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MEMORANDUM FOR: Sacramento River winter Chinook ocean salmon fishery consultation file 151422SWR2009PR00139

FROM: Rodney R. McInnis
Regional Administrator
NMFS Southwest Region

SUBJECT: Final implementation of the 2010 Reasonable and Prudent Alternative Sacramento River winter-run Chinook management framework for the Pacific Coast Salmon Fishery Management Plan

Attached is NOAA's National Marine Fisheries Service's (NMFS) final Reasonable and Prudent Alternative (RPA) and incidental take statement (ITS) from a 2010 Biological Opinion (Opinion) on the continued management of the west coast ocean salmon fishery in accordance with the Pacific Coast Salmon Fishery Management Plan (FMP) and its effects on species listed on the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), in accordance with Section 7 of the ESA.

NMFS is responsible for authorizing commercial and recreational ocean salmon fisheries in the U.S. Exclusive Economic Zone (EEZ) off the coasts of Washington, Oregon, and California under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Specifically, these fisheries are managed under the Federal Pacific Coast Salmon FMP (PFMC 2003). In 2010, NMFS completed formal consultation under Section 7(a)(2) of the Endangered Species Act (ESA) and issued an Opinion on the Authorization of Ocean Salmon Fisheries Pursuant to the Pacific Coast Salmon Fishery Management Plan and Additional Protective Measures as it affects Sacramento River Winter Chinook Salmon (herein referred to as winter-run; NMFS 2010). The proposed action analyzed in the 2010 Opinion consisted of two parts: the first part is authorization by NMFS of ocean salmon fisheries consistent with the FMP; the second part is a set of management measures, proposed by NMFS Sustainable Fisheries Division (SFD) to provide specific protection for winter-run that is intended to avoid the likelihood of jeopardizing the continued existence of this ESU (refer to Table 1 in the attached RPA). These measures were identical to the protective measures for winter-run that were analyzed by NMFS in the 2004 biological opinion for the same action. Previous consultations had concluded that these standards and management measures were effective in reducing impacts on the winter-run compared to historical ocean salmon fisheries.

The winter-run ESU is listed as endangered. In the past, regulatory actions have been taken to reduce the incidental take of this ESU in the ocean salmon fishery, as well as in numerous other non-fishery activities. In 2010, NMFS was required to reinitiate consultation of the ocean salmon fishery on winter-run under the ESA because the 2004 biological opinion that authorized incidental take of winter-run by the fishery at that time expired on April 30, 2010.

2010 Biological Opinion

The 2010 Opinion considered the best available scientific and commercial information including the most recent cohort reconstructions of winter-run and estimates of fishery impacts provided by the Southwest Fisheries Science Center Salmon Assessment Team (O'Farrell *et al.* 2010). These results indicated that spawning returns of winter-run would be expected to be reduced 10-25% per brood from impacts associated with harvest in the ocean salmon fishery, under the variable levels of both recreational and commercial fishing effort that could be expected given the current management structure of the ocean salmon fishery in the proposed action. These impacts are expected to occur primarily as a result of the removal of age-3 winter-run, almost exclusively in the areas south of Point Arena, California, when the ocean salmon fishery is open in those areas in conjunction with the seasonal and size restrictions of the proposed action. The majority of these impacts are expected to be associated with the recreational fishery in this area (see NMFS 2010 Opinion for full description of fishery impacts on winter-run).

Jeopardy Standard and Determination

The "jeopardy" standard has been interpreted in regulation (50 CFR 402.02) as a requirement that Federal agencies insure that their actions are not likely to result in appreciable reductions in the likelihood of both the survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution. NMFS equates a listed species' probability (or risk) of extinction with the likelihood of both the survival and recovery of the species in the wild for purposes of conducting jeopardy analyses under section 7(a)(2) of the ESA. In the case of listed salmonids, we use the Viable Salmonid Populations (VSP) framework (McElhany *et al.* 2000) as a bridge to the jeopardy standard. In addition, more specific recommendations of the characteristics describing a viable Central Valley salmon population found in Table 1 of Lindley *et al.* (2007) were also considered in this Opinion.

Within the confines of the VSP approach and the viability criteria of Lindley *et al.* (2007), the effects of the ocean salmon fishery are primarily related to the abundance and population growth or productivity of winter-run. The results of the cohort reconstruction analysis suggest that ocean fishery impacts have remained fairly consistent (approximately a 20% reduction in a brood's eventual spawner returns) regardless of the spawning abundance of winter-run or the specific annual ocean fishery regulations over that last decade. Looking specifically over the recent history of increasing spawning returns from the late 1990s through 2006 prior to large scale salmon fishery closures off California, it is clear that the winter-run population is capable of positive growth while sustaining the 10-25% reduction in the cohort spawning returns due to ocean fishery impacts during times of favorable or improving conditions like those which appear to have occurred during that

time. Therefore, NMFS concluded that the expected impacts of the fishery, based on past performance of both the fishery and the winter-run population, are not expected to reduce the likelihood of survival and recovery of the species during periods when the winter-run population was stable or increasing as a result of the myriad factors, both natural and anthropogenic, that affect species viability.

However, there is uncertainty in the immediate and long term future of this ESU. The sudden decline observed in recent years[1] raises concern that the stock is not replacing itself and the resiliency of the ESU is being compromised. The factors that are most likely acting as the agents in this case are not the result of fishing, but more likely due to poor early life survival resulting from a combination of conditions in the freshwater and marine environment. As the understanding of the specific mechanics of this system and the relative status of all parameters involved are not well understood, it is not clear how winter-run are going to respond in the future, regardless if impacts to this ESU from ocean salmon fisheries are realized or not.

Ultimately, the proposed action did not include more stringent measures that would further avoid, reduce, or constrain the fishery's impacts to winter-run during a time when the species' status is declining or is facing increased extinction risks. Without any explicit means to further constrain impacts after consideration of winter-run status in the fishery management process, the potential exists for total spawner reduction rates associated with the ocean salmon fishery to approach, and possibly exceed, 25% during periods of time when risks of extinction are significantly increased due to other factors. NMFS concluded that during times of generally negative patterns in spawner returns or other indications that the status of winter-run is deteriorating, fishing impacts at or above those observed in the past decade are likely to increase the probability of extinction of the ESU through losses in population abundance, impacts on diversity, and reductions in population growth rate. Therefore, NMFS finds it reasonable to conclude that the proposed operation of the fishery with impacts at a level that would be expected without any consideration for additional action based on the current status of winter-run has not ensured that the fishery is not likely to appreciably reduce the likelihood of survival and recovery. As a result, the 2010 Opinion concluded the proposed action was likely to jeopardize winter-run.

The ESA provides that if NMFS has reached a jeopardy, or destruction or adverse modification conclusion, it must identify an RPA to the proposed action that is expected to avoid the likelihood of jeopardy to the species, and avoid destruction or adverse modification of designated critical habitat, if such an alternative action can be offered. The 2010 Opinion included an RPA that required NMFS to develop and implement a new management framework for the ocean salmon fishery addressing impacts to winter-run before the 2012 ocean salmon fishery season. With the implementation of the new management framework described here, we believe this final RPA meets all four regulatory requirements, as set forth in 50 CFR 402.02.

