ENVIRONMENTAL ASSESSMENT
AND
REGULATORY IMPACT REVIEW

PACIFIC SARDINE HARVEST SPECIFICATIONS
2013 FISHING SEASON

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1.0 Summary

This document describes the environmental effects of the annual specifications and management measures for Pacific sardine for the fishing season January 1 through December 31. The annual overfishing limit (OFL), acceptable biological catch (ABC), annual catch limit (ACL), and harvest guideline (HG) or annual catch target (ACT) are established using the current estimated sardine biomass applied to the formulas and sustainable yield criteria in the fishery management plan (FMP). The harvest strategy approved each year must meet predetermined criteria that are carefully selected to avoid adverse effects to the fishery resource and recognizing that the biomass of Pacific sardines, along with the economic impacts to fishermen and communities dependent on the resource, fluctuates naturally from year to year. The method and effects for determining the annual catch amounts were analyzed in 1998 as a supplemental environmental impact statement for Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (CPS FMP, PFMC 1998) as well as the Environmental Assessments for Amendment 11 and 13 to the CPS FMP.

2.0 Purpose and Need

The purpose of the proposed action is to conserve and manage the U.S. Pacific sardine fishery resource in order to prevent overfishing, to ensure conservation, to facilitate long-term protection of essential fish habitat, and to realize the full potential of the Nation's fishery resources (MSA§2(a)(6)). In order to achieve this purpose, it is necessary to establish the annual harvest limits and targets and associated management measures for Pacific sardine, as set forth in the CPS FMP. The need for the proposed action is to implement these harvest limits as required by the FMP for Pacific sardine through application of formulas that utilize an estimate of biomass and specific conservation criteria. These limits and HG are established based on the best scientific information available and derived according to the required formula. They are intended to protect Pacific sardine from overharvest and recognize Pacific sardine's role as forage by limiting the directed commercial harvest of Pacific sardine while, at the same time, providing long-term harvest potential for the fishing industry.

3.0 Background

The Pacific sardine fishery off the west coast of North America has been economically important since the early part of the 20th century (Conser et al. 2004). The Pacific sardine fishery developed in response to demand for food during World War I. Delivery of sardines to processing facilities (landings) increased from 1916 to 1936 and supported the largest fishery in the western hemisphere during the 1930s and 1940s. During the 1940s and 1950s, approximately 200 vessels participated in the Pacific sardine fishery. The fishery declined in the late 1940s and remained at extremely low levels until the 1970s. In 1986, the state of California lifted its 18-year moratorium on sardine harvest on the basis of sea-survey and other data indicating that the spawning biomass had returned to fishable levels. In January 2000, management authority for the U.S. Pacific sardine fishery was transferred to the Pacific Fishery Management Council (Council) when the FMP was adopted. Around the same time that the FMP was being developed (the mid-1990s), the Pacific sardine stock expanded its range northward to the Pacific Northwest, prompting the start of state-managed fisheries off Oregon and Washington. A fishery for Pacific sardine has operated off Oregon and Washington since 1999.

The CPS fishery is administratively divided into a "limited entry" fishery (requiring Federal permits in order to participate in the fishery) south of 39 degrees North latitude (Southern subarea), and an "open access fishery" (not requiring Federal permits to participate in the fishery) north of 39 degrees North latitude (northern subarea). Vessels landing less than five metric tons of CPS per trip in the Southern subarea are exempt from limited entry requirements. However, the states of Oregon and Washington both have specific state restrictions that limit the number of vessels in their respective fisheries. The CPS LE fleet currently consists of 65 permits and 58 vessels. In Oregon and Washington, fishermen must have

individual state harvest permits to fish for Pacific sardine.

The northern and southern subareas of this fishery have different temporal characteristics. Historically, Pacific sardine landings in the southern subarea have occurred throughout the year, with a majority of the fishery occurring in the winter months (December-March). However, due to restrictive harvest limits over the last few years, landings have been grouped towards the start of each fishery allocation period (see section 3.1 for allocation period details). The majority of the Pacific sardine landed in the northern subarea occurs from June-September.

Stocks in the CPS FMP are classified under the following management categories: actively managed; monitored; and prohibited harvest species. The CPS FMP is based on a management framework designed to react quickly to changes in the fisheries and/or stocks, with the CPSMT providing advice on classification changes in accordance with fishery/stock dynamics. The following table lists the stocks currently managed under the CPS FMP.

Management Category	Common Name	**Scientific Name**
Actively Managed	Pacific sardine	*Sardinops sagax*
	Pacific (chub) mackerel	*Scomber japonicas*
Monitored	Northern anchovy Central and Northern Subpopulations	*Engraulis mordax*
	Market squid	*Loligo opalescens*
	Jack mackerel	*Trachurus symmetricus*
Prohibited Harvest	Krill or Euphausiids All West Coast EEZ Species Eight dominant species First two species are common and are the most vulnerable to fishing.	*Euphausia pacifica* *Thysanoessa spinifera* *Nyctiphanes simplex* *Nematocelis difficilis* *T. gregaria* *E. recurva* *E. gibboides* *E. eximia*

Harvest guidelines for the two actively managed species (Pacific sardine and Pacific mackerel) are based on formulas incorporating current biomass estimates. Annual biomass estimates are not made for the three monitored species (jack mackerel, northern anchovy, and market squid). During public meetings each year, the biomass for each actively managed species within the CPS FMP is presented to the Pacific Fishery Management Council's (Council) CPS Management Team (Team), the Council's CPS Advisory Subpanel (Subpanel) and the Council's Scientific and Statistical Committee (SSC). At that time, the biomass, the potential OFL, and the status of the fisheries are reviewed and discussed. This information then is presented to the Council along with HG recommendations and comments from the Team, Subpanel and SSC. Following review by the Council and after hearing public comment, the Council makes its OFL, ABC, ACL and HG or ACT recommendation to NMFS. If these harvest limits are found to be consistent with the Magnuson-Steven Act and other applicable law, including the Endangered

Species Act (ESA), NMFS implements the management measures. The harvest limits apply to the exclusive economic zone (EEZ), between 3 and 200 nautical miles off shore. The annual harvest limits and season structure are published by NMFS in the Federal Register as soon as practicable before the beginning of the fishing season. The Pacific sardine season begins on January 1 and ends on December 31 of each year. The fishery begins whether regulations are in place or not, however NMFS does not have the ability to close the fishery without published regulations.

Additionally, Amendment 9 to the CPS FMP established a treaty Indian fishing rights framework for CPS species in usual and accustomed areas off the coast of Washington. The FMP states "An allocation or a regulation specific to the tribes shall be initiated by a written request from a Pacific Coast treaty Indian tribe to the NMFS Southwest Regional Administrator, at least 120 days prior to the start of the fishing season as specified at 50 CFR 660.510, and will be subject to public review according to the procedures in 50 CFR 660.508(d)" (PFMC 2001). After considering any tribal request, the recommendation of the Council, and the comments of the public, NMFS will implement and announce any annual tribal allocation at the same time as the annual specifications.

3.1 Management Measures

In 2006, the adoption of Amendment 11 to the CPS FMP established the current allocation and apportionment scheme for Pacific sardine on the West Coast. Based on this apportionment scheme, 35 percent of the harvest guideline is allocated coastwide on January 1. On July 1, 40 percent of the harvest guideline - plus any portion not harvested from the initial allocation – is reallocated coastwide, and on September 15 the remaining 25 percent, plus any portion not harvested from earlier allocations, is reallocated.

In 2011, Amendment 13 to the CPS FMP was adopted to ensure the FMP was consistent with advisory guidelines published at 50 CFR 600.310 with respect to a process for setting ACLs and accountability measures (AMs) and clarifying management unit species (MUS) and ecosystem component species (EC). Amendment 13 modified management measures to include the specification of new reference points such as ACLs. This included the process for annually setting ACLs and associated AMs, as well as other provisions for preventing overfishing, such as the potential of setting ACTs.

The formulas established by Amendment 13 for actively managed species such as Pacific sardine are shown in the table below.

OFL	BIOMASS * F_{MSY} * DISTRIBUTION
ABC	BIOMASS * BUFFER * F_{MSY} * DISTRIBUTION
ACL	LESS THAN OR EQUAL TO ABC
HG	(BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION.
ACT	EQUAL TO HG OR ACL, WHICHEVER VALUE IS LESS

The OFL is an annual catch amount that corresponds to the estimate of (annual) MSY fishing mortality. The OFL is expressed in terms of numbers or weight of fish; overfishing occurs if catch exceeds the OFL. For Pacific sardine the OFL is based on a MSY proxy harvest rate, determined by the best available scientific information, applied to the best available estimate of biomass. Additionally, because a portion of the sardine population is in foreign waters, the OFL is adjusted using a DISTRIBUTION to estimate the percentage of the population in the U.S. EEZ.

The ABC is a harvest specification set below the OFL and is a threshold that incorporates a scientific uncertainty buffer against overfishing (i.e., exceeding the OFL). The ABC is decided by the Council based on its preferred level of overfishing risk aversion. The ABC incorporates a percentage reduction of

the OFL selected according to an SSC determination on scientific uncertainty and a risk policy determined by the Council. In cases where scientific uncertainty (σ) associated with estimating an OFL is quantified by the SSC, the percentage reduction that defines the scientific uncertainty buffer and the ABC can be determined by translating the estimated σ to a range of probability of overfishing (Pstar) values. After the Council decides on its level of preferred risk (Pstar) that value is matched to its corresponding BUFFER fraction. The BUFFER fraction then is applied to the OFL according to the ABC control rule.

An ACL is the level of annual catch of a population or population complex that is set to help prevent overfishing from occurring and, if met or exceeded, that triggers accountability measures such as a closure of the fishery or a review the management strategy of the fishery. The Pacific sardine fishery is managed to keep total catch from all sources below the ACL. ACLs are set no higher than ABC, and the HG cannot exceed the ACL or ABC. In cases where the result of the HG formula exceeds the ABC value, the Council will set a lower ACL, HG, or ACT in response. Along with optimum yield (OY) considerations, an HG or ACT may be utilized below an ACL or sector-specific ACL to account for management uncertainty, discard or bycatch mortality and research take. These provisions will be considered on an annual basis in response to changing resource status and fishery dynamics.

Along with the setting of HGs or ACTs below the ACL, accountability measures (AMs) are in place, such as inseason management controls and post-season review processes, to prevent ACLs from being exceeded and to correct or mitigate overages of the ACL if they occur.

To further protect the sardine resource from over harvest while allowing for fishing opportunity, the HG formula utilized for the Pacific sardine fishery is designed to continuously reduce the exploitation rate as biomass declines (Parrish and MacCall, 1978) and to allow for expansion of the resource if environmental conditions are favorable to recruitment of the species. With regard to the OY, adhering to the harvest formulas in the FMP is important to the stability of the resource and to species that depend on sardines for forage.

The harvest guideline (HG) formula for Pacific sardine is specified:

HARVEST GUIDELINE = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION, where:

HARVEST GUIDELINE is the target harvest level for each management year;
BIOMASS is the annual population biomass estimate of sardine ages 1 and older;
CUTOFF is the threshold below which fishing is prohibited; typically CUTOFF is the overfished threshold but it is 150,000 mt for sardine, 3x the overfished level;
FRACTION is the temperature-dependent exploitation fraction and ranges from 5% - 15%;
DISTRIBUTION is the average portion of the coastwide biomass in U.S. waters, assumed to be 87 percent;
MAXCAT is the maximum allowable catch regardless of biomass. MAXCAT is 200,000 mt for Pacific sardine.

