habitats

MSC Performance Indicators	Rating	Justification
2.4.1 Outcome		Lobster traps likely do not irreversibly damage the seafloor according to Eno et al. 2001, Shester 2008
2.4.2 Management		MLMA objective of conserving habitat; some measures in place (limited access permits, MPA/area and seasonal closures, 96 hr service requirement) to limit habitat impacts
2.4.3 Information		Trap impacts to rocky substrate are documented in several research studies, but none specific to CA lobster fishery habitat

Ecosystem

Spiny lobsters play a key role as predators in the southern California kelp forest ecosystem. Lobster predation on mussels and urchins is an important factor in maintaining diverse communities in these habitats (Tegner and Levin, 1983; Robles et al., 1990). In California's Anacapa Island marine reserve in the Santa Barbara Channel Islands where lobster fishing is prohibited, spiny lobsters were larger and more abundant than outside the reserve (Kay et al. 2012). In addition, the kelp forest ecosystem is more stable, associated with lobster predation upon kelp-eating sea urchins (PISCO 2002). The ecosystem impacts of fishing mortality in the California spiny lobster fishery are still unclear.

Management measures, including gear restrictions, may indirectly benefit ecosystem health. CDFW requires that trap doors of all spiny lobster traps be fastened with bare metal crimps that rust through seawater over time. This reduces the impact of 'ghost fishing', whereby lost

or abandoned fishing gear continues to catch animals over time (CDFG 2001; CSC 2006). In addition, the minimum size limit regulation prevents commercial and recreational fishers from keeping sublegal lobsters they incidentally catch (CDFG 2001).

Under the MLMA, CDFW must consider ecosystem impacts of a fishery, namely the conservation of not only the exploited species, but the other species that depend on that resource. However, the dynamics of many of the trophic relationships for spiny lobster are not well understood. At this stage, more information is needed to understand how the current management measures protect the ecosystem structure and function.

Evaluation against MSC Component 2.5: Ecosystem

MSC Performance Indicators	Rating	Justification
2.5.1 Outcome		Likely does not cause irreversible harm to ecosystem, but no quantitative measures available to assess
2.5.2 Management		Existing management may indirectly benefit ecosystem health (gear restrictions); MPAs will protect some habitat; Under MLMA, CDFW must consider ecosystem impacts
2.5.3 Information		More info needed on biology of spiny lobster to understand ecosystem impacts

MSC Principle 3: Management System

Governance and Policy

In state waters (0-3 miles offshore), the FGC manages various fisheries through measures that include but are not limited to determining seasons, bag limits, and methods of take. In each case, the Commission holds regular open public meetings throughout the state to receive and consider individual and group input prior to adoption of new or changed regulations. Recommendations also come from CDFW. Once the Commission votes to adopt a regulation, CDFW is responsible for enforcing it. The Legislature can increase the Commission's powers by delegating further regulatory and management authority. The MLMA governs the way the majority of California fisheries are managed (OPC 2011). Regulations must comply with the goals and objectives outlined in the MLMA, including (but not limited to) sustainability, limited bycatch, and habitat conservation.

Fishery management measures must achieve the goals and objectives of the MLMA. The MLMA gave the Commission and CDFW specific authorities, goals, objectives, and mandates for managing marine resources. The MLMA also requires periodic review of management measures because environmental, social, and economic changes during the year may lead to consideration of regulatory changes under the framework described above.

Evaluation against MSC Component 3.1: Governance and Policy

MSC Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		FGC and DFW manage the fishery within an effective framework for delivering sustainable fisheries
3.1.2 Consultation, Roles and responsibilities		Roles and responsibilities are clearly laid out; FGC meetings are open to the public and to public comments
3.1.3 Long-term Objectives		Goals and objectives outlined in MLMA
3.1.4 Incentives for Sustainable Fishing		Sustainability is an underlying goal of the MLMA

Fishery Specific Management System

This fishery is regulated by the FGC and managed by the CDFW (CDFG 2001). CDFW is currently in the process of developing a Fishery Management Plan (FMP) for spiny lobster as required by the MLMA. FMPs evaluate and consider:

- Biological information about the marine resources under consideration
- Habitat needs and issues
- Economic and social factors related to the fishery
- An account of fishing activity
- Conservation and management measures already in place
- The ecological role of the resource
- The environmental effects that may have to be considered
- Fishery research protocols
- The most appropriate management tools for a sustainable fishery
- Procedures for amending the FMP to allow for possible adaptation in the future

CDFW convened a spiny lobster advisory committee (LAC) to involve appointed representatives of constituent groups with providing the CDFW advice, feedback, and recommendations regarding the issues and actions that need to be taken during the development of the spiny lobster FMP (CDFG 2012c). The LAC will give guidance on FMP objectives and end products, as well as provide ideas for management options that address the key issues put forth by constituents and members of the public. The spiny lobster FMP will ensure a sustainable lobster resource, and healthy commercial and recreational fisheries. The spiny lobster FMP effort is timely because of the recent implementation of MPAs along the south coast of California that impact both the recreational and commercial lobster fisheries. The spiny lobster FMP is a multi-year project, and the draft plan is scheduled to be delivered to the FGC for adoption in early

2015. The spiny lobster FMP will contain a management strategy evaluation procedure that will allow CDFW to monitor and evaluate the health of the fishery as future data becomes available. In addition to developing the spiny lobster FMP, continuing existing public education and CDFW enforcement efforts are essential because an illegal market has always existed for shorts, which are very important to the health of the population.

Evaluation against MSC Component 3.2: Fishery specific management system

MSC Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		No clear objectives, likely detailed in FMP; CDFW does present a rationale to the FGC for current management practices though (Barsky, pers. comm.)
3.2.2 Decision-making Processes		CDFW provides recommendations that are vetted through the FGC; LAC providing recommendations for development of the Spiny Lobster FMP
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		No clear research plan in place, will likely be outlined in the FMP
3.2.5 Management Performance Evaluation		MLMA requires periodic review of management measures; 2011 stock assessment was externally reviewed

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: “Stock Status” (PI 1.1.1) and “By-catch of Endangered, Threatened, or Protected (ETP) Species” (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC’s peer review, thus bringing additional credibility, transparency, and independence to California’s certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone

or linked to a website that will reveal additional information about the fishery, and information about toxicity when available.

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Appendix A

MSC Assessment Tree			Spiny Lobster
			Trap
Principle	**Component**	**Performance Indicator**	**All**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status	
		1.1.2: Reference points	
		1.1.3: Stock rebuilding	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy	
		1.2.2: Harvest control rules	
		1.2.3: Info/ monitoring	
		1.2.4: Stock assessment	
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status	
		2.1.2: Mgmt strategy	
		2.1.3: Information	
	By-catch species	2.2.1: Status	
		2.2.2: Mgmt strategy	
		2.2.3: Info	
	ETP species	2.3.1: Status	
		2.3.2: Mgmt strategy	
		2.3.3: Info	
	Habitats	2.4.1: Status	
		2.4.2: Mgmt strategy	
		2.4.3: Info	
	Ecosystem	2.5.1: Status	
		2.5.2: Mgmt strategy	
		2.5.3: Info	
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework	
		3.1.2: Consultation, roles, and responsibilities	
		3.1.3: Long term objectives	
		3.1.4: Incentives for sustainable fishing	
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives	
		3.2.2: Decision making process	
		3.2.3: Compliance & enforcement	
		3.2.4: Research plan	
		3.2.5: Management performance evaluation	

Swordfish (*Xiphias gladius*)

Certification Units Covered Under this Species

- Southern California, Harpoon

Summary

Swordfish is a highly migratory species (HMS) distributed throughout the world's oceans. In the North Pacific, these stocks are monitored and assessed by the International Scientific Committee for Tuna and Tuna-like Species (ISC) and the Inter-American Tropical Tuna Commission (IATTC). Along the U.S. West Coast, swordfish are managed under the Pacific Fishery Management Council's Highly Migratory Species Fishery Management Plan. Swordfish are fished commercially primarily using harpoons, drift gillnets, and pelagic longlines. Stocks of Western and Central North Pacific (WCNPO) and Eastern North Pacific (EPO) swordfish are considered healthy and above the level required to sustain recent catches. Bycatch in the harpoon fishery is close to zero.

Strengths:

- North Pacific and Eastern Pacific stocks are considered healthy
- Stock assessments are conducted by international organizations; the information is reviewed annually by the PFMC
- Almost no bycatch in the harpoon fishery

Weaknesses:

- Harpoon fishery is small; may not be economical to pursue MSC certification

History of the Fishery in California

Biology of the Species

Swordfish (*Xiphias gladius*) is the sole member of the family Xiphiidae. It is a highly migratory species (HMS) distributed throughout the world's oceans. Swordfish are large fish with a maximum weight of over 650 kg and length of 457 cm. Swordfish have a distinctive sharp pointed bill which is a flattened extension of the upper jaw. Another distinctive characteristic of swordfish is they do not have pelvic fins. Adult swordfish feed opportunistically on a wide range of squids, fish and crustaceans. Off California, northern anchovy, squid, hake, jack mackerel, rockfish, barracudas, black smelt, ribbonfish, and shrimp are common prey items (PFMC 2003). Larval and young swordfish actively feed on zooplankton and by 11-12 mm in length start feeding on a variety of epipelagic fish larvae (PFMC 2003).