[1] The 2010 Biological Opinion was considering the decline in winter-run spawning returns observed from 2007-2009. Returns in 2010 and 2011 continued to decline, and only 824 winter-run fish were estimated to have returned to the spawning ground in 2011 (PFMC 2012).

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION RPA IMPLEMENTATION

ACTION:	Implementation of the Reasonable and Prudent Alternative Sacramento River Winter-run Chinook Management Framework for the Pacific Coast Salmon Fishery Management Plan
CONSULTATION CONDUCTED BY:	National Marine Fisheries Service, Southwest Region, Protect Resources Division
FILE NUMBER:	151422SWR2009PR00139
DATE ISSUED:	**April 30, 2012**

I. Reasonable and Prudent Alternative

The Endangered Species Act (ESA) requires that NMFS identify Reasonable and Prudent Alternatives (RPA) to a proposed Federal action that has not ensured against the likelihood of jeopardizing a listed species. By regulation, an RPA is defined as "alternative actions identified during formal consultation that can be implemented in a manner consistent with the intended purpose of the action, that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, that is economically and technologically feasible, and that the [NMFS] Director believes would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat" (50 CFR 402.02).

NMFS' approach to developing an RPA to the operation of the ocean salmon fishery under the Salmon FMP was to address the foundation of the jeopardy conclusion, which is the lack of explicit controls in the ocean salmon fishery management process to constrain and reduce impacts when the status of winter-run is declining or unfavorable, and the extinction risks are increased. In order to incorporate this consultation standard into the ocean salmon fishery management process, NMFS (in coordination with the Pacific Fisheries Management Council, or PFMC) is required to develop a management framework for winter-run that meets the objective that NMFS (and the PFMC) must consider the current status of winter-run as part of the annual preseason management process and apply as necessary fishery management actions that are designed to prevent fishery impacts from exceeding levels that would be expected to reduce the species' likelihood of survival and recovery given the species current status. This framework must provide a methodology that is practical given the Salmon FMP, the ocean salmon fishery management process, and the extent of information that may be available for consideration on a timely basis. The 2010 Biological Opinion (Opinion) required that the framework must be implemented as the new consultation standard of the ocean salmon fishery for Sacramento River

winter Chinook (winter-run) before NMFS issues the annual ESA guidance letter to the PFMC for the 2012 fishing season, or no later than March 1, 2012.

Interim RPA

At the time the 2010 Opinion was signed, the information and analysis required to establish specific management objectives or acceptable impact targets, and the tools needed to incorporate these criteria into the fishery management process, were not available. It was clear that additional analytical effort would be required before this framework could be finalized and implemented. In the absence of any developed framework, NMFS implemented an interim RPA for both the 2010 and 2011 fishing years whereby NMFS determined that impacts to winter-run from the ocean salmon fishery needed to be constrained from reaching the levels estimated during the years of 2000 to 2007 (age-3 impacts rates up to 0.21; total spawner reduction rates up to 0.25), due to the continued significant decline in the abundance of winter-run spawning returns since 2006. Options were given to the PFMC to either increase size limits or reduce fishing effort (seasonal closures) in the recreational fishery in 2010 and 2011 to produce a qualitative constraint and reduction to winter-run impacts (see NMFS 2010 and NMFS 2011 for explanation of interim RPA rationale).

II. RPA Management Framework

For the Pacific Coast Salmon FMP, NMFS' goal was to identify a threshold or set of thresholds, based on the status of winter-run Chinook salmon, that would trigger additional measures to reduce the impacts of the ocean salmon fishery on the species. The intent was to ensure that fishery impacts do not further exacerbate the declining or depressed species' condition. For the purposes of this RPA, NMFS has established thresholds to protect the endangered winter-run Chinook salmon given their current conservation status. This ESU currently consists of a single population, confined to areas below currently impassable barriers. Recovery goals and strategies for the species include the establishment of additional populations of the species through barrier removal or modification, habitat restoration and management, and conservation hatchery inputs. Over time, as additional information and assessments of the species' status and its response to various natural and anthropogenic factors become available, the thresholds identified in this framework may change.

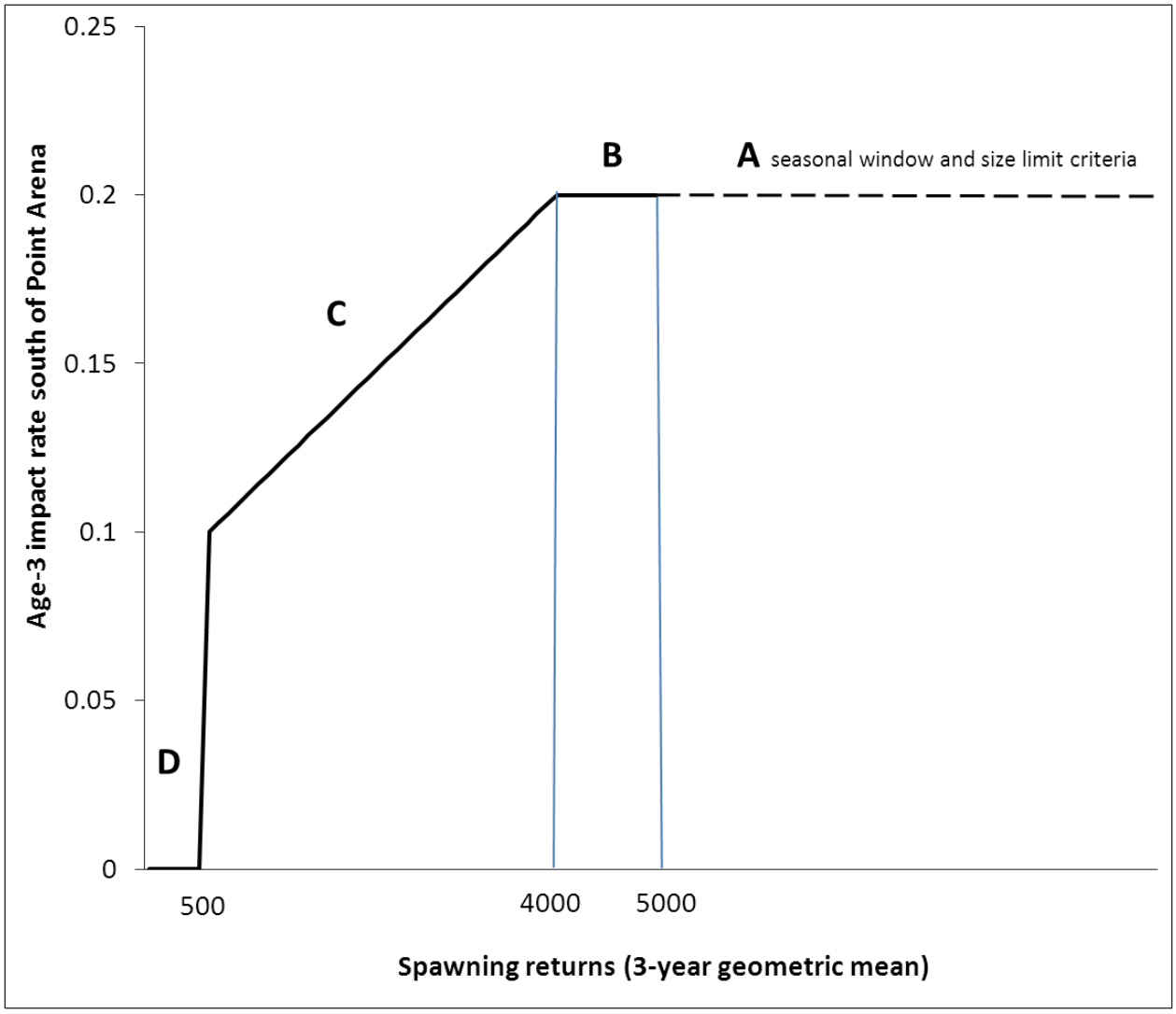
The new fisheries management framework for managing winter-run impacts in the ocean salmon fishery consists of two components. The first specifies that the previous consultation standards for winter-run regarding minimum size limits and seasonal windows south of Point Arena for both the commercial and recreational fisheries will continue to remain in effect at all times regardless of abundance estimates or impact rate limit (Table 1).