The purpose of CUTOFF is to protect the stock when biomass is low. The purpose of FRACTION is to specify how much of the stock is available to the fishery when BIOMASS exceeds CUTOFF. The DISTRIBUTION term is in recognition that the stock ranges beyond U.S. waters and, therefore, is subject to foreign fisheries.

BIOMASS is an estimate only; it is never assumed that BIOMASS is a perfect measure of abundance. In fact, levels of measurement error in BIOMASS typically have CVs of about 50 percent for CPS, an aspect that was included in the development of the current HG formula.

It is important to note that scientific uncertainty around biomass estimates (stock assessment error) is accounted for in all simulations used to evaluate the sardine HG formula. Amendment 8, Appendix B states:

> *"Simulated biomass estimates used to set quotas in the model were imprecise. Measurement errors for biomass estimates used in the simulations to set quotas were lognormally distributed with arithmetic scale CV equal to 60%. Recent sardine biomass estimates for 1997 had an arithmetic scale CV of about 50% (Hill et al. 1998), so a CV for errors in biomass estimates from stock assessments of 50% was assumed in simulations."*

The Council's HG formula for Pacific sardine is theoretically already robust to errors with respect to biomass estimation. The simulations account for scientific uncertainty by applying a CV of 50 percent to biomass in each run, with biomass errors being randomly drawn from a normal distribution with a mean of zero. A CV of 50 percent is higher than that estimated in the SSC's analysis for sardine (CV_{within} = 41%; SD_{within} = 0.39).

Simulations for evaluating management options for sardine are fully documented in Amendment 8 to the CPS FMP, Appendix B (PFMC 1998). The general harvest control rule for CPS is useful for lower trophic level species such as those managed under the CPS FMP because it puts an emphasis on maintaining high biomass versus high catch. If the CUTOFF is greater than zero, then the harvest rate (H/BIOMASS) declines as biomass declines. By the time BIOMASS falls as low as CUTOFF, the harvest rate is reduced to zero. The CUTOFF provides a buffer of spawning stock that is protected from fishing and available for use in rebuilding should a stock become overfished. The combination of a spawning biomass buffer equal to CUTOFF and reduced harvest rates at low biomass levels means that a rebuilding program for overfished stocks is defined implicitly. Moreover, the harvest rate never increases above FRACTION. If FRACTION is approximately equal to F_{MSY}, then the harvest control rule harvest rate will not exceed F_{MSY}.

The FRACTION term of the sardine HG formula has also been referred to as F_{MSY}, however this is somewhat of a misnomer for sardine because FRACTION levels explored along with other variables (e.g., CUTOFF, MAXCAT) were in some cases lower or higher than 'true' F_{MSY} values, and FRACTION builds in OY considerations and other precautions to avoid overharvest. Jacobson and MacCall (1995) examined the relationship between sea surface temperature (SST) and sardine productivity, and their analysis formed the theoretical basis for the temperature-based FRACTION term currently used in the control rule (PFMC 1998).

FRACTION depends on recent ocean temperatures because productivity of the sardine stock is higher under ocean conditions associated with warm water temperatures. An estimate of the relationship between FRACTION for sardine and ocean temperatures is:

$$\text{FRACTION} = 0.248649805\ T^2 - 8.190043975\ T + 67.4558326$$

where T is the average three season sea surface temperature at Scripps Pier, California during the three preceding years. The harvest control rule for sardine sets the control rule parameter FRACTION equal to the result of the equation above within the constraints that FRACTION can never be greater than 15 percent or less than 5 percent. Recent work by McClatchie et al (2010) has shown that the strength of the direct correlation between Scripps Pier sea surface temperature and sardine productivity is likely not as strong or defined as previously thought. However, it is well established that the physical environment and environmental forcing play a strong role in Pacific sardine recruitment.

OFL and ABC calculations are based on an estimate of F_{MSY}, which may be the FRACTION calculation or a separate estimate, and scientific uncertainty and are derived from the best available science as

recommended by the SSC. Although F_{MSY} may vary, the bounds on FRACTION of 5 percent and 15 percent are policy decisions taken by Council based on social, economic, and biological criteria. In contrast, relationships between FRACTION, $F_{MSY,}$ and environmental conditions are technical decisions and estimates or approaches may be revised by technical teams to accommodate new ideas and data

Additionally, the maximum harvest level parameter (MAXCAT) has been defined for sardine so that total harvest specified by the harvest formula never exceeds MAXCAT. MAXCAT is used to guard against extremely high catch levels due to errors in estimating biomass, to reduce year-to-year variation in catch levels, and to avoid overcapitalization during short periods of high biomass and high harvest. MAXCAT also prevents the catch from exceeding MSY at high stock levels and spreads the catch from strong year classes over a wider range of fishing seasons. Taken together, the variables in the equation determining harvest ensure conservation of the Pacific sardine stock, guard against overfishing of the resource, and provide adequate forage.

3.2 Current Management Measures in place to reduce bycatch and protected species interactions

Bycatch in CPS fisheries is minimal because fishing operations generally target aggregations of coastal pelagic species. Incidental catch allowances are designed to reduce bycatch in those instances in which Pacific sardine is mixed in schools of Pacific mackerel and market squid following closure of the Pacific sardine directed fishery.

Bycatch and interactions with protected species are monitored through dockside sampling, logbooks, and occasional observer programs. Interactions are reported annually in the CPS SAFE. NMFS has conducted consultations on sea birds, marine mammals, and fish stocks with no findings that fishing activities are likely to jeopardize protected species. Conservation measures are in place to avoid interactions with sea otters and ESA listed salmon stocks. Specifically, CPS fishing boat operators and crew are prohibited from deploying their nets if a southern sea otter is observed within the area that would be encircled by the purse seine and must report if any interaction does take place with a sea otter. With regards to salmon, salmon are a prohibited species under the CPS FMP. Therefore they must be released immediately upon capture.

CPS vessels fish with roundhaul gear (purse seine or lampara nets of approximately one-half mile in total length). These are encircling type nets, which are deployed around a school of fish or part of a school. Roundhaul fishing results in little unintentionally caught fish, primarily because the fishers target a specific school, which usually consists of one species. Fish tend to school by size, so if another species is present in the school, it is typically similar in size. The most common incidental catch in the CPS fishery is another CPS species (e.g., Pacific mackerel incidental to the Pacific sardine fishery). If larger fish are in the net, they can be released alive before pumping or brailed by lowering a section of the cork-line or by using a dip-net. Because pumping at sea is so common, any incidental catch of small fish would not be sorted at sea but rather observed and sorted when the catch is pumped out of the hold and weighed at the dock. At sea, grates can be used to sort larger non-CPS from the catch. Grates to sort larger non-CPS from the catch are mandatory in Oregon. Since the year 2000, at-sea observers have recorded discard off the states of Oregon, Washington, and California at one time or another. Bycatch is estimated and reported annually in the CPS SAFE.

NMFS Southwest Region implemented a pilot observer program in the Southern subarea of the fishery in July of 2004. The pilot observer program was put in place in order to document the type and amount of bycatch and to validate bycatch rates provided by California Department of Fish and Game (CDFG) dockside sampling. The State of Washington had an observer program in place continuously from 2000 until 2004. Observer coverage in the Washington Pacific sardine fishery ranged between 24 and 27 percent. Additionally, in 2000 and 2001, the state of Washington monitored dockside landings for

incidental catch of juvenile salmon. After two years, Washington Department of Fish and Wildlife (WDFW) ceased dockside monitoring because of a low incidence of general incidental catch and the absence of specific observations of juvenile salmon (Culver, Pers. Comm., 2005). During the first two years of the Oregon sardine fishery (2000 & 2001), Oregon Department of Fish and Wildlife (ODFW) placed observers on vessels. However, after 2001 the observer program was halted due to a lack of funding. Observer coverage was between 4 percent and 7 percent for the state of Oregon.

In the State of Washington, sardine fishing is not allowed in state waters (i.e., shoreline to 3 nm). Washington implemented a no fishing zone in order to minimize bycatch of salmon and to minimize the interaction between Pacific sardine fishermen with recreational salmon fishermen. WDFW also has a mandatory logbook program. The state of Oregon allows fishing in state waters. Oregon fishermen are required to maintain logbooks and to place grates over fish holds in order to minimize the take of incidentally caught species. Additionally, sardine fishermen in Oregon and Washington are encouraged to remove salmon from their nets using a dip-net to prevent injury or death to the salmon.

4.0 Proposed Action and Alternatives

4.1 Proposed Action—Annual Reference Points, Harvest Limits, Targets and Set-Asides for 2013 Fishing Season

The proposed action is to implement the recommended annual harvest limits for the 2013 Pacific sardine fishing season based on the estimated biomass. These include an overfishing limit of 103,284 mt, an ABC of 94,281 mt, an ACL of 94,281 mt (equal to the ABC), and an HG of 66,495 mt (HGs under the CPS FMP are operationally similar to ACTs) for the 2013 Pacific sardine fishing year.

2013 Pacific Sardine Annual Specifications	MT
OFL = BIOMASS * F_{MSY} * DISTRIBUTION	103,284
ABC$_{0.40}$ = BIOMASS * BUFFER$_{0.40}$ * F_{MSY} * DISTRIBUTION	94,281
ACL=ABC	94,281
HG = (BIOMASS - CUTOFF) * FRACTION *DISTRIBUTION	66,495
ACT/Annual HG = HG calculation or ACL, whichever is less	66,495

Harvest Specification and Formula Parameters	Value
BIOMASS (ages 1+, mt)	659,539
Pstar (probability of overfishing)	0.40
SCIENTIFIC UNCERTAINTY BUFFER $_{Pstar}$ (Sigma=0.36)	0.91283[1]
F_{MSY}	0.18[2]
FRACTION	0.15
CUTOFF (mt)	150,000
DISTRIBUTION (U.S.)	0.87

[1] The scientific uncertainty buffer that corresponds to a probability of overfishing of 40% and the calculated biomass estimate uncertainty (sigma) of 0.36.

[2] Result of re-evaluation of Amendment 8 stochastic F_{MSY} simulations estimated independently of temperature. Recommended as best available information by SSC for use in OFL and ABC calculations. More information can be found in Appendix 4 of the 2012 Pacific sardine assessment.

From the overall/maximum HG of 66,495 mt, 57,495 mt is allocated as the initial overall directed commercial fishing HG to be allocated across the three allocation periods for sardine management. This number has been reduced from the maximum HG by 9,000 mt: (i) for potential harvest by the Quinault Indian Nation of up to 6,000 mt and (ii) 3,000 mt which is initially reserved for potential exempted fishing permit(s) (EFPs) use. Additionally, incidental catch set asides are to be put in place for each allocation period. These incidental set asides are allocated as shown in the following table, which also shows the adjusted directed harvest levels for each period in metric tons:

	January 1-June 30	July 1-September 14	September 15 – December 31	Total
Total Seasonal Allocation	20,123 (35%)	22,998 (40%)	14,374 (25%)	57,495
Incidental Set Aside	1,000	1,000	1,000	3,000
Adjusted Directed Harvest Allocation	19,123	22,998	13,374	54,495

The Quinault Indian Nation provided NMFS with a request for the exclusive right to harvest Pacific sardine in 2013 in their Usual and Accustomed Fishing Area off the coast of Washington State, pursuant to their rights to fish under the 1856 Treaty of Olympia (Treaty with the Quinault). The set-aside of 6,000 mt for the Quinault Indian Nation – to take their Treaty right to one half the harvestable surplus of Pacific Sardine -- is 3,000 mt less than the Tribe requested and received at the start of the 2012 sardine season.