Swordfish can live between 9-14 years for males and 15-32 years for females (Wilson and Dean 1983; Radtke and Hurley 1983). Females are believed to mature at 4-5 years and males at 3-4 years old (Love 2011). Swordfish do not seem to have a discrete spawning ground or spawning season (PFMC 2003), however, larvae and juveniles tend to occur in warmer tropical and subtropical regions. The geographical distribution of larvae suggests that spawning occurs in waters where SSTs are above 24°C; this isotherm rarely extends north of 35° N or south of 35° S. Spawning occurs throughout the year in equatorial waters, but is progressively restricted to spring-summer at higher latitudes. Females are batch spawners; a 68 kg female is estimated to release 16,130,400 eggs (Love et al. 2011). Eggs hatch in 2.5 days. Larval abundance is high along sharp thermal and salinity gradients. Swordfish grow extremely fast during their first year of life, and by one year of age may reach 90 cm (3 feet) (Uchiyama et al. 1998; Ward and Elscot 2000). Growth is highly variable among fish of the same age and sex, and there is a marked difference in growth rate between males and females. After two years of age, females tend to grow faster than males, grow to a larger size, and are proportionately heavier at the same length (Palko et al. 1981). Most large-sized fish are females, and they appear to be more common in cooler waters. According to Beckett (1974) and Palko et al. (1981) few males tend to occur in waters below 18°C, and males make up the majority of warm water landings.

[From PFMC 2003]: Stock structure of swordfish in the Indian and Pacific oceans is unclear. Some genetic analyses (Reeb et al 2000; Kasapidis et al. 2008) suggest that swordfish comprise a single, homogenous population in the Pacific, and that gene flow occurs through a horseshoe-shaped corridor, running between the north-western Pacific, across to the eastern Pacific and back to the south-western Pacific. However other genetic analyses (Alvarado Bremer et al. 2006) and fisheries data (Hinton and Deriso 1998, Hinton 2003) indicate that the swordfish population in the Pacific is comprised of three or more distinct groups. The latest stock assessments by the ISC divide the North Pacific swordfish population into two groups: Western and Central North Pacific, and Eastern North Pacific.

Commercial Fishery

[From PFMC 2003]: Broadbill swordfish support major fisheries in all oceans of the world. Major Pacific Ocean fishing areas are off Japan, the North Pacific Transition Zone north of Hawaii, the west coasts of the U.S., Mexico, Ecuador, Peru, Chile, and off Australia and New Zealand. The largest catches of swordfish in the North Pacific Ocean have been taken by Japan for more than five decades (Figure 1). Along the U.S. West Coast EEZ, swordfish are targeted primarily by the drift gillnet fishery off California and Oregon (Holts and Sosa-Nishizaki 1998, PFMC 2012),

by a small harpoon fishery operating within the Southern California Bight (Coan et al. 1998, PFMC 2012), and by a Hawaii-based longline fishery that fishes beyond the U.S. West Coast EEZ on the high seas and land their catch in California, Oregon and Washington (PFMC 2012) (Figures 2 and 3). There has also been a very small surface hook-and-line fishery in the past, but from 2003-2011 landings were less than 0.5 mt per year. In 2012, surface-hook- and-line landings increased to 10.67 mt (Elizabeth Hellmers, personal communication, 2013).

[From PFMC 2012]: California's harpoon fishery for swordfish developed in the early 1900s. Prior to 1980, harpoon and hook-and-line were the only legal gears for commercially harvesting swordfish. At that time, harpoon gear accounted for the majority of swordfish landings in California ports. In the early 1980s, a limited entry drift gillnet fishery was authorized by the State Legislature and soon afterward drift gillnets replaced harpoons as the primary method for catching swordfish. drift gillnets replaced harpoons as the primary method for catching

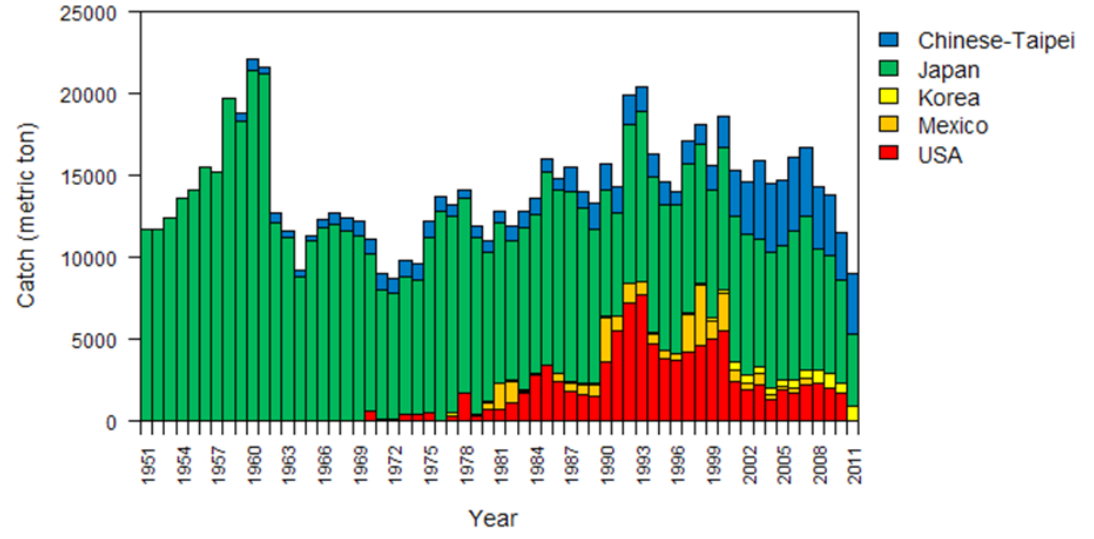

Figure 1. Annual landings of swordfish reported by ISC members in the North Pacific Ocean (figure from ISC 2013).

swordfish. Historically, the California drift gillnet fleet operated within EEZ waters adjacent to the state and as far north as the Columbia River, Oregon, during El Niño years; however, Oregon no longer issues the necessary permit to land drift gillnet catch in the state. Drift gillnet fishing activity is highly dependent on seasonal oceanographic conditions that create temperature fronts which concentrate feed for swordfish. Because of the seasonal migratory pattern of swordfish and seasonal fishing restrictions, over 90 percent of drift gillnet fishing effort occurs from August 15 through January 31.

In the U.S. West Coast harpoon fishery, 26 vessels participated in 2010, 17 in 2011 and only 9 in 2012. (PFMC 2012; Elizabeth Hellmers, personal communication, 2013). Fishing effort was concentrated in coastal waters off San Diego and in the Southern California Bight, especially between the coast and Santa Catalina and San Clemente Islands. A total of 158 swordfish were landed in 2010 by harpoon.

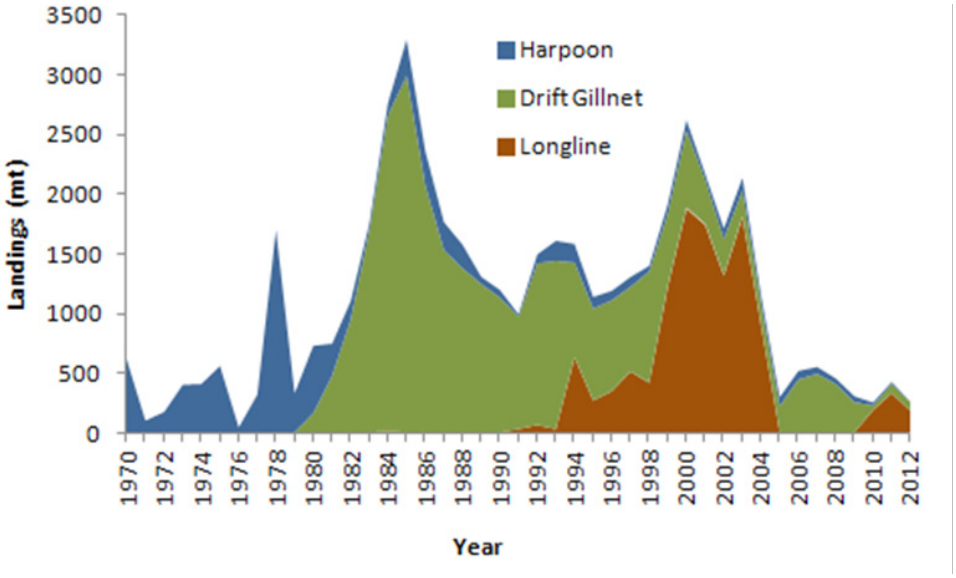

Figure 2. Swordfish landings along the U.S. West coast from 1970 to 2012 by gear type (data from ISC 2011; PFMC 2012; Elizabeth Hellmers, personal communication, 2013). Data for longline landings from 2005-2009 was not available.