Table 1. Management measures related to seasonal time/area restrictions and minimum size limits for the ocean salmon fishery to provide specific protection for Sacramento River winter Chinook.

Fishery	Location	Shall Open No	Shall Close No	Minimum Total

		Earlier Than:	Later Than:	Size Limit Shall be at Least:
Recreational*	Between Point Arena and Pigeon Point	1st Saturday in April	2nd Sunday in November	20 inches
	Between Pigeon Point and the U.S.-Mexico Border	1st Saturday in April	1st Sunday in October	
Commercial	Between Point Arena and the U.S.-Mexico Border*	May 1	September 30	26 inches
	**Exception: Between Point Reyes and Point San Pedro, there may be an October fishery conducted Monday through Friday, but shall end no later than October 15.*			

The second component is an abundance-based framework where, during periods of relatively low abundance, preseason fishery impact rate projections south of Point Arena for winter-run based on the proposed structure of fishing management measures each year must be equal to or less than the maximum allowable impact rate (impact rate cap) specified annually, based on the population status of winter-run (Figure 1). These impact rate caps will be determined annually based on the geometric mean of the most recent 3 years of spawning return estimates for winter-run generated by carcass surveys conducted on the Sacramento River by the U.S. Fish and Wildlife Service and California Department of Fish and Game, including the fish collected at the Keswick trap. Preliminary return estimates from the prior season are typically made available to the PFMC Salmon Technical Team in January in time for use in the March/April salmon management process. For the purposes of this fisheries management framework, the estimates of spawning returns that will be considered reflect all spawning returns, both natural and hatchery origin, including jacks. The preseason forecast of the age-3 impact rate will depend on the salmon fishery management measures adopted each season, as determined by a newly developed winter-run harvest model. Postseason estimates of realized impact rates will be evaluated as the data become available, but deviations from the preseason projection in both the positive and negative direction are expected.



Condition A: Geometric mean of the most recent 3 years of spawning return estimates greater than 5000 - No preseason impact rate cap (Minimum size limit and seasonal window restrictions still in effect).

Condition B: Geometric mean of the most recent 3 years of spawning return estimates between 5000 and 4000 – 20% impact rate cap.

Condition C: Geometric mean of the most recent 3 years of spawning return estimates between 4000 and 500 – a straight line, proportional decline between 20% and 10% impact rate cap.

Condition D: Geometric mean of the most recent 3 years of spawning return estimates of less than 500 - 0% impact rate cap.

Figure 1. Graphical representation of the fishery control rule and tiered approach for managing winter-run impacts in the ocean salmon fishery.

III. RPA Fisheries Management Framework Development

The 2010 Opinion committed NMFS to develop an overall management framework using the best information and analytical tools that are available. This framework needed to contain certain specific elements that can be translated into fishery management activity:

- Thresholds related to the status of winter-run must be established with criteria that identify when the status of winter-run is at varying stages of risk. Thresholds should be measurable and determinable on a regular basis.
- Given these established threshold criteria, fishery management objectives with regard to fishery impacts on winter-run must be established. These objectives must relate to impact rate targets that are readily measureable and regularly monitored for performance.
- In order to meet the management objectives, additional analytical tools and assessment models will be created to incorporate the objectives into the overall fishery management process for use in evaluating various management schemes. These tools should also be used in the ongoing assessment of the performance of the framework for managing fishery impacts to winter-run.

Based on these principles, the RPA framework was expected to take a tiered approach to the assessment of winter-run's status in a manner that could be incorporated into the annual preseason planning process. Based on the assessment, management action would be designed to meet specific objectives, such as fishery impact rate targets, that adaptively address the current status of winter-run. The framework that has been developed consists of a tiered set of conditions that meet the objectives and expectations laid for the RPA out in the 2010 Opinion.

The management framework being implemented by the RPA is based primarily on: the conclusions of the 2010 Opinion; the status and trends of the winter-run population in recent decades (based on 1970 to 2011 time series data); the Management Strategy Evaluation (MSE) conducted by the NMFS Southwest Fisheries Science Center Salmon Assessment Team (Winship *et al*. 2012); the framework for assessing viability of threatened and endangered Chinook salmon and steelhead in the Sacramento-San Joaquin Basin (Lindley *et al.* 2007); and additional information and analyses that support these documents as well as consultation with other NMFS biologists working on ESA-listed salmon conservation in the Central Valley.

Management Strategy Evaluation

At the crux of the jeopardy determination was the lack of any quantitative analysis of what levels of fishery impact might be appropriate given any condition or status of winter-run, such as during times when the population faces increased extinction risks. In response to the RPA mandate, the NMFS Southwest Fisheries Science Center Salmon Assessment Team engaged in efforts to develop the analytical tools required to evaluate various fishery exploitation scenarios

in a formal Management Strategy Evaluation (MSE) process. The term "Management Strategy Evaluation" represents all aspects of the analytical work used to support the decision–making process and implementation of a new fisheries management framework.

The purpose of the MSE is to simulate the winter-run population dynamics under a variety of prospective fishery management "control rules" to assess their performance relative to established population criteria or benchmarks. A control rule specifies the level of incidental take (age-3 impact rate) that fishery managers may target in a given year. For example, a control rule which allows a fixed annual fishing impact rate could be simulated and compared to other rules, such as one that increases the allowable impact rate as the population increases. The goal of the simulation is to evaluate the relative performance of various ocean salmon fishery control rules on the winter-run population.

In order to perform the simulations, a winter-run life-cycle type model was developed where the prescribed fishing impact rate under a control rule is an input as a source of mortality (with its attendant uncertainty), which in turn affected the abundance of the spawning return, leading directly to the generation of the next cohort, and so on throughout the population simulation (Winship *et al*. 2012). The MSE evaluated several forms of fishery control rules including constant age-3 fishery impact target scenarios representing: no impact (0%), estimated historical fishery impacts (25%), current fishery impacts (20%); and several variations of control rules with decreasing age-3 fishery impacts at decreasing population abundance levels (Winship *et al.* 2012[1]). The performance of alternative control rules were compared in terms of established population performance criteria. These were based primarily on population abundance levels and trends related to extinction risk, but other aspects were examined as well. Important results and conclusions of the MSE are captured in the Rationale Supporting Development of the Framework and Description and Basis of Framework Tiers below.