4.2 No Action—Establish No Reference Points and Harvest Targets or Tribal Set-Aside for the 2013 fishing season

The no action alternative would not establish an OFL, ABC, ACL or harvest guideline for the 2013 Pacific sardine fishing season. All other restrictions on the fishery would remain in place and the agency would maintain the ability to close the fishery under emergency action if it was determined necessary for the stock. Additionally a specific set-aside would not be established for the Quinalt Indian Nation under their Treaty rights.

4.3 Set Higher Reference Points/Harvest Levels

The following analysis is primarily intended as a qualitative assessment to be used for comparison purposes. The CPS FMP uses specific harvest control rule formulas for specifying harvest levels and in most instances does not provide for ranges of harvest levels. Therefore actual numbers or potential harvest levels are not specifically analyzed and were not considered by the Council. Additionally, alternatives of setting a higher OFL or higher ACL are not analyzed as the OFL is scientific calculation based on a specific formula in the FMP and the ACL is already set at its maximum level; equal to the ABC.

Because the HG is below the ABC level, if a substantive and justifiable reason could be found, setting a HG greater than that specified by the FMP might be achieved through an emergency rule or a point-of-concern framework change to the HG formula. However, this is not considered to be a reasonable alternative, as previously determined in the analysis completed for Amendment 8 to the FMP. That analysis concluded the harvest guideline should be determined by a specific harvest control rule (above in 4.1) applied to the current biomass estimate and is intended to produce OY over the long term. The management strategy in the CPS FMP for Pacific sardine is one that is intended to manage Pacific sardine at catch levels lower, and therefore more conservative, than one needed to ensure that overfishing does not occur. This is the reason for the large difference between the ABC/ACL level and

the commercial fishing harvest quota or HG level for the 2013 fishing year. The harvest control rule for Pacific sardine that calculates the annual HG includes a variety of OY considerations as well as precautions intended to prevent the stock from becoming overfished (reduced harvest fraction and 150,000 mt threshold below which fishing is prohibited). These OY considerations and precautions are based on the dynamic nature of the Pacific sardine stock as well as its importance in the ecosystem as forage for other species. The outcome of this control rule are catch levels more conservative than otherwise MSY-based management strategies (OFL/ABC), because the focus for CPS is oriented primarily towards biomass versus catch, leaving adequate forage in the ocean and maintaining long-term, consistent catch levels for industry.

Based on the formula in the FMP used to calculate ABC, a higher ABC, of up to 98,716 mt (result of Pstar of 0.45) could be achieved through the choice of a less risk adverse Pstar (risk of overfishing). The ABC for the 2013 fishing season is based on a Pstar choice of 0.40 which provides a greater buffer between the ABC and the OFL of 103,284 mt.

4.4 Set Lower Reference Points

The following analysis is intended as a qualitative assessment to be used for comparison purposes. The CPS FMP uses specific harvest control rule formulas for specifying harvest levels and does not provide for ranges of harvest levels. Therefore actual numbers or potential harvest levels are not specifically analyzed and were also not considered by the Council. Additionally, alternatives of setting a lower OFL are not analyzed as the OFL is scientific calculation based on a specific formula in the FMP.

Conceivably, setting a harvest guideline lower than that specified by the HG control rule in the FMP might be considered for either additional conservation purposes or management uncertainty to avoid exceeding the ACL. Additional, if the result of the ABC control rule was lower than the result of the HG formula, then a lower ACT would be set.

Based the formula in the FMP used to calculate ABC, a lower ABC value would result from a more risk adverse choice of Pstar, risk of overfishing. For the 2013 fishing season the ABC is calculated using a Pstar of 0.4. If there was determined to be a need to have a lower ABC to decrease the risk of overfishing based on the calculation of the OFL, than a lower Pstar could be chosen. The ACL is currently set equal to the ABC; a lower ACL could conceivably be put in place for potential management reasons if it was determined a lower ACL was necessary to prevent the fishery from reaching the ABC value.

4.5 No Set-Asides—Establish No Incidental, EFP or Tribal Set-asides

Under this alternative the directed commercial HG that is allocated across the three periods would not be reduced by 6,000 mt that has been proposed to be set aside for incidental landings and potential EFPs.

5.0 Affected Environment

For the purposes of this action, the general action area is the West Coast EEZ (which is directly affected by the Federal action) and the marine waters, other than internal, of the states of Washington, Oregon, and California (which may be indirectly affected by the federal action).

5.1 Sardine Resource

Pacific sardine (*Sardinops sagax*) are small schooling fish. When the population of Pacific sardine is large, it is abundant from the tip of Baja California to southeastern Alaska and throughout the Gulf of California. In the north, sardines tend to appear seasonally. Sardines also form three (and possibly four) subpopulations. The northern subpopulation of sardines is most important to U.S. commercial fisheries.

Sardines are taken by a wide variety of predators. More information on current Pacific sardine abundance and population trends is available in the current CPS SAFE Report (PFMC 2012) and the *Assessment of the Pacific Sardine Stock for U.S. Management in 2013,*) (Hill et al 2012). The Pacific sardine resource is assessed each fall in support of the Council process that recommends an annual OFL, ABC, ACL and HG for the U.S. commercial fishery. The primary purpose of the assessment is to provide an estimate of current biomass which is used to calculate HGs for the Jan 1 to Dec 31 management cycle.

Sardine, along with other species such as anchovy, hake, jack mackerel, and Pacific mackerel can achieve large populations in the California Current region as well as in other major eastern boundary currents. These populations are important to the trophic dynamics of the entire California Current ecosystem. Anchovy and sardines are key consumers of large quantities of primary production (phytoplankton) in the ecosystem and all five species are significant consumers of zooplankton. Additionally, all five species, and particularly the mackerels, hake, and also squid, are important predators of the early stages of fish. The juvenile stages, and in many cases the adults, of squid and all five species of finfish are important as forage for seabirds, pinnipeds, cetaceans, and other fish.

Trophic interactions between CPS and higher-trophic-level fish are complex, and it is unknown if populations of individual predaceous fish are enhanced or hindered by large populations of CPS. The value of CPS as forage to adult predators versus the negative effects of CPS predation (on larvae and juveniles of predator fish species) and competition (removal of phytoplankton, zooplankton, and other fish) is unknown.

Modeling efforts are underway that may enhance our understanding of these linkages and improve our ecosystem-based management approaches for these species. However, implementing ecosystem-based management requires an understanding of the complex dynamics of marine ecosystems as well as an understanding of how humans fit into the system. A key step toward ecosystem-based management is to better understand how interactions within food webs affect species of commercial and conservation importance. Efforts are underway to provide comprehensive diet information and food web analysis for major taxa within the California Current ecosystem, including fish, marine mammals, birds, and invertebrates (Dufault et al 2009). Furthermore, robust simulations of the California Current ecosystem that will allow the exploration of potential effects of natural and human-induced perturbations over a range of spatial and temporal scales have been undertaken (Horne et al 2010). Future management tools based on this ongoing work by NOAA will provide a platform for addressing important hypotheses relating to the effects of perturbations (e.g., harvest), characterizing the potential trade-offs of alternate management actions, and testing the utility of ecosystem indicators for long-term monitoring programs (Kaplan et al. 2013). Additionally, these tools will allow consideration of the entire ecosystem such that ecosystem management can maintain multiple ecosystem services as well as system resilience rather than focusing on a single species.

Environmental changes affect all species; however, small coastal pelagic species off the Pacific coast, like those managed by the CPS FMP, show responses that offer dramatic examples of environmental effects. In 1983, the biomass (age 1 +) of Pacific sardine was estimated to be 5,145 mt. By 1999, the biomass was estimated to be around 1 million mt (Conser et al.2001). Pacific mackerel biomass (age 1 +) estimates were atypically high in the early 1980s but began declining steadily from the mid 1980s to the early 2000s. In recent years, however, population estimates have increased moderately, with some signs of 'rebuilding' observed over the last several years (Crone et al. 2011). However, in historical terms, the population remains at a relatively low abundance level, due primarily to oceanographic conditions. In *El Nino* years, the availability of squid in its typical spawning areas where it is harvested is low, but squid make a dramatic reappearance when the effects of *El Nino* abate.

These types of fluctuations in abundance are common in R-selected species (e.g., pollock, herring, sardine, and mackerel), which generally have higher reproductive rates, are shorter-lived, attain sexual maturity at younger ages, and have faster individual growth rates than K-selected species (e.g., rockfish,

many flatfish). As such, predators that utilize R-selected fish species as prey (marine mammals, birds, and other fish) have evolved in an ecosystem in which fluctuations and changes in relative abundances of these species have occurred. Consequently, most of them are generalists who are not dependent on the availability of a single species but rather on a suite of species, any one (or more) of which is likely to be abundant each year.

5.2 Habitat

In 2011 a five-year review of CPS essential fish habitat (EFH) was completed and can be found in the 2011 Stock Assessment and Fishery Evaluation (SAFE) document (PFMC 2011). Although some new information was gathered during this process, no changes were made to the actual description of CPS EFH. A complete description of EFH for CPS may be found in Appendix D of the CPS FMP (PFMC 1998). In determining EFH for CPS, the estuarine and marine habitat necessary to provide sufficient production to support maximum sustainable yield and a healthy ecosystem were considered. Using presence/absence data, EFH is based on a thermal range bordered within the geographic area where a managed species occurs at any life stage, where the species has occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by the species.

The specific description and identification of EFH for CPS finfish accommodates the fact that the geographic range of all species varies widely over time in response to the temperature of the upper mixed layer of the ocean, particularly in the area north of 39° N latitude. For example, an increase in sea surface temperature since the 1970s has led to a northerly expansion of the Pacific sardine resource. CPS EFH is linked to ocean temperatures, which shift temporally and spatially, providing a dynamic definition of EFH. This definition is as follows:

> *The east-west geographic boundary of EFH for each individual CPS finfish and 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 10^0C to 26^0C. The southern boundary of the geographic range of all CPS finfish is consistently south of the US-Mexico border, indicating a consistency in SSTs below 26^0C, the upper thermal tolerance of CPS finfish. Therefore, the southern extent of EFH for CPS finfish is the US-Mexico maritime boundary. The northern boundary of the range of CPS finfish is more dynamic and variable due to the seasonal cooling of the SST. The northern EFH boundary is, therefore, the position of the 10^0C isotherm which varies both seasonally and annually.*

5.3 Protected Species

A more thorough description of the affected environment for protected species can be found in the Biological Opinion completed in December 2010 for the Pacific sardine fishery as well as in the Environmental Impact Statement (EIS) prepared for Amendment 8 to the Northern Anchovy FMP, now the CPS FMP (PFMC 1998). While the analysis provided in the EIS focused primarily on the fishery in southern California, most of the species that were identified occur along the entire U.S. West Coast and, thus, the analysis is applicable to fisheries currently managed under the CPS FMP.

The harvesting of Pacific sardines may affect species in two ways, direct take of the animals during the prosecution of the fishery (incidental catch) or indirectly due to reductions in prey base (sardine) that serve as forage. Protected species include species protected by three federal laws, the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), and the Migratory Bird Treaty Act (MBTA).