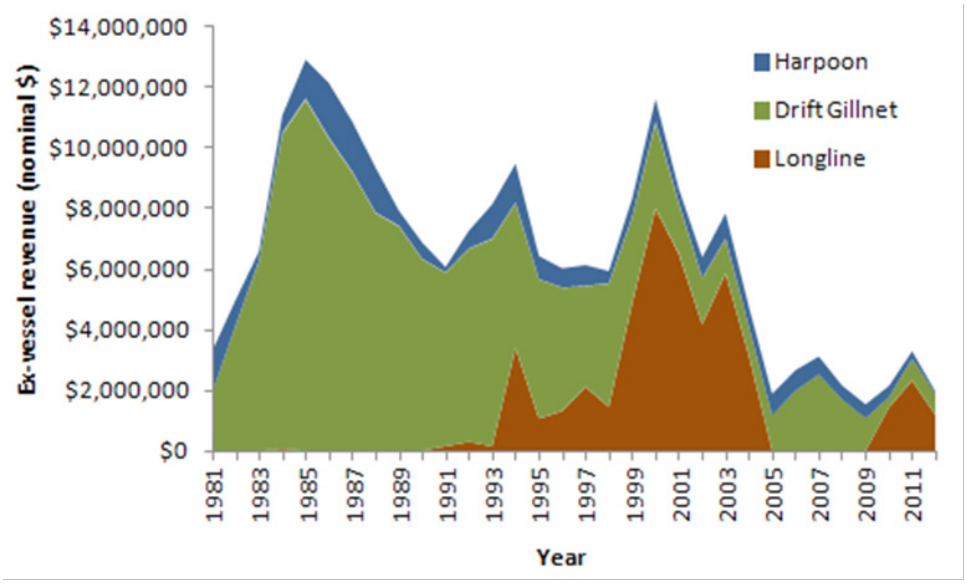

Figure 3. Annual ex-vessel revenue along the U.S. West coast from 1981 to 2012 (data from PFMC 2012; Elizabeth Hellmers, personal communication, 2013). Data for longline landings from 2005-2009 was not available.

Recreational Fishery

Recreationally caught swordfish are a rare occurrence along the West Coast. In California, recreational catch data is collected from the California Recreational Fisheries Survey (CRFS) program. Data from CRFS indicate that from 2003 to 2012, swordfish were only captured recreationally in California in 2007 (CDGF 2011; Elizabeth Hellmers, personal communication, 2013). However, this may not be an accurate reflection of total catch of swordfish by recreational anglers; the CRFS program only samples from public launch ramps. Several

billfish tournaments are held each year in the early fall, and these numbers, as well as those from private vessels launching from private marinas, are likely not captured (Elizabeth Hellmers, personal communication, 2013). There is a daily bag limit of 2 fish. Further information on recreational catch of swordfish in Southern California may be available from fishing tournament organizers.

MSC Principle 1: Resource Sustainability

*Sustainability of Target Stock

Swordfish are harvested in the North Pacific by fleets from Japan, Korea, Taiwan, and the United States. Stock assessments of the Western and Central North Pacific and Eastern North Pacific stocks of swordfish are considered healthy and above the level required to sustain recent catches (Brodziak and Ishimura 2010, IATTC 2011, ISC 2013) (Figure 4). Catch of swordfish by U.S. West Coast fisheries constitutes about 5.8 percent of the Eastern Pacific-wide catch. The PFMC uses the data from these stock assessments to inform the HMS FMP. Stock status reference points for BMSY and BMSST (minimum standing stock threshold biomass) were given in the latest stock assessment by the ISC (Brodziak and Ishimura 2010). The PFMC also has gear, permit, season, and area restrictions in place to manage bycatch.

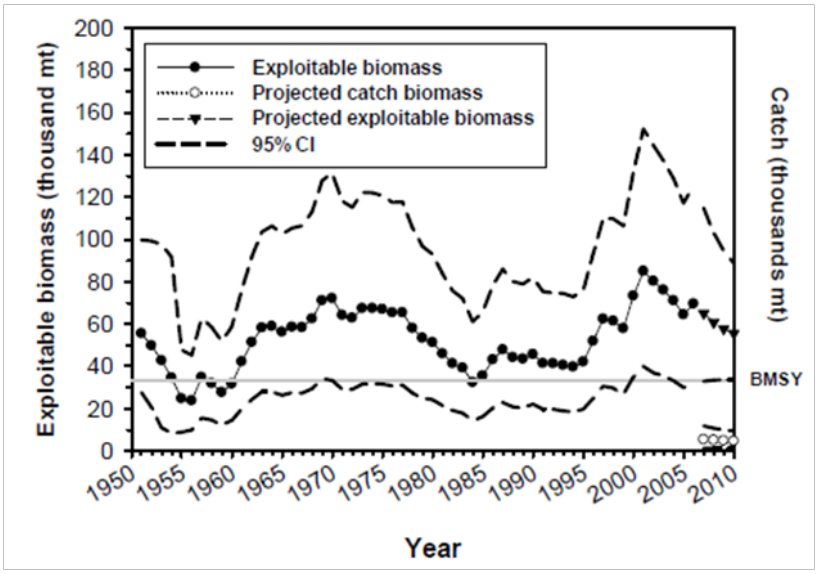

Figure 4. Time series of estimates of exploitable biomass (solid line, filled circle) of eastern North Pacific swordfish during 1952-2006, with 95% credibility intervals (dashed lines), projections of exploitable biomass (solid line, filled triangle), and 95% credibility intervals (dashed lines). Stochastic projections of exploitable biomass and catch biomass during 2007-2010 are based on production model dynamics assuming that the projected exploitation rate is normally distributed with a mean equal to the average exploitation rate during 2004-2006 and an associated standard deviation (ISC 2010).

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Evaluation against MSC Component 1.1: Sustainability of Target Stock

Performance Indicators	Rating	Justification
1.1.1 Stock Status		Stock biomass is above B_{MSY} and considered healthy
1.1.2 Reference Points		Reference points have been calculated and the stock is maintained at a level exceeding B_{MSY}
1.1.3 Stock rebuilding		Not triggered; stock is considered healthy

Harvest Strategy (Management)

Because swordfish are globally distributed, several international organizations undertake monitoring and stock assessments for swordfish. In the North Pacific, the fishery is divided into two stocks: the Western and Central North Pacific (WCNPO) and the Eastern North Pacific (EPO). The WCNPO stock is assessed by the International Scientific Committee for Tuna and Tuna-like Species (ISC) and is managed by the Western and Central Pacific Fisheries Commission (WCPFC). The EPO stock is assessed and managed by the Inter-American Tropical Tuna Commission (IATTC). The ISC and the IATTC work together under a Memorandum of Cooperation (MOC). Representatives from NOAA's Southwest Fisheries Science Center and Pacific Islands Fisheries Science Center participate in all three organizations.

[PFMC 2012]: Along the U.S. west coast, swordfish are managed under the Pacific Fishery Management Council's Highly Migratory Species Fishery Management Plan (HMS FMP). The PFMC does not assess the swordfish stock, but uses the data from the international stock assessments to inform the HMS FMP. Swordfish are targeted commercially using harpoons (in Southern California), drift gillnets, pelagic longlines, and recently after a several years hiatus, with surface hook-and-line gear. Catch of swordfish by U.S. West Coast fisheries constitutes about 5.8 percent of the Eastern Pacific-wide catch. No stock status reference points or quotas have been developed by the PFMC for swordfish because swordfish is one of eleven HMS species that fall under an "international exception" in place for stocks managed under an international agreement to which the United States is a party. However, reference points have been developed by the ISC in their latest stock assessment for swordfish (Brodziak and Ishimura 2010). The PFMC also has gear, permit, season, and area restrictions in place to manage bycatch.

For more information on management, see Section 3.2: Fishery Specific Management Objectives.

Evaluation against MSC Component 1.2: Harvest Strategy

Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Operates under Magnuson-Stevens Act to prevent overfishing; The U.S. fishery is monitored and mgmt actions are in place to limit bycatch; There are no set harvest limits because the stock is considered healthy.
1.2.2 Harvest Control Rules and Tools		Reference points were developed by the ISC and are evaluated during stock assessments every few years
1.2.3 Information/Monitoring		Observers and logbook data are available to monitor catch in the U.S.
1.2.4 Assessment of Stock Status		Until recently, stock assessments lacked enough data for accuracy. The most recent assessment with updated data from 2010 seems to be acceptable.