Additional Consultation

In addition to the quantitative work conducted by the Southwest Fisheries Science Center, NMFS engaged in discussions from 2010-2012 with biologists in the SWR working on salmon management, conservation, and recovery, to develop criteria to assess the status of the winter-run population or indicators of elevated extinction risks for the species, both for use within the MSE analysis and incorporation within the management framework. The document by Lindley *et al.* (2007) provided the primary source of peer-reviewed literature on the assessment of salmon population viability in the Central Valley of California (see Precautionary Approach below for more discussion), and served as a starting point for how to relate population criteria into a

[1] The initial MSE analysis consisted of control rules as described in Winship *et al*. 2012. A control rule that closely approximates the winter-run fisheries management framework described in this document was subsequently evaluated within the same MSE structure for analysis and consistency in comparison. Those results are included in the Winship *et al*. 2012 report.

management framework. Ultimately, the management framework reflects the incorporation of the best information that was available given the timeframe allowable by the 2010 Opinion.

Winter-run Harvest Model

Implementation of the framework control rule required the development of a winter-run harvest model (WRHM). The WRHM will be used to determine the expected age-3 impact rate as a function of fishery management measures in any given fishing season. It will allow the PFMC to design ocean salmon fishery management recommendations for NMFS on an annual basis such that an allowable impact rate specified by the control rule of the framework is met. For example, if the control rule allows for a maximum impact rate of 20% given the current population status of winter-run, the WRHM will be used by the PFMC to design commercial and recreational fishing seasons to meet this standard. It is important to note that the WRHM will produce a pre-season prediction of the impact rate. It is possible, and in fact will be required, that a post-season estimate of the actual realized impact rate will be made following the fishing season, once the data are available to do so (3 years after the fishing season has ended), in order to monitor the performance of the harvest model and management framework. The WRHM was developed using the most recent updated winter-run cohort reconstructions and estimates of winter-run fishery impacts available (O'Farrell *et al.* 2011b), and shares many of the same characteristics and structure as other models developed for use in the PFMC process such as the Klamath and Sacramento harvest models. The WHRM has been subject to PFMC Salmon Methodology Review and is ready for use in the 2012 preseason management process. The WHRM is designed to incorporate updated information regarding fishing effort and winter-run contact rates from each fishing season into the forecasts for subsequent fishing seasons when the data become available.

NMFS acknowledges that the actual realized age-3 impact rate could be greater or less than the preseason projection produced by the WRHM. In simple terms, the WRHM should predict impact rates that are less than the realized impact rates half the time, and more than the realized rates about half the time. The uncertainty of the WRHM has been considered and accounted for in the development of the framework. There is statistical information about the uncertainty of the WHRM directly incorporated into the MSE simulations of the winter-run population under various fisheries management control rules. This information was useful in understanding the potential influence of using preseason impact projections with the WRHM on this framework, and describing the realistic expectations for variance between predicted and realized impact rates.

Rationale Supporting Development of the Framework

The development of this management framework required consideration and incorporation of many concepts constituting the best available information and scientific judgment of NMFS.

The following list summarizes the main points that provide the rationale and justification for the construction of the RPA framework being implemented:

- The 2010 Opinion concluded that reducing fishery impacts from levels that could be expected given the original proposed action when the status of winter-run is reduced or facing increased extinction risk is necessary to ensure the ocean salmon fishery is not likely to jeopardize winter-run. Explicit consideration of the best available information regarding winter-run status each year prior to developing ocean salmon fishery management measures is the first component of meeting this RPA objective. Secondly, development of maximum allowable preseason impact rate projections that decline (along with the harvest model tool to measure them) as winter-run spawning returns decline fulfills the RPA requirement to implement a management framework that avoids jeopardy.

- The MSE results quantify the proportion of modeled population simulations that resulted in high, moderate, or low categories of extinction risk per the Lindley *et al*. (2007) criteria for each of the fishery control rules examined (Winship *et al*. 2012). Other performance measures such as long term equilibrium population size and relative fishing opportunity as measured by the distribution of the targetable impact rates over time were also quantified.

- Results from the MSE illustrate the primary impact of perpetual harvest of winter-run adults incidental to the ocean salmon fishery as a reduction in the equilibrium population value (long term average of spawning returns) over time (Table A4 and A5 Winship *et al*. 2012). Under these simulations, the annual spawning returns of winter-run average about 23,000 under a zero harvest impact scenario. When control rules were based on 20% impact as the largest maximum allowable fishery impact target, the long-term mean annual spawning returns were around 13,000, or about a 40% reduction. Increasing the base impact rate to historical levels estimated to be around 25% further reduced the equilibrium population to about 10,000.

- Results from the MSE suggest that the most influential factors in winter-run population dynamics are related to variation in juvenile survival rates (survival prior to age-2) in the fresh water and marine environments (Winship *et al*. 2012). This is a general conclusion supported by several results including:

    - Observation of widely ranging population trajectories despite relatively consistent fishing impact projections, or population variation at a scale that greatly exceeds the scale of impact rate modifications.

    - Use of high correlation values in juvenile survival rate had more influence on extinction risk than variations on impact rate adjustment at low abundance.

This agrees with the empirical data that juvenile survival rates of winter-run have varied by orders of magnitude across years and various stages (i.e. fry and smolt), compared to variations in estimated fishery impacts across years of only several percentage points (NMFS 2010, Winship *et al*. 2012).

- Results from the MSE indicate all control rules evaluated produced higher proportion of simulations in the moderate or high risk of extinction categories relative to the no-fishing scenario (Winship *et al*. 2012). In general, increased proportions of moderate and high risk were small, but noticeable, for all fishery control rules examined in the MSE using the Lindley *et al*. (2007) criteria. For example, the MSE results in terms of the percentage of simulations that fell under each extinction risk category using various fishery control rules based on population abundance criteria using high correlation in juvenile survival rates were:

	Extinction Risk		
Control rule	**Low**	**Moderate**	**High**
0	0.9861	0.0134	0.0006
1	0.9036	0.0854	0.0110
2	0.9377	0.0560	0.0064
3	0.9503	0.0469	0.0028
4	0.9512	0.0463	0.0022
5	0.9599	0.0391	0.0011
NMFS framework	0.9630	0.0357	0.0013

Table A9 in Winship *et al*. 2012. Control rule 0 = no fishing; 1 = 25% flat impact, 2 = 20% flat impact, 3-5 = variations on declining impact from 20%, NMFS framework = RPA management framework (see Figure 1).

The greatest benefit of the RPA framework under this scenario is in reducing the amount time the winter-run population experience increases to moderate extinction risks based on these population criteria relative to other control rules that allowed for fishing impact rates. A similar pattern and scale in relative changes in extinction risks or other criteria as defined in the MSE were evident throughout that analysis.

- The use of decreasing allowable fishery impact rate caps as the population abundance is declining in the management framework is supported by the results of the MSE, which illustrated those types of control rules would result in proportionally fewer simulations in the high or moderate risk of extinction categories than flat target impact rate control rules of 20 or 25% (illustrated in the table above). This is also consistent with the conclusion of the 2010 Opinion, as well as general approach taken throughout salmon harvest management to reduce impacts on stocks that are not doing well (Pacific Coast Salmon FMP; PFMC 2011).