The following list of endangered or threatened species that may be present in the action area:

Species		**Status**
Marine Mammals		
Blue whale *(Baleaenoptera musculus)*		Endangered
Fin whale *(Baleranoptera physalus)*		Endangered
Humpback whale (*Megaptera novaeangliae*)		Endangered
Sei whale (*Balaenoptera borealis*)		Endangered
Sperm whale (*Physeter macrocephalus*)		Endangered
Killer whales, southern resident DPS (*Orcinus orca*)		Endangered
Northern Right whale (Eubalaena glacialis)		Endangered
Steller sea lion, eastern distinct population segment (DPS) (*Eumetopias jubatus*)		Threatened
Southern sea otter (*Enhydra lutris nereis*)		Threatened
Guadalupe fur seal (Arctocephalus townsendi)		Threatened
Birds		
Short-tailed albatross (*Phoebastria albatrus*)		Endangered
Marbled murrelet *(Brachyramphus marmoratus marmoratus)*		Threatened
Bald eagle *(Haliaeetus leucocephalus)*		Threatened
California least-tern *(Sternum antillarum browni)*		Endangered
Xantus's murrelet *(Synthliboramphus hypoleucus)*		Candidate
Sea turtles		
Leatherback turtle (*Dermochelys coriacea*)		Endangered
North Pacific Loggerhead turtle (*Caretta caretta*)		Endangered
Olive Ridley (*Lepidochelys olivacea*)		Endangered/Threatened
Green Sea Turtle (*Chelonia mydas*)		Endangered/Threatened
Marine invertebrates		
White abalone (*Haliotis sorenseni*)		Endangered
Black abalone (*Haliotis crachereodii*)		Endangered
Fish		
Green Sturgeon, southern DPS (*Acipenser medirostris*)		Threatened
Pacific eulachon, southern DPS (Thaleichthys pacificus)		Threatened
Yelloweye Rockfish (Sebastes ruberrimus)		Threatened
Salmonids		
Chinook (*Oncorhynchus tshawytscha*)	Sacramento River winter, evolutionarily significant unit (ESU)	Endangered
	Central Valley Spring ESU	Threatened
	California Coastal ESU	Threatened
	Snake River Fall ESU	Threatened
	Snake River Spring/Summer ESU	Threatened
	Lower Columbia River ESU	Threatened
	Upper Willamette River ESU	Threatened
	Upper Columbia River Spring ESU	Endangered
	Puget Sound ESU	Threatened
Chum (*Oncorhynchus keta*)	Hood Canal Summer Run ESU	Threatened

	Columbia River ESU	Threatened
Coho (*Oncorhynchus kistuch*)	Central California Coastal ESU	Endangered
	S. Oregon/N. CA Coastal ESU	Threatened
	Oregon Coast ESU	Threatened
	Lower Columbia River ESU	Threatened
Sockeye (*Oncorhynchus nerka*)	Snake River ESU	Endangered
	Ozette Lake ESU	Threatened
Steelhead (*Oncorhynchus mykiss*)	Southern California DPS	Endangered
	South-Central California DPS	Threatened
	Central California Coast DPS	Threatened
	California Central Valley DPS	Threatened
	Northern California DPS	Threatened
	Upper Columbia River DPS	Endangered
	Snake River Basin DPS	Threatened
	Lower Columbia River DPS	Threatened
	Upper Willamette River DPS	Threatened

Critical Habitat		
Stellar sea lion (*Eumetopias jubatus*)	Rogue Reef: Pyramid Rock Oxnard Reef: Long Brown Rock and Seal Rock Ano Nuevo I. Southeast Farrallon I. Sugarloaf I.	Associated aquatic zones 3,000 feet seaward in State and Federally managed waters from the baseline of each rookery
Green Sturgeon, southern DPS (*Acipenser medirostris*)	US coastal marine waters within 60 fathoms from Monterey Bay, CA, to Cape Flattery, WA, the Sacramento River and other select waters within the Sacramento-San Joaquin River-Delta system, and other select coastal bays and estuaries waters within California, Oregon, and Washington.	
Letherback sea turtle (Dermochelys coriacea)	Includes approximately 16,910 square miles (43,798 square km) stretching along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour; and 25,004 square miles (64,760 square km) stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The designated areas comprise approximately 41,914 square miles (108,558 square km) of marine habitat	Critical habitat extends to a water depth of 80 meters from the ocean surface and is delineated along the shoreline at the line of extreme low water, except in the case of estuaries and bays where COLREGS lines (defined at 33 CFR part 80) shall be used as the shoreward boundary of critical habitat.

A number of non-ESA listed marine mammals may also occur in the affected area, these include: northern fur seal, California sea lion, harbor seal, northern elephant seal, bottlenose dolphin, Pacific white-sided dolphin, common dolphin, harbor porpoise, Dall's porpoise, and minke whale. These species,

like all marine mammals, are protected under the MMPA. Section 118 of the MMPA requires NMFS to place 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 occurring in each fishery (16 U.S.C. 1387(c)(1)), with Category I being the highest level of interactions and III being the lowest level. The California, Oregon and Washington sardine fisheries are listed as Category III fisheries, meaning that these fisheries have a remote likelihood of/no known incidental mortality or serious injury of marine mammal.

In addition, a number of non-ESA listed sea birds have been identified that forage on sardine and therefore may be affected directly or indirectly by the sardine fishery. These birds include grebes and loons, petrels and albatrosses, pelicans and cormorants, gulls, terns, auks, and some raptors (PFMC 1998).

At-sea observers have witnessed interactions with California sea lions, Pacific white-sided dolphins, and gulls within the California portion of the fishery. Observer records indicate that marine mammals, marine turtles, and steelhead are not encountered in the Pacific sardine purse seine fishery in Oregon and Washington. Fishermen in the southern subarea have not recorded incidental catch of marine turtles, southern green sturgeon, or steelhead in the sardine purse seine fishery. This is supported by preliminary observer information from vessels operating from San Pedro, Moss Landing, Dana Point, and San Diego, California.

Critical habitat for ESA listed cetaceans and most sea turtles has not been designated or proposed within the action area. Critical habitat for listed salmonids does not include marine waters and therefore it is not within the action area. Critical habitat for Steller sea lions in California are the rookeries at Ano Nuevo Island, Sugarloaf Island, and the southeast Farrallon Islands (50 CFR 226.202). Sardine fishermen in California do not fish near these islands therefore the proposed action is not expected to affect critical habitat for Steller sea lions.

5.4 Fishing Industry

During the 1940s and 1950s, approximately 200 vessels participated in the Pacific sardine fishery. In California, some present day CPS vessels are remnants of that fleet.

In recent history, a fishery for Pacific sardine has operated off Oregon and Washington since 1999. This fishery targets larger sardine, which have typically sold as bait for Asian longline tuna fisheries. Beginning in 2006, this fishery has been expanding into human consumption markets.

Along the West Coast, other vessels target CPS finfish in small quantities, typically selling their catch to specialty markets for relatively high prices. In recent years, these have included:

- Approximately 18 live bait vessels in southern California and two vessels in Oregon and Washington that landed about 4,000 mt per year of CPS finfish (mostly northern anchovy and Pacific sardine) for sale to recreational anglers.
- Roundhaul vessels that take a maximum of 1,000 mt to 3,000 mt per year of northern anchovy that are sold as dead bait to recreational anglers.
- Roundhaul and other mostly small vessels that target CPS finfish (particularly Pacific mackerel and Pacific sardine) for sale in local fresh fish markets or canneries.
- In Washington, albacore tuna vessels using lampara gear that target northern anchovy for use as live bait in the tuna fishery.

The CPS fishery is administratively divided into a federally managed “limited entry” fishery (requiring Federal permits in order to participate in the fishery), south of 39 degrees North latitude (Southern subarea), and an “open access fishery” (not requiring Federal permits to participate in the fishery), north of 39 degrees North latitude (northern subarea). Vessels landing less than five metric tons of CPS per

trip in the Southern subarea are exempt from limited entry requirements. However, the states of Oregon and Washington both have specific state restrictions that limit the number of vessels in their respective fisheries. The CPS LE fleet currently consists of 65 permits and 58 vessels. The LE vessels range in age from 4 to 68 years, with an average age of 33 years. Average vessel age has decreased by approximately two years since the initial fleet was established. The capacity goal and transferability provisions established under Amendment 10 are based on calculated gross tonnage (GT) of individual vessels. Calculated GT serves as a proxy for each vessel's physical capacity and is used to track total fleet capacity. The fleet capacity goal established through Amendment 10 is 5,650.9 GT, and the trigger for restricting transferability is 5,933.5 GT (Goal + 5 percent). The 20011 LE fleet was 5,238 GT, well within the bounds of the capacity goal and not likely substantially different from current capacity. In the northern subarea, fishermen must have individual state harvest permits to fish for Pacific sardine.

The northern subarea fishery operates in an area approximately 45 nm north and 30 nm south of the Columbia River, and extends approximately 35 nm offshore. Fishing depths range from 7 fathoms to over 400 fathoms. There are less specific data available to characterize the geographic range of the southern subarea fishery except that the majority of Pacific sardine are landed in the central California ports of Monterey and Moss Landing and the Southern California port in San Pedro. The gear type traditionally used in the CPS fishery is a purse seine. Typical purse seine nets measure 185 fathoms long, 22 fathoms wide and 1,600 meshes deep with 1 ¼ inch mesh (Lutz and Pendleton, 2000).

The Pacific sardine fishery in Oregon operates as a day fishery with vessels based primarily in Astoria where processing plants for sardine operate. Many vessels utilize aircraft to assist in locating schools of sardine and setting their nets when weather permits. Weather and tides are major factors in fishing operations and timing of vessels transiting in and out of the Columbia River. The Pacific sardine fishery off Oregon started in 1935, but there are recorded landings of sardine in Oregon dating back to 1928. The catch dropped off in the 1940s with 1948 being the last year of directed fishery landings until 1999 when the fishery was revived. Pacific sardine was managed as a developmental fishery from 1999 to 2005. In 2004, the sardine industry asked ODFW to remove Pacific sardines from the developmental species list and create a LE system for the fishery. ODFW began work with the Developmental Fisheries Board and the industry to develop alternatives for the fishery. In December 2005, the Oregon Fish and Wildlife Commission (OFWC) moved the Pacific sardine fishery from a developing fishery into a state-run LE fishery system. Twenty Oregon permits were initially established and made available to qualifying participants for the 2006 fishery. The OFWC amended an LE permit eligibility rule in August 2006, which resulted in an immediate addition of six permits for a total of 26 LE sardine fishery permits.

In April 2009 the OFWC enacted a number of rule changes for the Pacific sardine fishery. First, the OFWC modified the requirement for minimum landings of sardines into Oregon to qualify for permit renewal (initially enacted in 2006). The minimum landing requirements for permit renewal are now effective only when the federal coastwide maximum HG for the fishing year exceeds 100,000 mt. The minimum landing requirements, either a minimum of ten landings of at least five mt each or landings totaling at least $40,000 ex-vessel price, were not changed. Next, the OFWC eliminated a rule that became effective in 2008, which specified that permit holders must either own or operate a vessel that is permitted. The OFWC also established a lottery system for sardine permits. If the number of permits issued falls below 24 a lottery may be held the following year, but the total number issued shall not exceed 26 LE permits. Finally, a new rule defined catching vessels and limited catch sharing to catching vessels with state LE sardine permits. Of the 25 permits available in 2012, 20 vessels actively fished in the 2012 fishery.