MSC Principle 2: Environment

Retained Catch

Harpoon

There is almost no retained catch in the swordfish harpoon fishery. There may be an occasional shark, but this would be a rare occurrence (Elizabeth Hellmers, personal communication, 2013).

Evaluation against MSC Component 2.1: Retained Catch

Performance Indicators	Rating	Justification
2.1.1 Outcome		No retained species
2.1.2 Management		Not applicable because no retained species
2.1.3 Information		Logbook data

Harpoon

Bycatch in the swordfish harpoon fishery is expected to be almost non-existent (NMFS 2012).

Evaluation against MSC Component 2.2: Bycatch

Performance Indicators	Rating	Justification
2.2.1 Outcome		Bycatch is close to zero
2.2.2 Management		Not applicable because no bycatch
2.2.3 Information		Logbook data

*Endangered, Threatened, & Protected Species

Harpoon

No ETP species are known to be captured in the swordfish harpoon fishery.

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

Evaluation against MSC Component 2.3: Endangered, Threatened & Protected Species

Performance Indicators	Rating	Justification
2.3.1 Outcome		No ETP species
2.3.2 Management		Not applicable – no ETP bycatch
2.3.3 Information		Logbook data

Habitat

Harpoon

[From PFMC 2012]: Harpoon gear consists of a pointed dart or iron attached to the end of a line several hundred feet in length, the other end of which is attached to a flotation device. Harpoon gear is attached to a pole or stick that is propelled only by hand, and not by mechanical means.

Harpoons do not typically encounter the ocean bottom, thus there is very little or no bottom habitat impact from harpoons.

Evaluation against MSC Component 2.4: Habitat

Performance Indicators	Rating	Justification
2.4.1 Outcome		Limited to no impact on habitat
2.4.2 Management		No mgmt strategy, but should not be applicable because no habitat impacts
2.4.3 Information		Not applicable because no habitat impacts

Ecosystem

[From PFMC 2003]: Swordfish are top predators and feed opportunistically on a wide range of squids, fish and crustaceans. Off California they eat northern anchovy, squid, hake, jack mackerel, rockfish, barracudas, black smelt, ribbonfish, and shrimp. Off Baja California, Pacific hake, the flying purple squid and jumbo squid are important in their diet. Larval and young swordfish actively feed on zooplankton and by 11-12 mm in length start feeding on a variety of epipelagic fish larvae (Arata 1954; Gorbunova 1969). Swordfish can forage at great depths and have been photographed at a depth of 1,000 m by a deep diving submersible (Mather 1976). It is generally accepted that swordfish in the pelagic environment feed on squid and mesopelagic fish and forage on demersal fish when in shallower waters.

[From Palko et al. 1981]: Predators of juvenile swordfish likely include any sufficiently large piscivorous fish or marine mammal. Juvenile swordfish have been found in the stomach of blue marlin, black marlin, striped marlin, shortbill spearfish, sailfish, yellowfin tuna, albacore tuna, bigeye tuna, dolphin, and blue shark. Adult swordfish have few known natural enemies. Sperm whales, killer whales, and large sharks are perhaps the only species capable of preying on adults. Sharks are the only creatures ever seen in actual combat with swordfish.

Gears such as gillnets and pelagic longlines used in the swordfish fishery can have high levels of bycatch which include sea turtles, sharks, seabirds and marine mammals. Bycatch is strictly regulated in the U.S., but many other countries that fish the same stock do not have bycatch mitigation plans. Higher bycatch levels by other countries may impact ecosystem structure or function.

Evaluation against MSC Component 2.5: Ecosystem

Performance Indicators	Rating	Justification
2.5.1 Outcome		In countries other than the U.S., bycatch can be unregulated; this will likely have ecosystem impacts
2.5.2 Management		Strict regulations to prevent bycatch in the U.S; fewer bycatch regulations in other countries
2.5.3 Information		Observer and logbook data in the U.S.

MSC Principle 3: Management System

Governance and Policy

Fisheries in the U.S. are governed by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976. The MSFMCA requires managing at or below MSY levels, rebuilding overfished stocks and ending overfishing, minimizing bycatch and bycatch mortality, identification of essential fish habitat and mitigation of adverse fishing impacts. In addition, the Endangered Species Act, the Marine Mammal Act, the Migratory Bird Treaty Act, the Coastal Zone Management Act, and the Clean Water Act apply to or provide protection for species and/or habitat that may be affected by the target fishery.

The MSFCMA established eight regional fishery management councils to manage fishery resources in the U.S. Exclusive Economic Zone (EEZ). Along the U.S. west coast, the EEZ extends from 3 to 200 nautical miles offshore. Each council is comprised of Federal, State, and stakeholder representatives. Additionally, advisory bodies provide expert advice on matters related to the purpose of the council. The council process emphasizes public participation and involvement in fisheries management; meetings are open to the public and to public comment. Management measures developed by the each council are recommended to the Secretary of Commerce through NOAA's National Marine Fisheries Service (NMFS). Along the west coast, management measures are implemented by NMFS Northwest and Southwest Regional offices and enforced by the NOAA Office of Law Enforcement, the U.S. Coast Guard 11th District, and local enforcement agencies.

Each council develops fishery management plans (FMPs) for the stocks in their region specifying how a fishery will be managed. The Guidelines for Fishery Management Plans (NMFS 1997) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each FMP. SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries being managed under federal regulation. Regional fishery management councils use this information to determine annual harvest levels for each stock, document significant trends or changes in the resources, marine ecosystems, and fishery over time, and assess the relative success of existing state and federal fishery management programs. In California, the Pacific Fishery Management Council (PFMC) is the regional council that manages federal fisheries

Evaluation against MSC Component 3.1: Governance and Policy

Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		PFMC and NMFS operate under Magnuson-Stevens Act
3.1.2 Consultation, Roles and responsibilities		PFMC meetings are public and public participation is encouraged
3.1.3 Long-term Objectives		Magnuson-Stevens Act and FMPs
3.1.4 Incentives for Sustainable Fishing		Magnuson-Stevens Act

Fishery Specific Management System

Along the U.S. west coast, swordfish are managed under the Pacific Fishery Management Council's Highly Migratory Species Fishery Management Plan (HMS FMP). The PFMC does not assess the swordfish stock, but uses the data from the international stock assessments to inform the HMS FMP. Management and research goals for managing bycatch in the swordfish fishery are outlined in the HMS FMP. Swordfish are targeted commercially using harpoons (in Southern California), drift gillnets, pelagic longlines, and recently after a several years hiatus, with surface hook-and-line gear. No stock status reference points or quotas have been developed by the PFMC for swordfish because swordfish is one of eleven HMS species that fall under an "international exception" in place for stocks managed under an international agreement to which the United States is a party.

[From PFMC 2012]: To participate in the harpoon fishery a state permit and logbook are required in addition to a general resident or non-resident commercial fishing license. Additionally, for all U.S. vessels that fish for HMS within the West Coast EEZ and on the high seas, a federal permit with a harpoon gear endorsement is required.

The drift gillnet fishery is managed by a limited entry permit system, with mandatory gear standards and seasonal area closures used to address various conservation concerns. A logbook and observer coverage is also required; in 2010, approximately 12% of HMS drift gillnet vessels had observer coverage.

California prohibits pelagic longline fishing within the EEZ. Vessels operating outside of the EEZ on the high seas can land fish in California ports if the operator has a general resident or non-resident commercial fishing license, current CDFW vessel registration, and a federal permit with a pelagic longline gear endorsement. A logbook is also required.

Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		There are objectives on reducing bycatch in the HMS FMP
3.2.2 Decision-making Processes		PFMC has an appropriate decision-making process in place
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		Yes, HMS FMP
3.2.5 Management Performance Evaluation		Stock assessments and reference points are developed by the ISC; catch restrictions are evaluated by the PFMC

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available

Recommendations

Although the harpoon fishery for swordfish has a low impact to the ecosystem and would likely score well during an MSC assessment, catch of swordfish by harpoon is low. There is a good possibility it may not be economically feasible to certify this small fishery. Alternatively, the surface hook-and-line fishery appeared to make a comeback this year; if this continues, this may be another branch of the fishery to take a closer look at to determine if it would be economically feasible to certify this gear type. Hook-and-line fisheries typically have low bycatch and almost no habitat impacts.