- One of the major strengths of the MSE approach is the ability to directly account for the uncertainties and biases of a harvest model's "predicted impact rates" versus "realized impact rates". This acknowledges that the actual impact rate will sometimes be less, sometimes be greater, than the value predicted by the WRHM, but the MSE expressly accounted for these expected deviations in its overall evaluation. It is effectively equivalent to admitting that errors will occur while following the control rule, but that these errors have been accounted for in the control rule performance evaluation. This aspect of the analysis supports the claim that we have, in the development of the control rule, analyzed and anticipated a wide range of scenarios regarding actual fishing impact rates; not just those specified by the control rule.

- It is important to specify that the conclusion of the 2010 Opinion and RPA did not call for NMFS to identify the maximum amount of incidental impact that winter-run could sustain from fisheries without jeopardizing the species. As a result, the MSE was not intended to derive the type of information required to develop and support a framework based on that concept. The intention of the ESA is to promote survival and recovery of ESA-listed species to a point where ESA protections are no longer required, and NMFS does not take a maximum sustainable yield approach to authorizing incidental take of ESA-listed species under its jurisdiction. In addition, the MSE was not designed to derive critical population abundance thresholds for winter-run, or evaluate changes in the extinction risk of the species at intervals less than the threshold shifts between the extinction risk categories identified in Lindley *et al.* (2007). NMFS uses these criteria as a way to gauge the relative effect of fishing scenarios on winter-run, not as the standards in making any jeopardy determinations for fishery or non-fishery actions.

- NMFS is electing to employ some precaution in the development of a fisheries management framework where prudent as a matter of conservative policy in deference to the endangered status of this species per intent of the ESA, and requirement to "ensure" that the ocean salmon fishery is not likely to result in appreciable reductions in the likelihood of both the survival and recovery of winter-run. More detail on some precautionary elements can be found in the Precautionary Approach section below.

Description and Basis of Framework Tiers

1. Condition A: The 2010 Opinion concluded that the level of fishery impacts that had been exp erienced by winter-run in the recent past did not jeopardize the species during favorable conditions. In this framework, mean annual return estimates over 5000 are not subject to an explicit target impact rate cap, but the framework's first component consisting of seasonal windows and minimum size limits still apply. These restrictions alone are likely sufficient to prevent extraordinarily high impacts and would generally be expected to result in an impact rate of about 20%, but could vary higher or lower as indicated by the recent performance of the fishery (prior to implementation of the impact

rate control rule). Condition A is designed to minimize limitations on the fishery if both target stocks (i.e. Sacramento and Klamath fall-run) and ESA-listed populations (i.e. winter-run) are doing well enough to support a large fishery, consistent with the conclusions of the 2010 Opinion.

2. Condition B: A flat 20% impact rate cap is selected for population abundance levels between 4000 and 5000 individuals. The end points for this tier were derived using the record of winter-run spawning returns as the measure of population performance and identifying the general conditions when winter-run are doing relatively well or relatively poor. The 42-year record of the winter-run Chinook population indicates a geometric mean return size of approximately 3800 individuals. This 42-year record matches the timeframe reported annually in the PFMC Review of Ocean Salmon Fisheries report. This record includes periods of high returns and significant declines to very low abundances, including those that led to the species' listing under the ESA. These returns include estimates made using different approaches and quantitative methods over the years, and the confidence regarding the accuracy of some historical estimates is less than those made using current methods. Over the recent past (2001 – 2011), population abundances have again varied widely based on the species' response to natural and anthropogenic influences in their freshwater and oceanic habitats. In particular, the past 10 years have included two record returns as well as the significant decline in abundance levels immediately following these record returns. During this period, the geometric mean return size was approximately 4900 individuals. It is important to recognize that fishery impacts have been occurring all along during these historical time periods, at levels averaging about 20% in the recent decade, and likely at somewhat higher levels prior to the implementation of major restrictions on the ocean salmon fishery to protect winter-run beginning in the 1990s. Acknowledging that these mean estimates are uncertain and influenced by the time interval selected, NMFS observes that spawning returns of 4000-5000 appears to represent a breakpoint in the general condition and population performance of winter-run. As such, NMFS has selected 4000 as a threshold point at which to begin reducing the impact rate cap down from 20%. The intent of this flat impact rate cap is to maintain control of fishery impacts during periods when the species may be declining towards or recovering from mean spawning returns of less than 4000 individuals. Relying solely on the framework's season and size limit minimum restrictions (first component) may be expected to result in fishery impact rates that average about 20% over time, but in any given year could exceed 20%. The MSE results indicated a reduced proportion of simulations in the moderate to high risk extinction categories under a flat 20% vs. 25% impact rate cap scenario (which would be expected were the framework's first component not in place).

3. Condition C: Under this condition, a geometric mean of the most recent 3 years of spawning return estimates between 4000 and 500 individuals would be subject to a

linearly declining allowable impact rates of between 20 and 10%. NMFS expects that winter-run will benefit from additional reduction in fishery impacts at reduced abundance levels, based on the results of the MSE and the 2010 Opinion. As mentioned above, the end point 4000 represents a breakpoint in the average condition of the species over the longer term period of record used and considering recent trends in population abundances. The variance between this abundance trigger point to begin reducing impacts and the approach taken in construction of trigger points in the fishery control rules analyzed in the initial MSE analysis represents a conservative approach in the implementation of the RPA and this framework (See discussion on Precautionary Approach below). The secondary trigger point of 500 is based on the Lindley *et al.* (2007) criteria as described below. The lowest impact rate cap level of 10% was based on the concept that reducing impact rates to less than 10% may effectively lead to a complete closure of the fisheries due to the basic economics and logistics involved with small scale salmon fisheries, and consideration of the MSE results which suggested that a 10% fishery impact rate at smaller population abundances did not substantially affect population size risks compared to the other impact rate control rules evaluated.

4. Condition D: At some point, the winter-run population could get small enough that NMFS deems it appropriate to prohibit fishery impacts on winter-run. At this time, such a critical population abundance level had not been specifically identified for winter-run. However, the Lindley *et al*. (2007) population criteria did identify annual run sizes of 500 as a critical value relative to population decline and extinction. Whether a population has recently declined below this value or has stabilized under it, it seems reasonable to conclude that the population is likely at an increased risk of extinction, possibly even at high risk. As a result, for the purposes of this framework, NMFS deems this as a critically low abundance level below which it is appropriate to preclude any fishery impacts. It is important to note that 500 was identified in Lindley *et al*. (2007) as a critical value for any given single year of spawning returns of Central Valley salmonids. This framework is structured according to the principal that the 3-year geometric mean of spawning returns provides a reasonable reflection of the status of the total population of one complete generation of winter-run, and will not react exclusively on the performance of one weak cohort. Should some obvious trend in cohorts emerge that could be masked by use of a 3-year mean, NMFS will consider future modifications in how to approach this framework.