Pacific sardines are the primary coastal pelagic species harvested off the state of Washington. From 2000 through 2009, participation in the sardine fishery was managed under Washington's Emerging Commercial Fishery Act (ECFA), which provides for the harvest of a newly classified species or harvest of a classified species in a new area or by new means. In 2003, to address management needs of the

fishery, a formal Sardine Advisory Board (Board) was created, and the WDFW Director, in collaboration with the Board, advanced the sardine fishery designation from trial to experimental as provided for under the ECFA. The number of experimental fishery permits was capped at 25. The experimental fishery program continued through June 2009. Besides limiting participation, WDFW also restricted the amount of sardines sold for reduction to a 15 percent season cumulative total by weight by individual vessel.

Pacific sardines are the targeted catch in the Washington fishery, but anchovy, mackerel, and squid can also be retained and landed. In 2011 the only other CPS landed was 0.42 mt of mackerel.

During the 2009 Washington State legislative session, WDFW proposed legislation to establish a commercial license limitation program specifically for the harvest and delivery of Pacific sardines into the state. The legislation was passed into rule in July 2009. The new rules established 16 licenses to be issued to holders of a 2008 sardine experimental fishery permit only, with an exception for past participants of the experimental fishery that became ineligible because of loss of their vessel at sea. These newly created sardine licenses can be sold. In addition, the new rule provides criteria for the issuance of temporary annual permits at the discretion of the WDFW Director. In combination, the number of permanent and temporary annual licenses cannot exceed 25. Of the 16 licenses issued in 2011 seven were actively fished in the 2011 fishery. In 2012, 9 of the 16 Washington limited entry licenses were actively fished, as was one temporary annual permit issued for 2012.

A description of the affected socioeconomic environment and further economic analysis of this action can be found in Section 7.

5.5 Tribal Fisheries

Treaties between the United States and Pacific Northwest Indian Tribes reserve the rights of the Tribes to take fish at usual and accustomed fishing grounds. The Pacific Fishery Management Council's Coastal Pelagic Species Fishery Management Plan (CPS FMP), as amended by Amendment 9 and codified in National Marine Fisheries Service (NMFS) regulations (50 CFR 660.518), outline a process for the Council and NMFS to consider and implement tribal allocation requests for CPS.

As they did for fishing year 2012, the Quinault Indian Nation requested that for the 2013 fishing season NMFS provide the Quinault Indian Nation with the exclusive right to harvest 6,000 mt of Pacific sardine in their Usual and Accustomed Fishing Area off the coast of Washington State, pursuant to the 1856 Treaty of Olympia (Treaty with the Quinault). In 2012, through consultation, 9,000 mt of Pacific sardine were set-aside for the Quinault Indian Nation with the expectation that three Quinault fishing vessels would participate in the fishery. In 2012, in part because only one Quinault vessel fished, out of the expected three, the Tribe harvested only 1294.23 mt. For 2013, the Tribe expects that two Quinault vessels will fish actively for sardine. The Quinault usual and accustomed fishing area (U & A) is defined in § 660.50(c)(4) as "That portion of the Fishery Management Area between 47°40.10' N. lat. (Destruction Island) and 46°53.30' N. lat. (Point Chehalis) and east of 125°44' W. long." This represents an area directly off Westport/Gray's Harbor, Washington, and waters to the north of this area. This area is also regularly fished by the non-tribal commercial fishery.

While a large proportion of the sardine stock off the West Coast may pass through the Usual and Accustomed Fishing Area (U&A) of the Quinault in some years, the requested amount for 2013, as in 2012, was not based on a scientific determination of their precise treaty share under current conditions. In future years, the precise amount provided under the treaty will have to be more fully examined.

6.0 Environmental Consequences

The primary action being reviewed in this analysis is the setting of annual harvest limits for the 2013

Pacific sardine fishing season. Under the proposed action this includes an overfishing limit of 103,284 mt, an ABC of 94,281 mt, an ACL of 94,281 mt (equal to the ABC), and a maximum HG of 66,495 mt for the 2013 Pacific sardine fishing year. However, the proposed maximum HG of 66,495 mt is the primary management target for the fishery and essentially the maximum allowable catch level. As described above, the regular commercial fisheries will probably be allowed to harvest only 57,495 mt, which is the full HG reduced by 9,000 mt for the set-asides: 3,000 mt set aside for an exempted fishing permit and 6,000 mt set aside for harvest by the Quinault Indian Nation. Once this catch level has been reached the fishery is closed so as not to go over the 66,495 mt level. Therefore the focus for the analysis of impacts to the environment and associated alternatives will be on the maximum HG and therefore the potential removal/catch of 66,495 mt of Pacific sardine and the fishing activities associated with that removal/catch.

6.1 Proposed Action– Annual Reference Points, Harvest Limits, Targets and Set-Asides for 2013 Fishing Season

6.1.1 Sardine Resource

6.1.1.1 Direct and Indirect Impacts

As previously stated, primary impact to the sardine resource as a result of this action is the potential removal of approximately 66,495 mt of sardine, as this catch level is the maximum management target for the fishery. However, 57,494 mt will be used as the primary harvest level for the directed commercial fishery and once this catch level has been reached the fishery is closed and Pacific sardine may only be caught/landed as part of the live bait fishery. This potential removal is not considered a significant adverse impact to the sardine resource. Annual live bait landings average 2,000 mt and these landings are counted against the ACL of 94,281 mt. However, due to the incidental set-aside provisions for the 2013 fishing year, which are not only intended to allow harvest of other CPS if sardine fishing is closed and reduce bycatch, but also act as an accountability measure (AM) against going over the HG, total combined catch is not expected to exceed the 66,495 mt level. Pacific sardine are caught as incidental catch or bycatch in other CPS fisheries; however these landings are subtracted throughout the fishing season from the annual harvest guideline. Incidental catch or bycatch of Pacific sardine in non-CPS fisheries is *de minimus*, as is any sort of research catch (PFMC 2012).

The current harvest control rule formula used to determine the HG for Pacific sardine takes into account the sardine resource as well as ecosystem and physical environmental factors. This is accomplished through a low harvest fraction, a 150,000 mt threshold below which fishing is prohibited, and recognition that sardine are caught internationally. These precautions are based on the dynamic nature of the Pacific sardine stock as well as its importance in the ecosystem as forage for other species.

The harvest rate or harvest "fraction" in the formula is adjusted between 5 percent and 15 percent based on current ocean temperatures. Because past shifts in sardine productivity are linked with warm or cold ocean regimes, a higher fraction is allotted for harvest when ocean temperatures are warmer and sardine production is greater, while a lower fraction is used when ocean temperatures are cooler and sardine production is decreased. Although recent work shows that the explicit relationship underlying FRACTION in the harvest control rule may need to be revised, a FRACTION choice of 15 percent is still considered conservative, particularly when used in concert with the other formula parameters. Additionally, this FRACTION value is less than the F_{MSY} of 18 percent used in the OFL and ABC calculations, therefore adding further protection to the stock.

The current harvest control rule formula also incorporates a 150,000 mt stock biomass threshold, or "cutoff" below which no harvest is allowed. Each year this "cutoff" number of 150,000 mt, which is three times the overfished level of 50,000 mt, is subtracted from the overall biomass number before the harvestable biomass is calculated to ensure a minimum spawning biomass is protected. In so doing, the

sardine resource is protected at low or uncertain biomass estimates.

To further minimize any significant and adverse impacts on the sardine resource, the formula includes a DISTRIBUTION parameter in recognition of the transboundary nature of the sardine stock. In the absence of a cooperative international management agreement, the current approach in the CPS FMP sets harvest levels for U.S. fisheries by prorating the total target harvest level according to the portion of the stock estimated to be in U.S. waters, on average, over the long-term. The primary advantage of prorating the total target harvest level is that U.S. fisheries can be managed unilaterally in a responsible manner. Additionally, landings from both Mexico and Canada are including in the stock assessments used for U.S. management.

Additionally, the proposed set-asides in each allocation period and incidental catch allowances are intended to reduce bycatch of sardine in other fisheries when the sardine fishery is closed thereby minimizing the impact to sardines.

6.1.2 Habitat

6.1.2.1 Direct and Indirect Impacts

The area affected by the proposed action in the CPS fishery has been identified as EFH by Amendment 8 to the FMP (December 15, 1999; 64FR69888). The establishment of the HG and the associated fishing activities involved may affect EFH through the removal of a prey source. However, this is not expected to be a significant change from current conditions and would not result in a significance adverse impact. The CPS fishery uses lampara and purse seine gear which are generally not associated with adverse impacts to ocean and coastal habitats. The fishery is also prosecuted in pelagic habitats, which, because of their physical characteristics, are not significantly affected by this fishing gear.

Because the potential adverse impact on biological EFH is not substantial, NMFS conducted an abbreviated EFH consultation pursuant to 50 CFR 600.920(h) and prepared an EFH Assessment that incorporates all of the information required in 50 CFR 600.920(e)(3). An EFH consultation was requested with the Habitat Conservation Division (HCD), Southwest Region, on the impacts of the HG on EFH. HCD determined although the removal of Pacific sardine may affect EFH through the removal of a prey source, the HG adequately minimizes the adverse effect by ensuring that sufficient numbers of Pacific sardine remain in the ecosystem; as such, the HG adheres to the intent of the EFH provisions of the Magnuson-Stevens Act which is to promote the protection, conservation, and enhancement of EFH for the purpose of maintaining sustainable fisheries. HCD determined that the anticipated adverse effects are so minimal in nature that no EFH conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. This finding is similar to all previous consultations as they have determined that sardine fishing would not have a significant adverse effect on EFH.

6.1.3 Protected Resources

6.1.3.1 Direct and Indirect Impacts

The portion of the Pacific sardine fishery that operates off of Oregon and Washington is likely to take ESA listed salmon, however based on observation data, log-books and port sampling, there is no evidence to suggest that ESA listed southern green sturgeon, marine mammals, or sea turtles are being incidentally taken. To date, there is no evidence to suggest that ESA listed salmon, steelhead, southern green sturgeon, marine mammals, or sea turtles are being incidentally taken in the sardine fishery off California. This is supported by at-sea observer information from a pilot Federal observer program for vessels operating from San Francisco to San Diego, California as well as portside sampling by the California

Department of Fish and Game (CDFG). The Federal observer program operated from January 2006 to January 2008 and a total of 199 trips (426 sets) were observed. Although incidental catch and bycatch data collected during this time is continuing to be analyzed and categorized, no marine mammals, sea turtles, or seabirds were observed as bycatch. CDFG conducts portside catch sampling at San Pedro, CA and Monterey, CA, the two major ports for sardine landings. The sardine landings are sampled approximately 12 days per month for the past 20 years and thus far one salmon has been observed (Brady 2009; PFMC 2008). In 2007 one adult Chinook salmon was offloaded at Moss Landing and had been caught in Department of Fish and Game Block 509. Most sampling and observer coverage has focused in central and southern California because fishing for sardine is very rare in northern California. There was only one landing of sardine catch recorded in the Pacific Fisheries Information Network (PacFIN) database, a landing in 2003 in Eureka, Ca.

NMFS SWR Sustainable Fisheries Division initiated a formal section 7 consultation with NMFS SWR Protected Resources Division (PRD) on the operation and prosecution of the Pacific sardine fishery. PRD completed a formal section 7 consultation on this action and, in a Biological Opinion dated December 21, 2010, 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.