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Appendix A

MSC Assessment Tree			Swordfish
			Harpoon
Principle	**Component**	**Performance Indicator**	**Southern**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status	
		1.1.2: Reference points	
		1.1.3: Stock rebuilding	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy	
		1.2.2: Harvest control rules	
		1.2.3: Info/ monitoring	
		1.2.4: Stock assessment	
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status	
		2.1.2: Mgmt strategy	
		2.1.3: Information	
	By-catch species	2.2.1: Status	
		2.2.2: Mgmt strategy	
		2.2.3: Info	
	ETP species	2.3.1: Status	
		2.3.2: Mgmt strategy	
		2.3.3: Info	
	Habitats	2.4.1: Status	
		2.4.2: Mgmt strategy	
		2.4.3: Info	
	Ecosystem	2.5.1: Status	
		2.5.2: Mgmt strategy	
		2.5.3: Info	
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework	
		3.1.2: Consultation, roles, and responsibilities	
		3.1.3: Long term objectives	
		3.1.4: Incentives for sustainable fishing	
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives	
		3.2.2: Decision making process	
		3.2.3: Compliance & enforcement	
		3.2.4: Research plan	
		3.2.5: Management performance evaluation	

White Seabass (*Atractoscion nobilis*)

Certification Units Covered Under this Species

- Small Mesh Drift Gill Net

Summary

White seabass can range from Magdalena Bay in Baja California, Mexico to Juneau, Alaska, however they are rarely seen north of the San Francisco area. Stock structure is unclear, although there is evidence of genetic mixing between California and Mexico. White seabass are regulated by the Fish and Game Commission and managed by the Department of Fish and Wildlife. A White Seabass Fishery Management Plan was completed in 2002 and the fishery undergoes annual management reviews. There is also an experimental enhancement program that releases about 100,000 juveniles each year.

Strengths:

- Stock biomass has increased over the last 2 decades and is considered healthy
- Small mesh drift gill nets have minimal habitat impacts
- Fishery has a Fishery Management Plan and annual management reviews

Weaknesses:

- No stock assessment completed (yet)
- No harvest control rules and fishery independent monitoring data may be weak
- Need more information on retained, bycatch, and ETP species; some marine mammal and seabird bycatch

History of the Fishery in California

Biology of the Species

[From DFG 2006]: The white seabass is the largest member of the croaker family (Sciaenidae) in California. White seabass can range from Magdalena Bay, Baja California, Mexico to Juneau, Alaska, however they are rarely seen north of the San Francisco area. They are also found in the northern Gulf of California. The center of the white seabass population appears to be off central Baja California. Genetic research on white seabass populations shows that some mixing of fish from California and Mexico occurs. However, there may be local subpopulations of fish that do not mix regularly. While the question of population continuity remains unresolved, there is evidence that each summer the fish move northward with warming ocean temperatures (as demonstrated by catches), likely for spawning.

Spawning occurs over rocky reefs from April to August, with a peak in the late spring to early summer. Fecundity (egg productivity) for this species has not been determined, but a maturity study in the late 1920s reported females matured at 4 years old (61 cm) and some males matured at 3 years (51 cm). All white seabass have spawned at least once by age 6 (81 cm). The eggs, which are the largest of any croaker on the west coast (approximately 1.3 mm in diameter), are planktonic. The larvae, which are darkly colored, have been collected from Santa Rosa Island, California to Magdalena Bay, Baja California, Mexico. Most are found in the inshore areas of Sebastian Viscaino and San Juanico Bays, Baja California, Mexico, indicating major spawning occurs off central Baja California.

Young-of-the-year white seabass, ranging in length from 0.6 to 5.7 cm, inhabit the open coast in waters 4 m to 9 m deep. They associate with drifting macroalgae in areas of sandy ocean bottom. Between the ages of 1 and 3 years old, some juveniles may move into protected bays where they utilize eelgrass communities for cover and forage. Older juveniles are caught off piers and jetties and around beds of giant kelp. Maximum size for adult white seabass is 166 cm and 42.3 kg, although most commercially caught fish are near 102 cm and weigh about 9 kg. They can live at least 13 years (Love et al. 2011). Adults occupy a wide range of habitats including kelp beds, reefs, offshore banks, and the open ocean; they can be found in depths ranging from the surf zone to 122 m. Adult white seabass eat Pacific mackerel, Pacific sardines, market squid, pelagic red crabs, and Pacific herring.

Commercial Fishery

[CDFG 2006]: Prior to 1982, the majority of commercial white seabass catch was taken from Mexican waters; since that time, the Mexican government has denied access permits to U.S. fishermen, and the fishery has been concentrated in southern California, south of Point Conception. In the last decade, catch of white seabass has increased north of Point Conception, although this still comprises less than 20% of the total catch. Commercial landings of white seabass have fluctuated widely over the past 90 years of record keeping. Since 1959, when 1,588 mt were landed, the trend has been one of general decline (Figure 1). By the 1980–1981 fishing season, the fishery had collapsed to 10 percent of its historic catch (Allen et al. 2007), and annual landings remained at this level for the next 15 years. However, landings since 1999 have exceeded 91 mt annually, which is a modest increase over the period of 1983-1998. White seabass is a valuable fishery, exceeding $1 million in ex-vessel revenues over last two years (Figure 2).

During the early years of the fishery, commercial catches were made using gill nets, hook-and-line, and round haul nets. Round-haul net use was curtailed in the late 1920s because decreasing catches made it uneconomical. By the early 1940's, the take of white seabass by round haul gear was prohibited, and gill nets became the major commercial fishing gear, often accounting for over 90% of commercial landings. In 1994, restrictions on gill nets from Point Arguello to the US-Mexican border went into effect, and in 2002, gill net depth restrictions were expanded from Point Arguello north to Point Reyes (CDFG 2006). Despite these restrictions, most commercial landings are still taken with small mesh drift and set gill nets, although over the last three fishing seasons hook-and-line landings have increased steadily (Figure 3). The number of vessels using hook-and-line gear has also increased substantially in recent years (Figure 4), although the majority of hook and line vessels opportunistically catch white seabass when available along the coast (CDFG 2011).

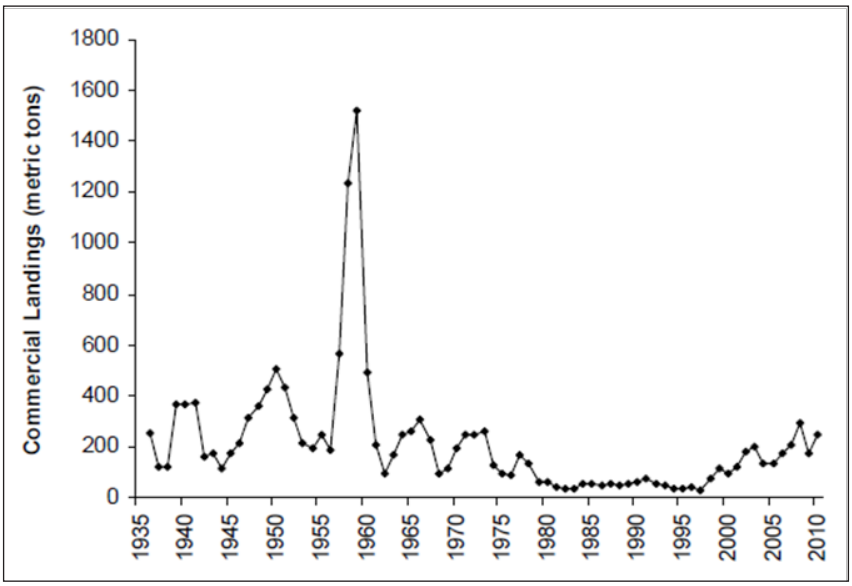

Figure 1. Commercial landings of white seabass that were both caught and landed in California (excludes data from when Mexico waters were open access) through 2010 (CDFG 2011).

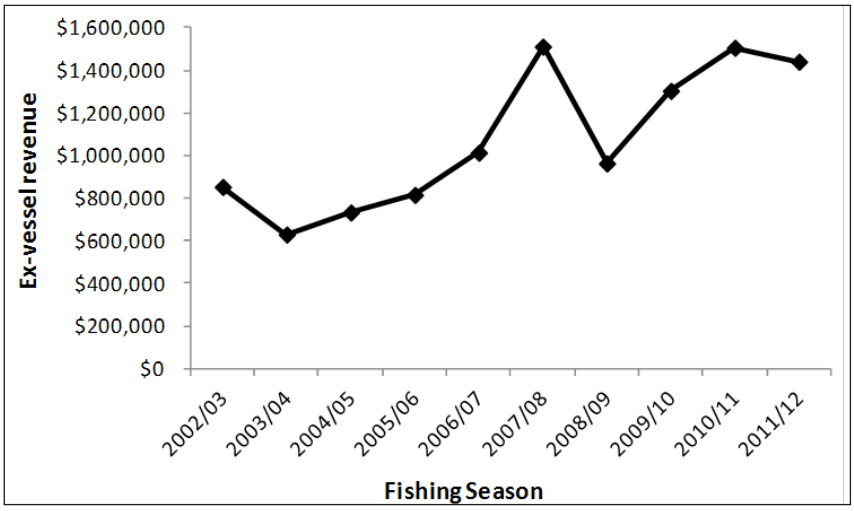

Figure 2. Total ex-vessel revenue from commercial white seabass from the 2002/03 to 2011/12 fishing seasons (data from CDFW 2013).