For all specific impact rate caps, realized impact rates could be greater or lesser in some years, due to the nature of the harvest model used to forecast impact rates, variability in fishing effort, variations in the distribution of winter-run, etc. The MSE accounted for this uncertainty in the simulations used to evaluate the suite of fishery control rules examined, including the control rule that represents this management framework. In all those example scenarios, the results support the conclusion that this variation between the preseason impact rate forecasts and the

postseason realized impact rates does not appear to influence extinction risks associated with the Lindley *et al*. (2007) population criteria over the long term.

Precautionary Approach

In the development of this framework, NMFS has relied upon the best scientific information available. The supporting analysis of the MSE in concert with the Lindley *et al.* (2007) population criteria for assessing extinction risk represent a reasonable and sophisticated approach given the current state of knowledge, the available data, and published information. However, NMFS is instituting a level of precaution into the fishery management framework that does deviate from some explicit elements in those documents. The reasons for this are based in the logic of conservation science and policy.

1. The winter-run ESU is composed of only one population with a relatively small remaining area where spawning could be expected to occur. NMFS has identified that the key to recovering this species rests on the ability to reintroduce additional viable populations. Until that time, it is essential that the lone population be treated with a commensurate level of precaution as the lone remnant of this endangered ESU.

2. NMFS notes that this framework is not typical of other salmon fishery control rules that are based on a forecast of the current year ocean abundance because there is no ability to make such a forecast for winter-run given their run-timing relative to the conduct of the fishery[2]. As a result, this framework is not premised on a forecast of the winter-run spawning returns that will result after the anticipated fishing impacts in any given year. The link between the framework and comparisons with abundance thresholds is not direct in real time.

3. The population criteria used in Lindley *et al*. (2007) represents thresholds between general extinction risk categories. It is the policy decision of NMFS to not manage the fishery impacts on winter-run down to the thresholds between risk extinction categories, particularly when the prohibition against jeopardizing a species speaks to appreciable reductions in the species' likelihood of survival and recovery, and not to significant changes or shifts between general extinction risk categories. The decision to start reducing impacts well before the population is approaching a population abundance risk category threshold is a reflection of that conservative approach. The decision to preclude fishery impacts all together at very low abundance is reflective of this approach as well.

[2]Ocean abundance estimates are typically generated by looking at the previous season's spawning returns. Winter-run are returning to the Sacramento River during the preseason management process, and spawning occurs during the late spring and early summer (NMFS 2010). By the time spawning return estimates are available, it is time for the preseason management process to begin again. However, those adults that would have been "predicted" to remain in the ocean are beginning to enter the Sacramento River by that time. As a result, any prediction of ocean abundance that could be made would likely be moot.

4. Similarly, the population criteria of Lindley *et al*. (2007) were not specifically developed based on the population demographics of winter-run. They reflect a general framework for assessing the viability of all salmonid populations in the Central Valley. While this work represents the best scientific advice available and remains the foundation of evaluating relative categories of extinction risk and the initial guide in establishing abundance thresholds for winter-run in the development of this management framework, it may not be prudent to literally incorporate those criteria/thresholds into fisheries management when they were not developed for this purpose. NMFS concludes that it is the general results and findings of the MSE that are most significant and informative, not the specific abundance thresholds adopted in the suite of control rules evaluated.

5. The MSE goes to great lengths to incorporate the uncertainties that are associated with implementing an abundance based control rule into the analysis of risk, and NMFS believes the results and conclusions drawn from the MSE are robust to those uncertainties over the long term. However, there are many factors that affect the population dynamics of winter-run that could not be incorporated into the models used in the MSE to more fully reflect the true complexity of the system. Given the mandate to be conservative relative to the management of ESA-listed species, a conservative approach in response to declining or low estimates of spawning returns is thus warranted.

Important factors influencing the population dynamics of winter-run that are not fully incorporated into the MSE include climate change and genetic effects. Other important factors such as variability in early-life survival through age-2 are directly accounted for in the MSE, and the results reflect the response of the early life stages to varying habitat conditions in both the freshwater and marine environment, and the resulting consequences on population abundance and extinction risk. However, it would be desirable to link specific influences across the life history of winter-run into an ecosystem approach to managing impacts across that entire life history. If additional information or analytical tools become available in the future that would help inform these relationships or improve our knowledge of the system to allow for a more holistic approach to the management of winter-run, this framework should be re-examined.

IV. Analysis of RPA

Avoidance of Jeopardy

The rationale for implementing this management framework as the RPA has been laid out in the explanation and justification for the framework presented in this document. The elements that were identified in the 2010 Opinion as being essential to avoiding jeopardy are satisfied by this RPA. Specifically, the framework provides an explicit mechanism for NMFS and the PFMC to consider the status of winter-run in the preseason ocean salmon fishery management process and adjust impacts accordingly to reflect that status, especially during times when the population is at low levels, in a manner that was not previously available under the original proposed action.

This framework contains clearly defined abundance thresholds, prescribed fishery objectives, and the tools required for implementation into the ocean salmon fishery management process. Consistency with the principles and conclusions outlined in the 2010 Opinion support NMFS' conclusion that with adoption of this RPA, the ocean salmon fishery managed under the Federal Pacific Coast Salmon FMP would avoid jeopardizing the Sacramento River winter-run Chinook ESU.

Economic and Technical Feasibility

When developing an RPA, NMFS is required by regulation to devise an RPA that is "economically and technologically feasible" in addition to avoiding jeopardy and/or adverse modification. In developing the RPA, the 2010 Opinion specified that the RPA incorporate "methodology that is practical given the Salmon FMP, the ocean salmon fishery management process, and the extent of information that may be available for consideration on a timely basis." This management framework relies on estimates of winter-run spawning returns that are generated annually, and are expected to be available to NMFS and the PFMC by February each year. Use of data and information updated prior to the March and April PFMC meetings in the development of the ocean salmon fishery management regulations is the standard process for maintaining compliance with MSA conservation objectives and ESA consultation standards for this fishery. The 2010 Opinion also specified that "analytical tools and assessment models will need to be created that can incorporate the objectives into the overall fishery management process and used to evaluate various management schemes. These tools should also be used in the ongoing assessment of the performance of the framework for managing fishery impacts to winter-run". Development of the WRHM allows for implementation of maximum allowable harvest rates consistent with the control rule and management framework developed under this RPA. The data necessary to continuously update the WRHM to accurately reflect the actual performance of the fishery over time is also expected to be available over time. The cohort reconstruction methodology associated with post-season estimates of fishery impacts and monitoring of the framework is consistent with well-established approaches already in use by NMFS and the PFMC. As a result, the implementation of this RPA is technically feasible.

Implementation of the RPA will require time and attention from NMFS staff each year, but is not expected to add much cost much in terms of additional commitment of resources from NMFS or any other resource agency or entity. Currently, the preseason management process provides access to the necessary information and NMFS staff already conducts similar assessments for other salmon ESUs or stocks. Overall, NMFS concludes the RPA is both economically and technologically feasible for implementation.

Consistency with the Intended Purpose of the Action and the Action Agencies' Legal Authority and Jurisdiction

As noted in the introduction to this RPA, regulations provide that an RPA must be an alternative that, "can be implemented in a manner consistent with the intended purpose of the action, [and] that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction" (50 CFR 402.02). This RPA meets both of these criteria.