The sardine fishery could indirectly affect the southern resident population of killer whales due to the removal of prey resources in the Pacific Northwest. The primary prey of Southern Resident killer whales, at least during the summer months, has been identified as Chinook salmon, which is incidentally taken in the sardine fishery. However, the timing and location of the sardine fishery in the PNW (near the Columbia River mouth in summer and early fall) occurs when Southern Resident killer whales are found in more northern and inland waters, therefore no direct competition between these killer whales and the fishery via salmon bycatch is likely. The best information on the relationship between salmon in the PNW and Southern Resident killer whales is found in the most recent section 7 consultation of the salmon ocean fishery on Southern Resident killer whales (NMFS 2009). The analysis in that opinion looked at the reduction in prey availability in terms of the ratio of prey needs to availability at certain times of the year under a number of scenarios of different salmon abundance and whale prey selectivity (size selectivity). The percent reduction in prey availability in the inland waters where Southern Resident's spend the vast majority of their time during a poor Chinook year as a result of salmon ocean fishery impacts was estimated at no more than 1.4% (NMFS 2009). The conclusion was the salmon fishery does not jeopardize Southern Resident killer whales. It is unlikely that the small amount of Chinook taken by the sardine fishery will affect southern resident killer whale prey availability.

Although there may be some concentrated fishing effort in the Usual and Accustomed fishing grounds of the Quinault Indian Nation off the coast of Washington due to their set-aside of 6,000 mt, this area is also utilized by the non-tribal commercial fleet during the fishing season and therefore we do not expect there to be any increased interactions with protected species due to this set-aside. Additionally, it is difficult to predict whether sardine will even be available in enough numbers in the Usual and Accustomed area to allow for 6,000 mt to be caught. In 2012, 9,000 mt were initially set-aside to the Quinault, of which approximately 1,700 mt were landed.

It is unlikely that the sardine fishery will have significant direct or indirect impacts on protected resources.

6.1.4 Fishing Industry

6.1.4.1 Direct and Indirect Impacts

Determining the annual HG merely implements the established procedure and continues to provide expected net benefits to the nation, regardless of what the specific annual allowable harvest of Pacific sardine is determined to be. Additionally, incidental set-aside provisions allow access to other important CPS fisheries that many sardine fishermen also utilize. A more detailed analysis of the economic impact of this action can be found in Section 7.

The proposed allocation to the Quinault Indian Nation of 6,000 mt will have a direct negative impact on the directed non-tribal portion of the fishery as these fish would normally be part of the directed HG. However, NMFS did not consider a broad range of alternatives to the proposed tribal allocation because the tribal allocation is based primarily on the requests of the tribes for a level of participation in the fishery that will allow them to exercise their treaty right to fish for sardine.

6.1.5 Tribal Fisheries

6.1.5.1 Direct and Indirect Impacts

The proposed action would allow the Quinault Indian Nation the exclusive right to harvest 6,000 mt of Pacific sardine in 2013 in their Usual and Accustomed Fishing Area off the coast of Washington State, pursuant to their rights to fish under the 1856 Treaty of Olympia (Treaty with the Quinault) – to take their Treaty right to one half the harvestable surplus of Pacific Sardine. The primary direct and indirect impacts of the proposed action on the tribal fishery are the direct and indirect economic impacts associated with the catch and processing of 6,000 mt of sardine. Based on the ex-vessel price of $209 per mt in the non-tribal fishery this could represent approximately $1.25 million in ex-vessel revenue to the tribal fishery and Quinault Indian Nation along with any other associated indirect benefits derived through the processing and sale of the fish.

6.2 No Action—Establish No Reference Points and Harvest Targets or Tribal Set-Aside for the 2013 fishing season

6.2.1 Direct and Indirect Impacts

6.2.1.1 Sardine Resource

The Pacific sardine fishing season begins on January 1 even if an OFL, ABC, ACL or a harvest guideline are not established. Implementing the no action alternative would eliminate the allocation procedures in the FMP. This would allow vessels to harvest coastwide without the restrictions explicit in the OFL, ABC, ACL and harvest guideline, such as incidental set-asides and/or inseason allocations. A fishery unregulated by these measures could result in overfishing of Pacific sardine as fishing effort could increase. This would not pose a biologically irreversible situation for the sardine resource however, as these are only annual harvest levels, and potential uncapped harvest in a single year is unlikely to affect the stock; however there would be some risk of exceeding levels that are associated with attaining OY. Additionally, if catch did appear to be exceeding a level that appeared to pose some sort of short term risk, NMFS could close the fishery through emergency action.

6.2.1.2 Habitat

Unrestricted harvest may have a negative impact on the affected habitat through the removal of a prey source.

6.2.1.3 Protected Resources

Unrestricted harvest could increase the take (bycatch) of ESA listed salmon species in the northern

subarea of the Pacific sardine fishery.

6.2.1.4 Fishing Industry

Implementing the no action alternative could potentially provide short term economic benefits to industry due to increased revenues.

6.2.1.5 Tribal Fishery

NMFS did not consider a broad range of alternatives to the proposed tribal allocation because the tribal allocation is based primarily on the requests of the tribes for a level of participation in the fishery that will allow them to exercise their treaty right to fish for sardine. A no action alternative was considered, but the regulatory structure provides for a tribal allocation on an annual basis. Therefore, no action would result in no set-aside to the Quinault Indian Nation, inconsistent with NMFS' obligation to manage the fishery consistent with the tribes' treaty rights.

6.3 Set a Higher Harvest Guideline

6.3.1 Direct and Indirect Impacts (all resource areas)

The impacts to all resources under this alternative would be similar to the no action alternative (6.2.1.1-6.2.1.4) however scaled down as the HG would still have an upper bound of the ABC level. Therefore there would be the potential for an increased risk to ESA listed species and habitat; however because the proposed HG is below the ABC level which is intended to protect the stock from overfishing, catch at that level would not pose a risk to the sardine stock itself or future fishing availability. Setting a harvest level greater than the proposed guideline may produce short term economic benefits to fishermen. Changes in the HG amount would have no effect on the tribal set-aside and therefore tribal fisheries

4.4 Set Lower Harvest Guideline

6.4.1 Direct and Indirect Impacts

6.4.1.1 Sardine Resource

Setting a lower harvest guideline may have a positive impact on the sardine resource through the reduction in catch. However protection to maintain the sustainability of the sardine resource is already built into the harvest formula. Additionally the HG is already approximately 37,000 mt below the OFL, so setting a lower HG is unlikely to have an increased benefit to the sardine stock itself.

6.4.1.2 Habitat

A reduced harvest guideline may have a positive effect on habitat by increasing prey availability or forage base. However, this effect would not have significantly beneficial impacts to the marine habitat in terms of increased prey availability or forage base as forage considerations are already built into the harvest formula.

6.4.1.3 Protected Resources

Although this alternative could decrease the risk of protected species interactions, current fishing levels have been shown unlikely to jeopardize the continued existence of any endangered or threatened species.

6.4.1.4 Fishing Industry

Setting a harvest guideline less than what is specified by the harvest formula in the FMP would have a direct negative impact on the fishing industry due to decreased potential revenues.

6.4.1.5 Tribal fisheries

Changes in the HG amount would have no effect on the tribal set-aside and therefore tribal fisheries

6.5 No Set-Asides—Establish No Incidental or Tribal Set-asides

6.5.1 Direct and Indirect Impacts (all resource areas)

NMFS did not consider a broad range of alternatives to the proposed tribal allocation because the tribal allocation is based primarily on the requests of the tribes for a level of participation in the fishery that will allow them to exercise their treaty right to fish for sardine. Consideration of amounts lower than the tribal requests is not appropriate here, where based on the information available to NMFS the requested amount appears to be within the amount to which the tribes are entitled. A higher amount would arguably be within the scope of the treaty right, but would unnecessarily limit the non-tribal fishery. A no action alternative was considered, but the regulatory structure provides for a tribal allocation on an annual basis only.

The incidental catch allowances in the sardine fishery are designed to reduce discard/bycatch of Pacific sardine in those instances in which Pacific sardine is mixed in schools of Pacific mackerel and market squid following closure of the Pacific sardine directed fishery. Therefore, not having incidental set-asides could have a negative impact on the sardine resource and habitat (as sardine prey source), due to increased bycatch of sardine in other fisheries. The incidental set-asides are not only intended to allow harvest of other CPS if sardine fishing is closed and reduce bycatch, but also act as an accountability measure (AM) against going over the HG, total combined catch is not expected to exceed the 66,495 mt level. Additionally, due to the fact that sardine school with other CPS species, not providing for incidental catch provisions could have a negative impact on the fishing industry by not allowing them opportunity to catch other CPS if and when the sardine fishery is closed.

6.6 Climate Change

Climate change is defined as any significant change in climate metrics, including temperature, precipitation, and wind patterns, over a period of time (U.S. EPA Glossary of Climate Change Terms, http://www.epa.gov/climatechange/glossary.html#C). The effects of climate change most people refer to today stem from “global warming,” a relatively recent phenomenon of rising average temperatures across the globe. The temperature increase is thought to be due in large part to the human-induced increase in greenhouse gas emissions released into the atmosphere as a result of combustion. Common greenhouse gases (GHG) such as carbon dioxide, methane, and nitrous oxide trap radiant heat from the earth causing the average temperature to rise.

The alternatives presented here would not be expected to affect climate change. The purpose of the proposed action is to set harvest levels for the Pacific sardine fishery. This action will not affect fishing fleet dynamics (ie. Number of vessels, amount of time spent fishing).

As mentioned in previous sections, fluctuating oceanographic conditions are known to have significant effects on the abundance of CPS in the Pacific Ocean and worldwide. The El Niño/Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) are known to cause significant fluctuations at annual and longer time scales, altering primary and secondary production in the California Current and

influencing CPS abundances. Many CPS and other fishes show significant alterations in their coastal distributions during strong El Niño or warm ocean periods (Phillips et al. 2007), and sardines appear to become abundant during warm PDO periods and anchovy during cool PDO periods. Ocean temperatures, which are known to have direct effects on CPS recruitment, distribution, and abundance, have increased worldwide (Domingues et al. 2008). Climate change is expected to alter frequencies and duration of oscillations, but the levels are still impossible to predict.

Other impacts of climate change include effects on upwelling and ocean pH. Upwelling is responsible for bringing nutrient rich waters from depth to the surface, thus enhancing primary production. Future climate change scenarios indicate much uncertainty as to whether winds and ocean conditions will be more conducive to upwelling or not. There is also concern that the phenology (i.e., timing of upwelling relative to the evolved life histories of various species) might be affected by alterations or changes in the seasonality and timing of upwelling periods along the west coast (Bograd et al. 2008). Furthermore, increased concentrations of carbon dioxide dissolving into the oceans and leading to decreased pH, or ocean acidification, will have significant consequences on calcifying prey organisms that sardines and other CPS rely on (Feely et al. 2004; 2008; Kerr 2010).

However, because it is known that sardine populations can fluctuate both over the short and long-term in response to the environment, the harvest control rule and harvest setting process is intended to be robust to these changes by annually assessing the stock and maintaining a minimum level of spawning biomass through the use of the 150,000 mt Cutoff parameter of the control rule. Therefore there will not be negative cumulative impacts from this action when considered with potential impacts of climate change.