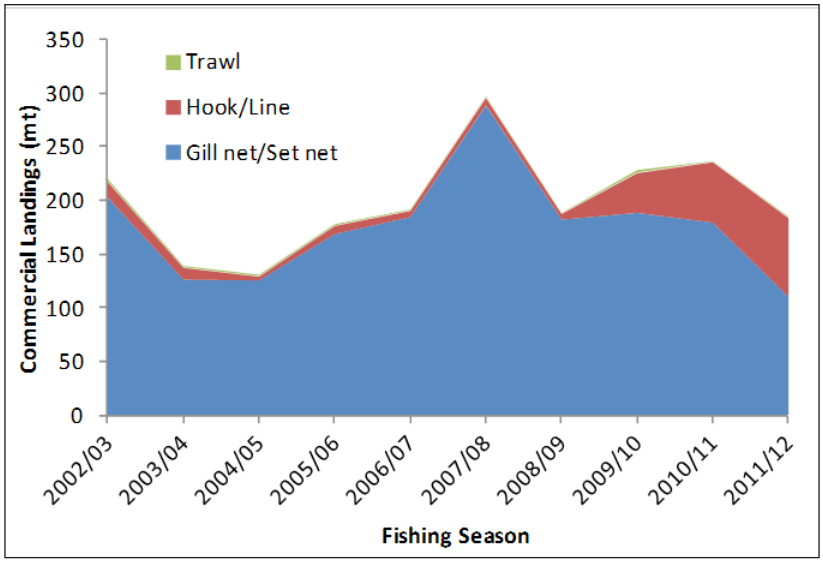

Figure 3. California commercial white seabass landings by gear type from the 2002-03 to 2011-12 fishing seasons (data from CDFW 2013).

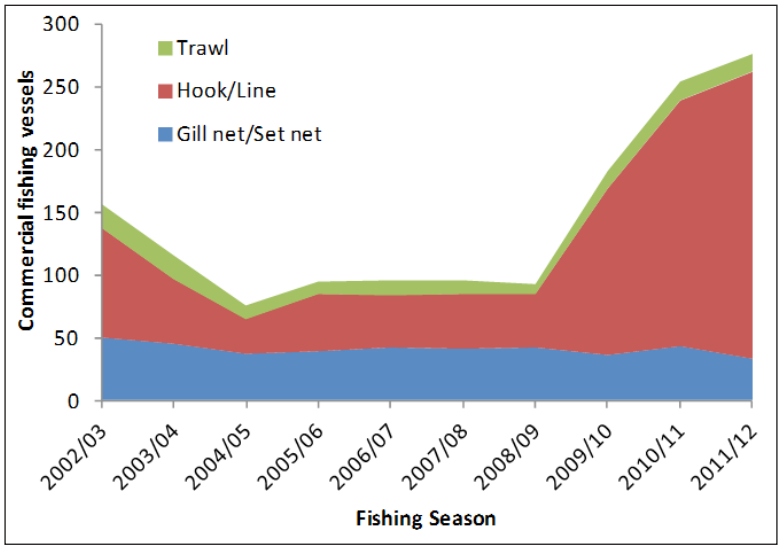

Figure 4. Number of commercial fishing vessels landing white seabass by principal gear type from the 2002-03 to 2011-12 fishing seasons (data from CDFW 2013).

Recreational Fishery

There is a very active recreational fishery in California; prior to 2004 recreational landings exceeded commercial landings (Figures 5 and 6). Most of the recreational fishery (90-95%) typically occurs south of Point Arguello; however, in recent years, increased landings have occurred further north in Monterey Bay (CDFG 2011). The recreational fishery is open year round but occurs primarily March through September. The daily bag limit is three fish, except from March 15 through June 15 when the daily bag limit is one fish south of Point Conception. There is also a minimum size limit of 71 cm (28 in). Most fish are caught by hook-and-line

anglers onboard CPFVs and private boats. From 1980 to 2004, the method for estimating recreational catch was the Marine Recreational Fisheries Statistical Survey (MRFSS) (Figure 5). After 2004, the California Recreational Fishing Survey (CRFS) was used to estimate recreational catch (Figure 6). Because these two data sets use different survey methods for collecting data, the data sets are not comparable.

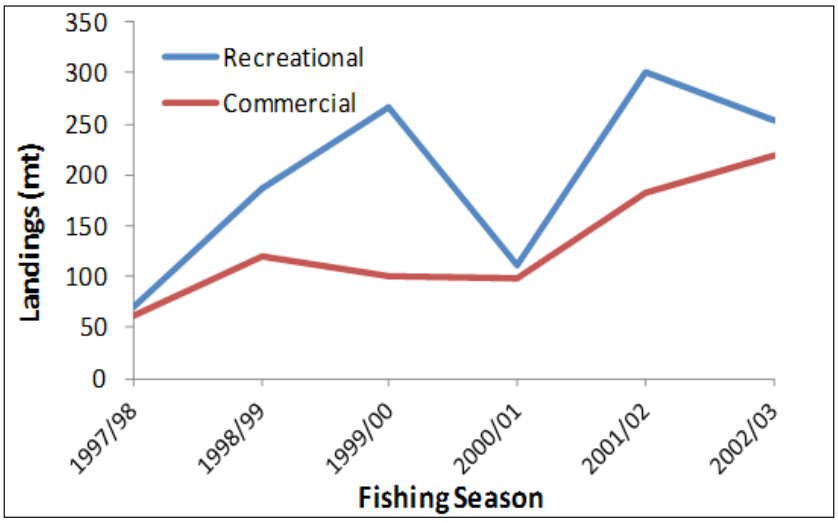

Figure 5. Recreational and commercial landings in California of white seabass from the 1997-98 season to the 2002-03 season (data compiled from CDFG 2011, CDFG 2006).

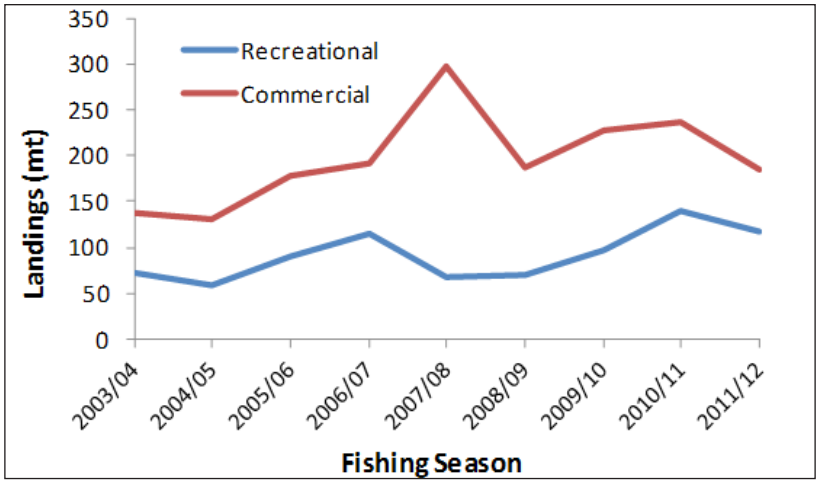

Figure 6. Recreational and commercial landings in California of white seabass from the 2003-04 season to the 2011-12 season (data from CDFW 2013).

MSC Principle 1: Resource Sustainability

*Sustainability of the Target Stock

Biomass at maximum sustainable yield (BMSY) was set in 2002 at 7,982 mt (16 million pounds). Although the fishery is data poor and current estimates of stock size do not exist, a scientific

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

and constituent advisory panel determined that current biomass of white seabass is above the BMSY (CDFG 2002). A conservative optimum yield (OY) or total allowable catch (TAC) was set in 2002 of 599 mt (1.2 million pounds). The TAC has not been reached since it was set.

Historically, white seabass stocks experienced a long period of general decline (1960–1997), and in 1980 the stock was depleted to 10 percent of its historic catch (Allen et al. 2007). However, populations and landings have increased over the last two decades. Recent increases are largely attributed to increased regulation, particularly the closure of gill net fishing in California state waters south of Point Arguello (Allen et al. 2007).

Research is underway to conduct a stock assessment on white seabass (Valerie Taylor, personal comm., 2013). In lieu of a stock assessment, an annual review of both the commercial and recreational white seabass fishery has been conducted since 2002, as required by the White Seabass Fishery Management Plan (WSFMP). The review evaluates six points of concern (CDFG 2002); if any of them are met the California Fish and Game Commission (FGC), with guidance from the California Department of Fish and Wildlife (DFW), will determine if management measures need to be taken to prevent overfishing. A long-term goal of the 2002 WSFMP was to develop a formal stock assessment for the fishery rather than relying on fishery dependent data to evaluate the health of the stock. Once the stock assessment is complete, it will likely be incorporated into the WSFMP.