NMFS has authority under MSA to manage fisheries under Federal fisheries management plans, such as the Pacific Coast Salmon FMP. Implementation of this management framework is consistent with the MSA and the mandate to work within the PFMC process, providing guidance and tools like the WRHM to the PFMC for assisting in development of recommendations for fishery management to NMFS. NMFS has established standards for the ocean salmon fishery relative to other ESA-listed salmon species through numerous consultations and biological opinions. Some of these consultations have concluded in jeopardy opinions, which have resulted in changes to fisheries management and reduced impacts on ESA-listed salmon ESUs.

The management framework of this RPA is consistent with similar standards that do severely limit or eliminate salmon fisheries based on specific circumstances and conservation purposes for other ESA-listed species and fisheries. Coho directed fisheries continue to be prohibited off the coast of California due primarily to the status of Central California Coastal coho (NMFS 1999). The standards for Lower Columbia River coho and Oregon Coast Natural coho include allowable fishery impact rates that range from zero to eight percent during critical conditions (NMFS 1999 and NMFS 2008). There is also some similarity with abundance-based fishery control rules for non-ESA stocks in California. If Klamath River Fall Chinook or Sacramento River Fall Chinook returns are at extremely low levels, the *de minimis* fishing provisions of the Pacific Coast Salmon FMP allow some limited discretion for non-zero impacts, but from a practical point of view would allow very little fishing when the stocks reach critical levels (PFMC 2011). As mentioned above, the PFMC has closed fisheries on more than one occasion in recent years in response to conservation concerns for other stocks that were arguably less dire than those represented by the critical abundance level that would limit fisheries for winter-run.

Under this RPA, NMFS will continue to manage the ocean salmon fishery consistent with the intent of the proposed action. At times, there will be additional protective measures required beyond those identified in the proposed action. The implementation of maximum allowable impact rates will likely affect fishing opportunity, although the majority of time (about 70%) NMFS expects that the original conditions and measures presented in the proposed action will be the standard for the fishery in any given fishing season. The Preamble to the ESA consultation regulations states that "a Federal agency's responsibility under section 7(a)(2) permeates the full range of discretionary authority held by that agency," and that the Services can prescribe a RPA "that involves the maximum exercise of Federal agency authority when to do so is necessary, in the opinion of the Service, to avoid jeopardy." (51 Fed. Reg. 19925, 19937; June 3, 1986). As a result, NMFS concludes this RPA is consistent with the intended purpose of the action and the action agencies' legal authority and jurisdiction.

V. Incidental Take Statement

Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to engage in any such conduct." Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as "take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity." Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action, is not considered to be prohibited under the ESA, provided that such taking is in compliance with the terms and conditions of the incidental take statement.

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, and the proposed action may incidentally take individuals of a listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts.

The measures described below are non-discretionary, and must be undertaken by NMFS so that they become binding conditions of any permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If NMFS fails to implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS must document the progress of the action and its impact on the species as specified in the incidental take statement (50CFR § 402.14(i)(3)).

Amount or Extent of Take

The proposed action of authorization of the ocean salmon fisheries pursuant to the Pacific Coast Salmon Fishery Management Plan, in conjunction with additional protective measures designed to protect Sacramento River winter Chinook, is likely to result in incidental take of this ESA-listed endangered ESU. As part of the RPA for this action, NMFS is instituting a new management framework that provides standards for allowable projected winter-run impacts based on the most recent 3-year geometric mean abundance estimate of winter-run spawning returns. The framework expresses the amount or extent of winter-run take in terms of projected levels of annual fishery impact on age-3 winter-run in the ocean given the status of the species (Figure 1).

Under circumstances of relatively good conditions and higher winter-run abundance, this framework does not specify any maximum allowable projected impact from the ocean salmon fishery. Instead, the consultation standards regarding minimum size limits and seasonal windows are expected to continue to provide the same level of take considered in the 2010

Opinion. Over the long term, in cases where additional protective measures triggered by the status of winter-run are not needed, NMFS expects the annual impact rates of age-3 winter-run to remain consistent and average about 20% over time. NMFS anticipates that the incidental take of winter-run will produce spawner reduction rates that will fluctuate more than age-3 impact rates on an annual basis, but will ultimately average about 20% over time[3]. Unless or until these expected impact levels are modified by future analysis, NMFS considers these estimates to be anticipated incidental take during periods when the consultation standards are the basic protective measures of season and minimum limits that have been implemented in the past. Even though specific maximum allowable impact rate projections may not be applicable during those years, NMFS will continue to monitor postseason impact rates to check for consistency with the anticipated take levels considered in this Opinion (see details below).

During times when the ocean salmon fishery is subject to maximum allowable impact rate restrictions, there is particular interest in the relationship between preseason expectations for fishery impacts in a given season compared to postseason estimates of realized impacts, as represented by impacts on age-3 fish. NMFS acknowledges that the actual realized age-3 impact rate could be greater or less than the preseason projection produced by the WRHM. This uncertainty has been anticipated and accounted for to a certain degree, both in the MSE analysis and the precautionary approach used for support in developing this RPA. The difference between preseason impact rate projections according to the WRHM and postseason estimates generated after the data are available is expected to remain within the reasonable bounds of what was considered in the development of the RPA framework and stipulated within the anticipated incidental take below.

Given the anticipated variance between impact rate projections and realized impact rates each year, there is a need to describe events that are expected under the RPA. In order to establish limits on amount and extent of realized incidental take authorized by this Biological Opinion and implementation of this RPA, NMFS looks to the known information about the WRHM uncertainty incorporated into the MSE simulations and the Precautionary Approach principles outlined previously to set boundaries on acceptable scenarios of incidental take.

The scenarios listed below are designed to represent boundaries beyond which NMFS concludes that the underlying assumptions and expectations of the framework have been exceeded. These scenarios refer to specific characteristics that have been used in the development of this RPA management framework that influence the amount or extent of winter-run take in the ocean salmon fishery. Examination of postseason estimates of fishery and WHRM model performance that reveal repeated violations of major assumptions are strong indications that the incidental take of winter-run that is expected under this management framework has been exceeded.

[3] Age-3 impact rate and total spawner reduction rates are typically very similar for a brood due primarily to the high maturity rates of winter-run age-3 fish and limited vulnerability of age-2 fish to fisheries due to their small size relative to minimum size limits. As a result, there are very few winter-run older than age-3in the ocean, and limited estimated impacts on age-2 fish.

NMFS specifies the following scenarios or conditions would clearly signal that the action has exceeded the expectations for incidental take considered in the development of this RPA framework:

1. Any single year postseason age-3 impact rate estimate south of Point Arena exceeds the lower of (a) twice the impact rate specified by the control rule, or (b) 0.35 regardless of what framework tier or preseason allowable fishery rate projection the fishery is operating under, for 3 consecutive years.

   Rationale: Realized postseason estimates of these magnitudes are beyond what was considered in development of the management framework because: (a) the MSE of fishery control rules did not consider the possibility of age-3 impact rates greater than 0.35; and (b) realized impact rates at least twice as high as the impact rate specified by the control rule within the MSE occurred less than 1% of the time in the MSE results. Using a 3-year horizon permits NMFS an opportunity to distinguish between isolated events that may occur by random chance, and those that are representative of patterns or trends that are inconsistent with the analysis supporting this RPA framework. A 3-year horizon also matches well with the span of one generation for winter-run, allowing NMFS to assess the impact of any observed scenario of fishery impact across the entire population.