7.0 Cumulative Impacts

Sardine productivity and population size, over short (annual) and long (multidecadal) time scales, primarily is driven by ocean conditions and environmental factors. Outside of this environmental forcing, the primary past, present and foreseeable actions that may impact sardines are primarily those associated with the directed commercial harvest of Pacific sardine as there are no state or Federal fisheries for which a significant amount of Pacific sardine is caught as bycatch, and research catch of this species is *de minimus* (less than 1 mt). Therefore this will be the focus of the analysis in this section. Additionally, because this action is only for one fishing season and is not changing the framework or formulas in the FMP used to set catch levels which have been previously analyzed (PFMC 1999 and 2011), none of the alternatives analyzed likely pose significant cumulative impacts when added to past, present and foreseeable actions as new catch levels will be implemented the following year based on new biomass estimates and mitigation measures are built into the harvest formulas so that as biomass goes up or down so do catch levels and that minimum level of spawning biomass is always protected. Also, the regulatory structure provides for a tribal allocation on an annual basis only, therefore decisions on tribal set-asides will be decided on an annual basis. While a large proportion of the sardine stock off the West Coast may pass through the Usual and Accustomed Fishing Area (U&A) of the Quinault Indian Nation in some years, the requested amount for 2013 was not based on a scientific determination of their precise treaty share under current conditions. In future years, the precise amount provided under the treaty will have to be more fully examined.

7.1 Proposed Action– Annual Reference Points, Harvest Limits, Targets and Set-Asides for 2013 Fishing Season

7.1.1 Sardine Resource

The proposed action is not likely to result in significant cumulative impacts to sardines when added to other past, present, and reasonably foreseeable future actions.

The proposed action maintains the harvest strategy established in the FMP, which provides benefits to society while maintaining a renewable resource. The choice of this particular management strategy is described in Section 4.3 of the FMP (Amendment 8 [PFMC 1998]) and Section 3 of this document. The strategy, which incorporates annual estimates of biomass, utilizes, among other considerations, a biomass cutoff level to protect a viable spawning stock in low biomass years, for fishable biomass in Mexican and Canadian waters by using the percent of the resource in U.S. waters and the inherent uncertainty in estimating biomass.

The annual harvest guideline is directly tied to annual estimates of biomass. Two circumstances can lead to biomass projections that would exceed reality and potentially allow for excess harvest. One is the model overestimating abundance in any particular year. To reduce the chance of this happening, data for the most recent year and any new biological information that might have been obtained are compared to all past biomass estimates. The biomass estimate obtained each year provides a new picture of the fluctuation of the resource over time. The other circumstance that can confound management is harvest in Mexico and Canada that exceeds what is accounted for in the formula, which could potentially lead to overfishing of the resource on a stock level. Landing information is obtained from Mexico and Canada each year, and landings from all areas for the previous year, are incorporated into the model so that all harvested fish are accounted for. If actual harvests exceed planned harvests in any year, this could lead to a lower biomass estimate the following year, which, in turn, would lead to a lower harvest guideline than would otherwise be possible. This is a short-term risk that can be remedied in the following year's biomass projections and harvest limits. Further, stock assessment biologists from NMFS Southwest Fisheries Science Center (SWFSC) in La Jolla, California, have recently been working with scientists from Mexico to obtain better landings estimates from the Mexican sardine fishery and are collaborating with scientists from both countries to develop more robust estimates of sardine abundance.

Additionally, there is an approximately 28,000 mt difference between the higher ABC/ACL level and the lower HG catch level as well as a 38,000 mt difference between the OFL and the HG fishing year for the 2013 fishing year that further protects the stock from overfishing. This accountability measure is the result of the management strategy for Pacific sardine that manages at catch levels more conservative than needed to solely ensure that overfishing does not occur. The harvest control rule for Pacific sardine that calculates the HG includes a variety of OY considerations as well as precautions intended to prevent the stock from becoming overfished (reduced harvest fraction and 150,000 mt threshold below which fishing is prohibited). These OY considerations and precautions are based on the dynamic nature of the Pacific sardine stock as well as its importance in the ecosystem as forage for other species. The outcome of this control rule is catch levels more conservative than otherwise MSY-based management strategies (OFL/ABC). Because the focus for CPS is oriented primarily towards biomass versus catch, leaving adequate forage in the ocean, and maintaining long-term, consistent catch levels for industry no significant adverse cumulative impacts to the sardine resource is expected.

7.1.2 Habitat

The proposed action is not likely to result in significant cumulative impacts to EFH when added to other past, present, and reasonably foreseeable future actions. The establishment of the HG and the associated fishing activities involved are not likely to have a significant adverse effect on EFH. Outside of environmental forcing, the primary past, present and foreseeable actions that may impact habitat are those associated with the directed commercial harvest of Pacific sardine, which is the component of EFH for some other commercially fished species. However, the HG leaves a substantial amount of Pacific sardine for ecosystem needs (i.e., forage). The CPS fishery itself uses lampara and purse seine gear which are generally not associated with adverse physical impacts to pelagic habitats which are the EFH for CPS.

Currently there is not evidence that a fishing activity is having an identifiable adverse effect on CPS EFH.

With the exception of harvesting prey species, fishing for CPS finfish has little effect on CPS EFH because CPS finfish are pelagic at all lfe stages. Contact between roundhaul gear 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 EFH 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. CPS are planktivores at all or most life stages and utilize forage that is not affected by fishing.

7.1.3 Protected Resources

The proposed action is not likely to result in significant cumulative impacts to protected species when added to other past, present, and reasonably foreseeable future actions as the proposed action itself will not have any significant direct or indirect impacts to protected species.

To date, there have been nine consultations on the effects of CPS fisheries on endangered and threatened species. Most recently, NMFS SWR Sustainable Fisheries Division initiated a formal section 7 consultation with NMFS SWR Protected Resources Division (PRD) on the operation and prosecution of the Pacific sardine fishery. PRD completed a formal section 7 consultation on this action and, in a Biological Opinion dated December 21, 2010, 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.

NMFS also initiated an ESA section 7 consultation with U.S. Fish and Wildlife Service (USFWS) regarding the possible effects of fishing under the CPS FMP, as amended by Amendment 11 to the CPS FMP. USFWS concurred with NMFS and determined that fishing under the CPS FMP as amended by Amendment 11 may affect, but was not likely to adversely affect: the endangered tidewater goby, the threatened western snowy plover, the Santa Ana sucker, the endangered short tailed albatross, the endangered California brown pelican, the endangered California least-tern, the threatened marbled murrelet, the threatened bald eagle, the threatened bull trout, and the candidate Xantus's murrelet. Formal consultation, however, was deemed necessary on the possible effects to the southern sea otter. The resulting biological opinion (BO) signed June 16, 2006, concluded that fishing activities conducted under Amendment 11 and its implementing regulations were not likely to jeopardize the continued existence of the otter. As a result of this BO, new reporting requirements and conservation measures were implemented in accordance with the CPS FMP to provide further protection for southern sea otters. Specifically, CPS fishing boat operators and crew are prohibited from deploying their nets if a southern sea otter is observed within the area that would be encircled by the purse seine and must report if any interaction does take place with a sea otter. This management regime continues unchanged under the current CPS FMP, as amended through Amendment 13, and therefore the 2006 BO issued by USFWS remains valid and effective.

In order to assess the cumulative impact of the salmon bycatch in the sardine fishery the biological opinion completed in 2010 considered the scale of impact from ocean salmon harvest and the estimated impacts of the sardine fishery established in this opinion. At the maximum harvesting capacity of 63,000 mt, it is anticipated that up to almost 3,800 salmon may be incidentally taken as bycatch in the sardine fishery, although only about 1,500 will be Chinook salmon, the preferred food of Residents in the PNW. In comparison, the harvest of Chinook salmon in the ocean fisheries off Washington and Oregon typically totals at least 100,000 to 750,000 fish or more (PFMC 2010). The impact of the salmon fishery is two

orders of magnitude (maybe 3 at times) greater than salmon bycatch in the sardine fishery. Given the relative size of the salmon catch in the sardine fishery compared to the ocean salmon harvest the impact would comparatively represent a very small fraction of an already small impact attributable to the ocean fishery. Based on the relative scales of salmon bycatch, the total combined impact including both the ocean salmon fisheries and salmon bycatch in the sardine fishery in the inland waters should round up to a maximum prey reduction level of 1.5%, if the impact of the sardine fishery is enough to change the number at all. The impact of removing a few thousand salmon from the ocean environment on an annual basis is not likely to have an appreciable effect on the availability of salmon as a prey resource for Residents. Therefore, it is unlikely that the small amount of Chinook taken by the sardine fishery will affect southern resident killer whale prey availability.

7.1.4 Fishing Industry

An analysis of the economic impact of this action can be found in Section 7.

7.2 No Action—Establish No Harvest Guideline

7.2.1 Sardine Resource

The no action alternative could present an increased risk to overharvesting the Pacific sardine resource. This could negatively impact the Pacific sardine resource in future years. One of the intents of the FMP harvest formula is to protect enough Pacific sardine to allow maintenance of the stock biomass. Landings are included in the model determining the following year's biomass; therefore, under the no action alternative, the following year's biomass may be less than would be realized by adhering to the harvest formula in the FMP. In summary, not having a harvest guideline for the current fishing season could pose a future negative biological impact on the resource, however it is unlikely to be a significant negative cumulative impact as this action is only setting quotas for one year and next year a new quota would be set. Therefore this would likely only be a problem if harvest went unregulated for multiply years.

7.2.2 Habitat

Because one of the intents of the FMP harvest formula is to allow Pacific sardine to provide enough prey for species that utilize Pacific sardine, providing forage for predatory species is built into the harvest formula. Therefore exceeding the HG likely would not have a habitat effect on those species dependent on sardines; a higher harvest than specified by the FMP could be realized without a short-term detrimental effect on the resource. However, this only speaks to a large harvest this year and does not address extending such a practice to future years when recruitment might be affected by a declining biomass.

7.2.3 Protected Resources

The no action alternative could present an increased risk to protected resources if multiple years of unregulated fishing of Pacific sardine could reduce biomass to such an extent that seabirds and other predators might be influenced. Studies of predator-prey interactions suggest there is a threshold in prey abundance below which seabirds experience reduced or more variable reproduction (Cury et al 2011). While current HG levels are well below this threshold, sustained overfishing of Pacific sardine could drive biomass below the level necessary to maintain seabird productivity over the long term. Not having a harvest guideline for the current fishing season could pose a future negative biological impact on listed species.

7.2.4 Fishing Industry

The lack of a harvest guideline for the current fishing season could provide a positive economic impact to

fishermen in the short term. However the HG formula is intended to ensure long-term optimum yield of sardine, and therefore long-term opportunities for relatively stable levels of harvest as opposed to a "boom-and-bust" type fishery.

7.3 Set a Higher HG

7.3.1 Sardine Resource

Setting an HG greater than specified by the FMP may result in two significant impacts: (1) the potential for increasing a decline of the resource with increased harvest, and (2) the increased likelihood of negative biological impacts if juvenile estimates are uncertain however will not have a significant cumulative impact on the sardine resource. The higher the harvest is above that intended by the FMP, the greater the potential for exacerbating a decline of the resource that could already be occurring. The potential for negative biological impacts also is high if the uncertainty of the estimate of sardine less than age 1 is high. Given that natural mortality is high, how much biomass the zero age class will contribute to the biomass of the resource falls more in the area of speculation than science, even when biomass estimates are high. Increased levels of uncertainty increase the likelihood of negative biological impacts.

7.3.2 Habitat

The proposed harvest guideline is at a level that allows use of the Pacific sardine resource yet takes the affected environment into account (by use of "the cutoff" and "the harvest fraction"); setting an HG greater than specified by the FMP could detrimentally affect habitat by reducing the forage available to predators.

7.3.3 Protected Resources

A harvest guideline specified by the FMP avoids a significant cumulative effect to the affected environment; however setting an HG greater than specified by the FMP could adversely affect protected resources by increasing the risk of ESA listed salmon being caught as bycatch.