In addition to the wild population, the white seabass population is also supplemented by the Ocean Resources Enhancement and Hatchery Program (OREHP). In 1982, the California Legislature established the OREHP to enhance populations of depleted marine finfish. The OREHP is an experimental aquaculture program that raises juvenile white seabass to a length of 200–250 mm and releases them into the wild. Currently the OREHP can release up to 350,000 individuals per year, but have on average released around 100,000 individuals per year (Valerie Taylor, personal comm., 2013). In comparison, the red drum enhancement program in the Gulf of Mexico releases up to 1.4 million individuals per year. DFW is currently beginning the process of evaluating the OREHP to determine the program's contribution to the wild population (Valerie Taylor, personal comm., 2013).

Evaluation against MSC Component 1.1: Sustainability of Target Stock

Performance Indicators	Rating	Justification
1.1.1 Stock Status		Stock biomass is above B_{MSY}
1.1.2 Reference Points		Reference points have been calculated; the stock is maintained at a level exceeding B_{MSY}
1.1.3 Stock rebuilding		Not triggered

Harvest Strategy (Management)

White seabass are regulated by the FGC and managed by DFW. The WSFMP was adopted by the FGC in 2002. Under the WSFMP, the fishery undergoes an annual review where DFW works with the White Seabass Scientific and Constituent Advisory Panel (WSSCAP) to evaluate the fishery against criteria set forth in the WSFMP. DFW then presents the results and makes a recommendation to the FGC. It is at the discretion of the FGC to determine whether or not a

change to the management of the fishery needs to be made. The six criteria include:

1. Catch is expected to exceed the current harvest guideline or quota;

2. Any adverse or significant change in the biological characteristics of white seabass (age composition, size composition, age at maturity or recruitment) is discovered;

3. An overfishing condition exists or is imminent; consisting of evaluating:

   a. a 20% decline in the total annual commercial landings of white seabass for the past two consecutive seasons compared to the prior five season average;

   b. 20% decline in both the number of fish and the average size of fish caught in the recreational fishery; and

   c. 30% decline in OREHP recruitment indices for juvenile white seabass compared to the prior five season average.

4. Any adverse or significant change in the availability of white seabass forage or in the status of a dependent species is discovered;

5. New information on the status of white seabass;

6. An error in data or stock assessment is detected that significantly changes estimates of impacts due to current management.

Since the inception of the WSFMP, none of the points of concern have been met so no management changes have been adopted. Through 2008, status was evaluated using a combination of fishery dependent and fishery independent data (CDFG 2006); fishery independent data on juvenile white seabass was collected by the OREHP. However, from 2009-2011 funding for collection of juvenile recruitment data was cut and only fishery dependent data was used to inform reviews. Partial funding was restored in 2012 and a portion of the fishery independent data is being collected again (Valerie Taylor, personal comm., 2013).

Catch of white seabass is also regulated by limited entry permits, gear restrictions, minimum size limits, and seasonal and area closures:

- Limited entry gill/trammel net permit is required
- Minimum gill net mesh size of 15 cm (6 in)
- Minimum size limit of 71 cm (28 in) for both the commercial and recreational fishery
- Commercial fishery closure from March 15 to June 15 south of Point Conception to protect fish during spawning season
- State ban of gill net fishing in state waters from the US-Mexico border to Point Arguello, 70 fathoms or within one nautical mile (whichever is less) of the Channel Islands, inshore of 60 fathoms from Point Arguello north

We could find no information on fishery management practices in Mexico.

Evaluation against MSC Component 1.2: Harvest Strategy

Performance Indicators	Rating	Justification
1.2.1 Harvest Strategy		Management structure in place, but not rigorous right now; Might be lacking in monitoring; no harvest control rules; tools are available for limiting catch.
1.2.2 Harvest Control Rules and Tools		Mechanisms for response if stock declines, but no triggers; management strategy evaluations are a tool that could be used for this (limited entry, gear limits, area closures, etc); no info on removals from Mexico.
1.2.3 Information/Monitoring		Fishery dependent and independent data are collected.
1.2.4 Assessment of Stock Status		There are annual reviews, but no stock assessment (it is underway).

MSC Principle 2: Environment

Retained Catch

Small Mesh Drift Gill Net

This information is not available at this time, but could be accessed in the future by analyzing DFW landings receipts and logbooks. There is a sub-portion of this fishery that targets, not only seabass, but halibut, yellowtail, barracuda, or angel sharks. Since these are targeted species, they are not considered retained catch.

Evaluation against MSC Component 2.1: Retained Catch

Performance Indicators	Rating	Justification
2.1.1 Outcome		Unknown; no information publicly available, cannot assess
2.1.2 Management		Unknown; no information publicly available, cannot assess
2.1.3 Information		DFW landings receipts and logbooks should be available, although no information is publicly available

Bycatch

Small Mesh Drift Gill Net

Although detailed information from past observer programs was not readily available, there

should be data available on bycatch of non-protected species in these data sets. In addition, a federal observer program, for which data is not available at this time, may provide insight into bycatch for this fishery (see next section). Bycatch is not known for the hook-and-line portion of the fishery but is considered to be low.

Evaluation against MSC Component 2.2: Bycatch

Performance Indicators	Rating	Justification
2.2.1 Outcome		Unknown; no information publicly available, cannot assess
2.2.2 Management		Bycatch species unknown, need more information; although gear restrictions likely limit bycatch
2.2.3 Information		Some observer data, logbooks

Endangered, Threatened, & Protected Species

Small Mesh Drift Gill Net

The small mesh drift gill net fishery under the Marine Mammal Protection Act is currently rated a Category II (NMFS 2012). There is limited data available on ETP species bycatch in the small mesh drift gill net fishery; all data is from a federal observer program from 2002 to 2004 associated with the yellowtail, barracuda, and white seabass drift gill net fishery. A federal gill net observer program has been contracted out again, but there is no data available at this time (Valerie Taylor, personal comm., 2013). Observer data from 2002 to 2004 documented mortalities of three California sea lions and two long-beaked common dolphins among a total of 64 sets observed (Carretta et al. 2004, Carretta et al. 2005). Populations of these species are considered to be stable or increasing.

Evaluation against MSC Component 2.3: Endangered, Threatened & Protected Species

Performance Indicators	Rating	Justification
2.3.1 Outcome		Limited data publicly available; data that is available suggests the fishery does not cause irreversible harm to ETP species
2.3.2 Management		Gear restrictions in place likely limit harm to ETP species
2.3.3 Information		Some observer data, logbooks

Habitat

Drift gill nets have minimal impacts on physical habitats since they are not designed to come into contact with the seafloor (Cheunpagdee et al. 2003, Morgan et al. 2004). The state ban on

*For California's Sustainable Seafood Program, this category must score an 80 or higher during an MSC assessment.

gill net fishing in many state waters protects some of the habitat that might be fished if the ban were not in place.

Evaluation against MSC Component 2.4: Habitat

Performance Indicators	Rating	Justification
2.4.1 Outcome		Minimal habitat impacts from drift gill nets
2.4.2 Management		Limited entry permits, gear restrictions, area closures and seasonal closures help limit habitat impacts
2.4.3 Information		It is unclear if the information available on habitat impacts is adequate to assess the risk posed

Ecosystem

White seabass primarily prey on anchovies, herring, sardines, squid, and pelagic crabs (Thomas 1968; Vojokovivh et al 1983). Juveniles are preyed upon by many larger fish (Marguiles 1989), and adults have been seen being eaten by sea lions and sharks (CDFG 2002). It is unknown whether any changes to the ecosystem can be attributed to the white seabass gill net fisheries (CDFG 2002).

Evaluation against MSC Component 2.5: Ecosystem

Performance Indicators	Rating	Justification
2.5.1 Outcome		Not enough information to assess
2.5.2 Management		WS FMP criteria #4 addresses changes in the availability of white seabass forage fish species; existing mgmt may indirectly benefit ecosystem health; MPAs will protect some juvenile habitat
2.5.3 Information		There should be some info available on retained, bycatch and ETP species from landings receipts and observer data to help assess this PI

MSC Principle 3: Management System

Governance and Policy

The fishery is regulated by the Fish and Game Commission and managed by DFW. It is subject to and managed under all relevant US federal laws as well as California state regulations pertaining to fisheries management. The fishery is subject to an FMP and is reviewed on an annual basis by the Commission with recommendations from DFW and WSSCAP. The public can attend and comment at public Commission meetings, or send in comments by mail or e-mail.