2. Age-3 impact rate north of Point Arena greater than 0.05 for 3 consecutive years.

   Rationale: The management framework assumes that almost all ocean salmon fishery impacts to winter-run occur south of Point Arena, based on cohort reconstructions (O'Farrell 2011a). As a result, the management framework is built upon that assumption. Observation of substantial impacts observed north of Point Arena could indicate a change in how the ocean salmon fishery is affecting winter-run.

3. Age-3 maturation rate less than 0.7 for 3 consecutive years.

   Rationale: The management framework relies upon the cohort reconstruction analysis (O'Farrell 2011a) that indicate a large proportion of winter-run individuals mature at age-3 (about 90%), and that relatively few fish older than age-3 are subject to take in the ocean salmon fishery. As a result, the management framework assumes that age-3 impact rates closely approximate the total impact of the fishery. If lower age-3 maturation rates are observed, more age-4 fish could be exposed to the fishery. The MSE did not consider the implication of maturation rates this low in the evaluation of fishery control rules, and the management framework is not currently capable of accounting for this scenario. Maturation rates of winter-run are calculated as a byproduct of the cohort

reconstruction analysis used to estimate realized fishery impact rates, which are expected to be updated every year.

It is also possible that other scenarios, involving realized levels fishing impact or some other associated condition, could signal to NMFS that the RPA framework is not functioning as anticipated, or that changes to the framework would be advantageous. It is not possible to describe all such possible scenarios or conditions at this time, and NMFS does not deem the scenarios described above as the sole consideration in deciding whether or not to reinitiate consultation on the ocean salmon fishery impacts to winter-run. NMFS will continually assess the performance of the framework as required by the terms and conditions of this RPA and make those determinations as appropriate.

Effect of the Take

In the accompanying Biological Opinion and RPA analysis, NMFS determined that the incidental take associated with the proposed action, in conjunction with the RPA, is not likely to jeopardize the continued existence of Sacramento River winter Chinook.

Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures, as implemented by the terms and conditions, are necessary and appropriate to minimize impacts to Sacramento River winter-run as a result of incidental take in the ocean salmon fishery. The measures described below are non-discretionary and must be undertaken for the exemption in section 7(o)(2) to apply. If NMFS fails to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. Thus, the following reasonable and prudent measures must be implemented in order to authorize the ocean salmon fishery under the Pacific Salmon FMP in a manner which may result in the incidental take of winter-run.

1. In-season management actions taken during the course of the fisheries must be consistent with the harvest objectives and other management measures established in accordance with the salmon FMP that were subject to review with this biological opinion.

2. Incidental harvest impacts of Sacramento River winter Chinook shall be monitored on an annual basis using the best available measures. Although NMFS is the Federal agency responsible for ensuring that this reasonable and prudent measure is carried out, it is the states, tribes, and U.S. Fish and Wildlife Service (USFWS) that conduct monitoring and reporting of catch and other data necessary to complete analyses of impacts.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following term and condition implements reasonable and prudent measure No. 1.

   1A. NMFS must confer with the affected states and tribes, and the PFMC chair, as appropriate, to ensure preseason and in-season management actions taken during the course of the fisheries are consistent with the objectives of the Reasonable and Prudent Alternative and the take specified in the Incidental Take Statement of this biological opinion.

2. The following term and condition implements reasonable and prudent measure No. 2.

   2A. NMFS, in cooperation with the affected states and tribes, the PFMC chair, and USFWS, as appropriate, must support efforts to ensure that the catch and effort and the implementation of other management measures under the Pacific Coast Salmon FMP by the PFMC, states, and tribes is monitored at levels that are at least comparable to those used in recent years. Catch monitoring programs must be stratified by gear, time, and management area.

   2B. NMFS, in cooperation with the affected states and tribes, the PFMC chair, and USFWS, as appropriate, must support efforts to ensure that surveys of spawning populations are conducted at a level sufficient to provide reliable estimates of spawning abundance that are made available prior to the preseason salmon management process each season. To that end, NMFS must assess current spawning survey programs and evaluate plans to improve or address deficient efforts in the future.

   2C. NMFS, in cooperation with the affected states and tribes, the PFMC chair, and USFWS, as appropriate, must support efforts to ensure that fisheries are sampled for stock composition, including the collection of coded-wire-tags (CWTs) in all fisheries. Additionally, collection of CWTs from spawning surveys must be conducted at a level sufficient to provide the data needed to complete estimates of impacts to ESA-listed salmon ESUs. To that end, NMFS must assess current CWT collection programs and evaluate plans to improve or address deficient efforts in the future.

   2D. NMFS must ensure that post-season estimates of age-3 ocean impact rates and updates of spawner reduction rate estimates are conducted on an annual basis, as cohort reconstructions are completed. The Sustainable Fisheries Division, NMFS Southwest Region, will provide such estimates.

   2E. NMFS must monitor and assess the effectiveness of this RPA management framework over time, including annual review of the WHRM as a reasonable predictor of winter-run impacts from the ocean salmon fishery. As part of this process, NMFS may consider a full evaluation of the WRHM and potential remedies to correct or improve WRHM deficiencies prior to engagement in any formal consultation reinitiation. However, mandatory requirements to consider new information about the status of the

species or the effects of the action remain in effect, and may not be superseded by modifications of the WRHM or preseason ocean salmon fishery management process.

VI. Reinitiation of Consultation

This completes implementation of the Reasonable and Prudent Alternative to avoid jeopardy as determined under formal consultation on the authorization of the ocean salmon fisheries, developed in accordance with the Pacific Coast Fisheries Management Plan and additional protective measures proposed, by NMFS, as it affects Sacramento River winter Chinook. Implementation of the management framework described herein goes into effect May 1, 2012. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, or is expected to be exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is modified in a manner that causes an effect to listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR § 402.16). In addition to any limits regarding postseason estimates of fishery impacts specified in the incidental take statement of this Opinion, NMFS maintains the discretion to reinitiate consultation based on any results of postseason estimates of fisheries impacts that provide cause for concern about the structure of the RPA management framework and/or impacts to winter-run resulting from the ocean salmon fishery..

VII. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purpose of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information that could be useful in management decisions. NMFS believes the following conservation recommendation is consistent with these obligations, and therefore should be implemented by NMFS.

1. NMFS, in collaboration with the PFMC, states, and tribes, should continue to develop improvements in gear technologies and fishing methods to reduce the mortality of ESA-listed species.

2. NMFS, in collaboration with the PFMC, states, and tribes, should continue to improve the knowledge of ocean rearing and migration patterns, as well as the relationships between ocean conditions and survival of salmon in the marine environment to better understand how ESA-listed and non-ESA listed salmon respond to variables in the marine environment. Use of this knowledge could assist in the development of more efficient tools to manage the impacts of fisheries on ESA-listed stocks.

3. NMFS, in cooperation with PFMC and other affected interests, should work cooperatively to develop and implement a more ecosystem-based management approach that integrates harvest, hatchery, habitat, and water management, in consideration of ocean conditions and climate change, which reflects the complex influences of individual environmental components upon each other and the system as a whole.

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