7.3.4 Fishing Industry

Some economic benefits of increased revenue would accrue to the fishing industry by allowing a harvest greater than that permitted by the formula in the FMP. Economic benefits could be conferred on the fishing industry if the HG was greater than specified by the FMP.

7.4 Set a Lower HG

7.4.1 Sardine Resource

Reducing the harvest of Pacific sardine by setting a harvest guideline lower than the proposed harvest guideline may have an overall positive effect on the Pacific sardine resource. However, the benefit would be limited to situations such as catastrophic environmental events (e.g., a strong El Nino) and management failure and would likely not have any significant cumulative impact on sardines.

7.4.2 Habitat

Setting a harvest guideline less than the proposed harvest guideline may have an overall positive effect on marine habitat and the ecosystem through the increase in available forage, but only in terms of the potential to function as insurance from catastrophic environmental events (e.g., a strong El Nino) and management failure and therefore is unlikely to result in any significant cumulative impact.

7.4.3 Protected Resources

Setting a lower HG is may decrease the take of salmon species, however it is unlikely to significantly decrease the cumulative impacts to these species as the current take level is extremely low. Currently the sardine fishery does not take or interact with other protected species, therefore a decrease in fishing effort is unlikely to have an impact on protected species.

7.4.4 Fishing Industry

Setting a lower HG likely would have a negative economic impact on fishermen. The cumulative impact of reducing the potential profit achieved be the fishery is difficult to determine because it is dependent upon how much sardine the fleet ultimately catches in this fishing season as well as any profit from other fisheries in which they may participate.

8.0 Economic Consequences

After reduction by the exempted fishing permit and Quinault Tribal set-asides as described above, the HG is apportioned based on the following allocation scheme: 35 percent of the HG is allocated coastwide on January 1; 40 percent of the HG, plus any portion not harvested from the initial allocation is then reallocated coastwide on July 1; and on September 15 the remaining 25 percent, plus any portion not harvested from earlier allocations, will be released. If the total HG or these apportionment levels for Pacific sardine are reached at any time, the Pacific sardine fishery is closed until either it re-opens per the allocation scheme or the next fishing season begins. There is no limit on the amount of catch that any single vessel can take during an allocation period or the year; the HG and seasonal allocations are available until fully utilized by the entire CPS fleet.

The small entities that would be affected by the proposed action are the vessels that compose the West Coast CPS small purse seine fleet. In 2012 there were approximately 96 vessels permitted to operate in the directed sardine fishery component of the CPS fishery off the U.S. West Coast; 55 vessels in the Federal CPS limited entry fishery off California (south of 39 N. lat.), and a combined 23 vessels in Oregon and Washington's state Pacific sardine fisheries. The annual per vessel revenue in 2012 for the West Coast CPS finfish fleet was well below $4 million; therefore, all of these vessels are considered small businesses under the RFA. Because each affected vessel is a small business, this proposed rule has an equal effect on all of these small entities, and therefore will impact these small entities in the same manner.

The profitability of these vessels as a result of this proposed rule is based on the average Pacific sardine ex-vessel price per mt. NMFS used average Pacific sardine ex-vessel price per mt to conduct a profitability analysis because cost data for the harvesting operations of CPS finfish vessels was unavailable.

For the 2012 fishing year approximately 105,000 mt were available for harvest by the directed fishery. Approximately 95,000 mt (21,000 in California and 74,000 mt in Oregon and Washington) of this HG were harvested during the 2012 fishing season, for an estimated ex-vessel value of $20 million. Using these figures, the average 2012 ex-vessel price per mt of Pacific sardines was approximately $208.

The proposed directed commercial fishing HG for the 2013 Pacific sardine fishing season (January 1, 2013 through December 31, 2013) is 57,495 metric tons (mt). This HG is approximately 47,000 mt less than the allocation for 2012. If the fleet were to take the entire 2013 HG, and assuming a coastwide average ex-vessel price per mt of $204 (average of 2011 and 2012 ex-vessel), the potential revenue to the fleet would be approximately $12 million. Therefore the proposed rule will decrease small entities'

potential profitability compared to last season, due to the lower HG this fishing season.

There will likely be a drop in profitability based on this rule compared to last season due to the lower HG this year. However, from 2007 through 2011 the average coastwide annual ex-vessel revenue was $12.5 million; therefore at current ex-vessel price per mt, the harvest guideline for 2013 should provide similar revenue as seen during the five years preceding 2012. Additionally, unused sardine from the potential EFP or the release of any unused portion of the 6,000-mt set-aside for the Quinault Indian Nation might be used to supplement the amount available to the directed fishery of the third allocation period (September 15 through December 31) as occurred in 2012, thereby increasing the potential revenue to the fleet.

The revenue derived from harvesting Pacific sardine is also only one factor determining the overall revenue for a majority of the vessels in the CPS fleet, and, therefore, the economic impact to the fleet from the proposed action cannot be viewed in isolation. CPS vessels typically harvest a number of other species, including anchovy, mackerel, and in particular squid (which has averaged annual ex-vessel revenue of approximately $66 million over the last three years), making Pacific sardine only one component of a multi-species CPS fishery. Vessels rely on multiple species for profitability because each CPS stock is highly associated with different ocean conditions and different time periods, and so are harvested at various times throughout the year. Because each species responds to ocean conditions in its own way, not all CPS stocks are likely to be abundant at the same time; therefore as abundance levels and markets fluctuate, the CPS fishery as a whole relies on a group of species for annual revenues.

8.1 Proposed Action–Harvest Guideline for 2013 Based on FMP Harvest Formula

The proposed HG for the 2013 Pacific sardine fishing season (January 1, 2013 through December 31. 2013) is 66,495 metric tons (mt). This HG is approximately 40,000 mt less than the HG for 2012. If the fleet were to take the entire 2013 HG, and assuming a coastwide average ex-vessel price per mt of $204 (average of 2011 and 2012 ex-vessel), the potential revenue to the fleet would be approximately $12 million. Whether this will occur depends greatly on market forces within the fishery and on the regional availability of the resource to the fleets and the fleets' ability to find pure schools of Pacific sardine. A change in the market and/or the potential lack of availability of the resource to the fleets could cause a reduction in the amount of Pacific sardine that is harvested, in turn, reducing the total revenue to the fleet from Pacific sardine.

However, the revenue derived from harvesting Pacific sardine is only one factor determining the overall revenue of a majority of the CPS fleet and, therefore, the economic impact to the fleet from the proposed action cannot be viewed in isolation. CPS finfish vessels typically harvest a number of other species, including anchovy, mackerel, and squid, making Pacific sardine only one component of a multi-species CPS fishery. A reliance on multiple species is a necessity because each CPS stock is highly associated with current ocean and environmental conditions and responds to such conditions in its own way. For instance, even yellowfin and bluefin tuna are harvested if these species show up within range of the CPS fishing fleet. Not all CPS stocks are likely to be abundant at the same time; as abundance levels and markets fluctuate, the CPS fishery as a whole endures by depending on a group of species.

Overall, because the sardine fishery makes up a large portion of the total CPS fishery, there likely will be a decrease in profitability based on this rule compared to last season due to the lower HG this year.

8.2 No Action—Establish No Harvest Guideline

Implementing the no action alternative would eliminate the allocation procedures in the FMP. This would allow vessels to harvest coastwide without restriction. The current allocation scheme is set up to allow optimal attainment of the resource by all regions. In the absence of the HG, one region may benefit

economically at the expense of another, as well as at the expense of the following year's harvestable biomass. An absence of harvest guidelines could provide substantial economic benefits to the fishing industry if excess fish are readily available to be caught and markets exist for them.

8.3 Set a Harvest Guideline Greater than Specified by the FMP

The impacts of this alternative would be similar to the no action alternative. If availability of the resource to the fleets is similar to last year and market conditions are similar as well, setting an HG greater than that specified by the FMP could provide greater economic benefits to the fleets for 2012. However, this could do damage to the stock and greatly hurt revenue potential in the future.

8.4 Set a Harvest Guideline Less than that Specified by the FMP

Setting a harvest guideline less than the proposed 2013 harvest guideline could have significant adverse economic impacts. At an ex-vessel price of $209 per mt if the entire 2013 HG were attained, it would yield revenue of approximately $12 million. Every 10,000 mt reduction in landings would reduce revenue by approximately $2 million.

9.0 Other Applicable Law

9.1 Regulatory Flexibility Act (RFA)

An Initial Regulatory Flexibility Analysis (IRFA) was conducted for this action and can be found in Section 7. This analysis is also included in the proposed rule.

9.2 Paperwork Reduction Act (PRA)

This action does not contain a collection-of-information requirement for purposes of the PRA.

9.3 Executive Order 12866 (E.O. 12866)

E. O. 12866 is intended to enhance planning and coordination with respect to both new and existing regulations; to reaffirm the primacy of Federal agencies in the regulatory decision-making process; to restore the integrity and legitimacy of regulatory review and oversight; and to make the process more accessible and open to the public. These proposed specifications are exempt from review under E.O. 12866.

The National Marine Fisheries Service prepares a Regulatory Impact Review (RIR), which includes an analysis of the economic effects of the preferred alternative actions. One of the purposes of the RIR is to comply with the requirements of E.O. 12866. The RIR is intended to assist NMFS in selecting the regulatory approach that maximizes net benefits to the nation. The RIR is contained within the sections of this document and key elements of the RIR are cited below:

- Description of the management objectives: Section 2, Purpose and Need
- Description of the fishery: Section 3, Background
- Statement of the problem: Section 2, Purpose and Need
- Description of each alternative: Section 4, Proposed Action and Alternatives
- Economic Analysis: Section 7: Economic Consequences

9.4 Executive Order 13132 (E.O. 13132)

This action does not contain policies with federalism implications under E.O. 13132.

9.5 Information Quality Act

Pursuant to Section 515 of Public Law 106-554, this information product has undergone a pre-dissemination review by NOAA Fisheries-Southwest Regional Office-Sustainable Fisheries Division, completed on February 23, 2012. The signed Pre-dissemination Review and Documentation Form is on file in that Office.

10.0 Response to Comments on Draft Environmental Assessment

On January 31, 2013, NMFS published a proposed rule in the Federal Register (78 FR 6794) on the action to implement the 2013 Pacific sardine harvest specifications and requested public comments on the rule and draft Environmental Assessment (EA). One commenter stated that the EA prepared for this action was inadequate because it should have included a greater range of alternatives, and because alternative methods for determining the annual specifications should be analyzed in an Environment Impact Statement (EIS).

The 2013 specifications fall within the analysis in the EIS prepared for the CPS FMP under the National Environmental Policy Act. The EA completed for this action demonstrates that the implementation of the 2013 catch levels for the Pacific sardine fishery based on the HG and ABC control rules in the FMP will not significantly impact the quality of the human environment. Therefore a new EIS is not necessary to comply with NEPA for this action.

With regard to the scope and range of alternatives, the six alternatives analyzed in the EA was a reasonable number and covered an appropriate scope based on the limited nature of this action, which is described above. The six alternatives (including the proposed action) were objectively evaluated in recognition of the purpose and need of this action and the framework process in place based on the HG and ABC control rules for setting catch levels for Pacific sardine. The CPS FMP describes a specific framework process for annually setting required catch levels and reference points. Although there is some flexibility built into this process in terms of determinations of scientific and management uncertainty, there is little discretion in the OFL control rules (level for determining overfishing), the ABC control rule (used to determine the ACL), or the HG control rule (level at which directed fishing is stopped), with the annual biomass estimate being the primary determinant in both these levels.

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No agencies or persons were consulted for this action.

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