Evaluation against MSC Component 3.1: Governance and Policy

Performance Indicators	Rating	Justification
3.1.1 Legal and/or Customary Framework		FGC and DFW manage the fishery within an effective framework for delivering sustainable fisheries
3.1.2 Consultation, Roles and responsibilities		Roles and responsibilities are clearly laid out; FGC meetings are open to the public and to public comments
3.1.3 Long-term Objectives		Magnuson-Stevens Act, Marine Life Management Act
3.1.4 Incentives for Sustainable Fishing		Magnuson-Stevens Act, Marine Life Management Act

Fishery Specific Management System

The white seabass fishery is actively managed and regulated by both the Commission and DFW. See the Harvest Strategy section for more information. It undergoes an annual review, and DFW is currently evaluating its experimental enhancement program. Enforcement of fishing regulations is conducted in state waters by CDFW's Law Enforcement Division and in federal waters by NOAA's Office of Law Enforcement. Additionally tools such as port sampling, logbooks, and observer coverage are used to monitor catch and ensure vessels have the correct permits for the catch they are landing. Violators are prosecuted under the law. There is no evidence of systemic non-compliance.

Evaluation against MSC Component 3.2: Fishery Specific Management System

Performance Indicators	Rating	Justification
3.2.1 Fishery Specific Objectives		Clear objectives are outlined in the WSFMP
3.2.2 Decision-making Processes		DFW provides recommendations that are vetted through the FGC
3.2.3 Compliance & Enforcement		An enforcement system exists and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.
3.2.4 Research Plan		The WS FMP outlines short and long term research objectives however the research plan has not been formally reviewed in awhile
3.2.5 Management Performance Evaluation		There is an annual review to evaluate the fishery against six management criteria

California Specific Requirements

The California voluntary sustainable seafood program requires fisheries seeking certification to meet California specific standards in addition to the standards and requirements of the Marine Stewardship Council (MSC) sustainable fisheries certification program. These include:

1. Higher scores (80 instead of 60) for two performance indicators (PI) of the MSC program: "Stock Status" (PI 1.1.1) and "By-catch of Endangered, Threatened, or Protected (ETP) Species" (PI 2.3.1). These two PIs are highlighted in the report.

2. Additional independent scientific review: The OPC Science Advisory Team will be engaged in the certification process through early consultation in reviewing minimum eligibility criteria, and review of the MSC-required pre-assessments and full assessments. The reviews will be conducted in addition to MSC's peer review, thus bringing additional credibility, transparency, and independence to California's certification process.

3. Additional traceability components: The California program will develop a unique barcode for California certified sustainable fish. This barcode can be either scanned by a smart-phone or linked to a website that will reveal additional information about the fishery, and information about toxicity when available

Recommendations

In this fishery, there are three gear types. We investigated the small mesh drift gill net fishery, but we need to better understand the choices being made by fishermen when fishing either with set or small mesh drift gill nets. There are reasonably different impacts to habitat associated with each of these gear types that may affect the sustainability of the fishery. In addition, we did not consider the hook-and-line fishery that takes place in Monterey Bay. This is still a relatively small portion of the fishery but appears to be growing (Valerie Taylor personal comm., 2013). It is possible this portion of the fishery expands and shrinks based on environmental factors (warming waters, prey availability) (Valerie Taylor personal comm., 2013). California may want to take a closer look at the hook-and-line fishery since it appears to be a relatively sustainable gear type.

This fishery also has several components that are currently under investigation and will provide a clearer state of the fishery once complete. These include stock assessment research, review of the OREHP, resuming fishery independent data collection that has been suspended since 2008, and a federal observer program on both set and small mesh drift gill net vessels.

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Appendix A

MSC Assessment Tree			White Seabass
			Drift gill nets
Principle	**Component**	**Performance Indicator**	**Southern**
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status	
		1.1.2: Reference points	
		1.1.3: Stock rebuilding	*Did not assess*
	Harvest Strategy (Management)	1.2.1: Harvest strategy	
		1.2.2: Harvest control rules	
		1.2.3: Info/ monitoring	
		1.2.4: Stock assessment	
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status	
		2.1.2: Mgmt strategy	
		2.1.3: Information	
	By-catch species	2.2.1: Status	
		2.2.2: Mgmt strategy	
		2.2.3: Info	
	ETP species	2.3.1: Status	
		2.3.2: Mgmt strategy	
		2.3.3: Info	
	Habitats	2.4.1: Status	
		2.4.2: Mgmt strategy	
		2.4.3: Info	
	Ecosystem	2.5.1: Status	
		2.5.2: Mgmt strategy	
		2.5.3: Info	
Principle 3: Management System	Governance & Policy	3.1.1: Legal framework	
		3.1.2: Consultation, roles, and responsibilities	
		3.1.3: Long term objectives	
		3.1.4: Incentives for sustainable fishing	
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives	
		3.2.2: Decision making process	
		3.2.3: Compliance & enforcement	
		3.2.4: Research plan	
		3.2.5: Management performance evaluation	

Rapid Assessments Appendices

Appendix A: Rapid Assessments Species Summary

MSC Assessment Tree			Albacore Tuna*		CA Halibut		Dungeness Crab	Market Squid		Pacific Herring	Pacific Sardine	Pink Shrimp		Sablefish			Spiny Lobster	Swordfish	White Seabass
			Pole and line	Troll and jig	Trawl		Trap	Round Haul	Brail	Gill net	Purse seine	Otter trawl		Bottom trawl IFQ	Longline IFQ	Trap IFQ	Trap	Harpoon	Drift gill nets
Principle	**Component**	**Perf. Indicator**	All	All	Central	South	All	All	All	SF Bay	All	North	South	All	All	All	All	South	South
Principle 1: Health of Fish Stock	Outcome	1.1.1: Stock status																	
		1.1.2: Reference points																	
		1.1.3: Stock rebuilding	*Did not assess*		*Did not assess*		*Did not assess*	*Did not assess*		*Did not assess*	*Did not assess*	*Did not assess*		*Did not assess*			*Did not assess*	*Did not assess*	*Did not assess*
	Harvest Strategy (Mgmt)	1.2.1: Harvest strategy																	
		1.2.2: Harvest control rules																	
		1.2.3: Info/ monitoring																	
		1.2.4: Stock assessment																	
Principle 2: Impact on Ecosystem	Retained species	2.1.1: Status																	
		2.1.2: Mgmt strategy																	
		2.1.3: Information																	
	By-catch species	2.2.1: Status																	
		2.2.2: Mgmt strategy																	
		2.2.3: Info																	
	ETP species	2.3.1: Status																	
		2.3.2: Mgmt strategy																	
		2.3.3: Info																	
	Habitats	2.4.1: Status																	
		2.4.2: Mgmt strategy																	
		2.4.3: Info																	
	Ecosystem	2.5.1: Status																	
		2.5.2: Mgmt strategy																	
		2.5.3: Info																	
Principle 3: Mgmt System	Governance & Policy	3.1.1: Legal framework																	
		3.1.2: Consultation, roles, and responsibilities																	
		3.1.3: Long term objectives																	
		3.1.4: Incentives for sustainable fishing																	
	Fishery Specific Mgmt System	3.2.1: Fishery specific objectives																	
		3.2.2: Decision making process																	
		3.2.3: Compliance & enforcement																	
		3.2.4: Research plan																	
		3.2.5: Mgmt perf evaluation																	

Appendix B: Selection of Fishery Units

Fishery units chosen for rapid assessments were selected by representative from the Ocean Protection Council, the Department of Fish and Wildlife, and the Fish and Game Commission. The Ocean Science Trust (OST) facilitated the selection of fisheries by providing background information, guidance on MSC standards, and guidance on other rapid assessments. OST defined a target of approximately 20-25 certification units and provided the group with several main categories and other issues they may want to consider while selecting fisheries. These included:

- Economic Value
- Fleet/Gear participation
- Management Interest
- Future Potential
- Environmental Impacts/Issues
- Dependence of ports or regions on a fishery
- Importance of fishery to a particular type of fleet
- Fisheries where minor management, improvement projects, or additional research could significantly and positively impact the fishery
- Fisheries for which information gathered from this assessment would be of particular use to OPC, DFW, and/or the Commission
- Likelihood of meeting MSC standards
- Species, gear types, or fleets that may work to be certified as one group rather than individual units

Fishery units were organized by high, low and not currently a priority based on recommendations from agency staff. From this process, eleven fisheries, which comprise 17 certification units, were considered high priority and selected for rapid assessments. These fishery units are listed in Table 1.

Table 1. Fishery units selected for rapid assessments.

Unit	Species	Gear	Region
1	Albacore tuna	Pole and line	All
2	Albacore tuna	Troll and jig	All
3	California halibut	Bottom trawl	Central
4	California halibut	Bottom trawl	Southern
5	Dungeness crab	Trap	All
6	Herring (Pacific roe)	Gill net	SF Bay
7	Market squid	Seine (Purse and Drum)	All
8	Market squid	Brail	All
9	Pink shrimp	Trawl	Northern
10	Pink shrimp	Trawl	Southern
11	Sablefish	Longline IFQ	All
12	Sablefish	Trap IFQ	All
13	Sablefish	Trawl IFQ	All
14	Sardine, Pacific	Purse seine	All
15	Spiny lobster	Trap	All
16	Swordfish, Pacific	Harpoon	Southern
17	White seabass	Small mesh drift gillnet	All

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