PROGRESS REPORT ON ALTERNATIVES FOR PACIFIC COAST SALMON PLAN AMENDMENT 16: CLASSIFYING STOCKS, REVISING STATUS DETERMINATION CRITERIA, ESTABLISHING ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES, AND ESTABLISHING *DE MINIMIS* FISHING PROVISIONS

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List of Acronyms

ABC	acceptable biological catch
ACL	annual catch limit
AEQ	adult equivalent (exploitation rate [ER])
AM	accountability measure
ACT	annual catch target
C	catch (based reference points)
CA ESA	California (salmon stocks listed under the) Endangered Species Act
CAN	Canadian (coho, Chinook, or pink salmon)
CA/S OR C	California/Southern Oregon Coast (Chinook)
CFR	Code of Federal Regulations
CR ESA	Columbia River (salmon stocks listed under the) Endangered Species Act
CR F	Columbia River fall (upper river bright Chinook)
CR S	Columbia River summer (Chinook)
EA	Environmental Assessment
EC	Ecosystem Component
EFH	Essential Fish Habitat
ER	exploitation rate
F	fishing mortality rate (instantaneous)
FMP	Fisheries Management Plan
FONSI	Finding Of No Significant Impacts
GM	geometric mean
HAT	Hatchery (origin salmon stocks)
HC	Habitat Committee
IRFA	Initial Regulatory Flexibility Analysis
KOHM	Klamath Ocean Harvest Model
KRFC	Klamath River fall Chinook
MSA	Magnuson Stevens Act
MFMT	maximum fishery mortality threshold
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NS1Gs	National Standard 1 Guidelines
ODFW	Oregon Department of Fish and Wildlife
OFL	overfishing limit
OR C	Oregon Coast
OY	optimum yield
PFMC	Pacific Fishery Management Council (Council)
PS	Puget Sound
PS ESA	Puget Sound (salmon stocks listed under the) Endangered Species Act
PST	Pacific Salmon Treaty
RIR	Regulatory Impact Review
S	spawning escapement
SAC	(Ad Hoc) Salmon Amendment Committee
SAS	Salmon Advisory Subpanel
SDC	status determination criteria
SHM	Sacramento Harvest Model

List of Acronyms (continued)

SI	Sacramento Index (of abundance)
SRFC	Sacramento River fall Chinook
SSC	Scientific and Statistical Committee
STT	Salmon Technical Team
VEWG	Vulnerability Evaluation Work Group
WA C	Washington Coast (coho)
WA/CR Sp/S	Washington/Oregon spring/summer (Chinook)
WA/OR S/F	Washington/Oregon summer/fall (Chinook)

1.0 INTRODUCTION

The reauthorization of the Magnuson-Stevens Act (MSA) in 2006 established new requirements to end and prevent overfishing through the use of annual catch limits (ACLs) and accountability measures (AMs). The reauthorization also contained new requirements for the Scientific and Statistical Committee (SSC) to recommend acceptable biological catch (ABC) levels to the Council that account for scientific uncertainty. On January 16, 2009, National Marine Fisheries Service (NMFS) published amended guidelines for National Standard 1 (NS1Gs) to provide guidance on how to comply with new provisions of the MSA. In order to comply with these new requirements and guidelines, the Salmon Fishery Management Plan (FMP) would have to be amended.

This process began in March 2009 for the purpose of initiating scoping of an FMP amendment to address the new MSA requirements and NS-1 Guidelines. At that time the Council also identified some related issues that should be considered in the amendment process, including *de minimis* fishing provisions and updates to stock conservation objectives. The Council was interested in potential solutions to complete fishery closures when stock projections were below objectives. Most salmon stocks had some form of allowance for these circumstances, but a few did not, resulting in situations like 2008-2009 (fishery closures) and 2006 (emergency rule promulgation).

1.1 Document Organization

This is an integrated document in regard to the assessments required for an FMP amendment. The Council decision process for this initiative is outlined in Section 1.3. The description of the proposed amendment and impacts in Sections 2.0, 4.0 and 5.0 contain key elements necessary for a Regulatory Impact Review/Initial Regulatory Flexibility Analysis (RIR/IRFA) and EA. Section 5.0 summarizes the relationship of this amendment to other existing laws and policies. Section 5.5 contains or references the information required for a structurally complete RIR/IRFA. The proposed FMP wording changes necessary to implement the amendment appears in Section 6.0. Appendix A contains the names and affiliations of the Salmon Amendment Committee (SAC) members.

1.2 Purpose and Need for Action

The purpose of the proposed action is to provide a framework for specifying biological and management reference points and AMs that will meet the requirements of the revised MSA and NS1Gs to account for uncertainty in the fishery management process, reduce the probability of overfishing, and include clear and objective status determination criteria (SDC), while integrating with existing management processes and capabilities to the degree possible.

This action is needed to bring the Salmon FMP into compliance with new requirements to end and prevent overfishing in the MSA, as amended in 2007, and to address the corresponding 2009 revised National Standard 1 Guidelines (NS1Gs) (CFR § 600.310). The MSA now requires specification of ABC, ACLs, and AMs. The NS1Gs establish a detailed framework that integrates the existing and new biological reference points and AMs. In addition, the proposed action needs to revise SDC and associated actions of the current SDC in the Salmon FMP to make them consistent with the NS1Gs and to address issues with ambiguity, timeliness, and implementation of annual management measures.

Specifically the proposed action needs to:

- Classify salmon stocks in the FMP as “in the fishery” or as “ecosystem components”;
- Identify the salmon stocks for which the international exception to specification of ABC, ACL and AM will apply;

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; MSA-Magnuson Stevens Act; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; SDC-status determination criteria

- Establish a framework for the specification of the following reference points: overfishing limit (OFL), ABC (with a corresponding ABC control rule), ACL, and possibly annual catch target (ACT);
- Establish AMs to prevent the ACL from being exceeded, where possible, and establish AMs to address overages of the ACL;
- Revise the SDC for overfishing, overfished, approaching overfished, and rebuilt to be "measurable and objective" as required by the MSA, and establish maximum fishing mortality threshold (MFMT) and minimum stock size threshold (MSST) reference points used for status determinations;
- Explain how and why "flexibility" in the application of the NS1Gs will be applied in the Salmon FMP;
- Clarify any discrepancies with current "exceptions" as identified in the Salmon FMP with new terminology of the MSA; and
- Integrate, to the extent possible, existing management processes and capabilities.

1.3 Plan Development Schedule and Council Advisory Committee Participation

The expectation for this EA was that the Council would recommend to the Secretary of Commerce (Secretary) adoption of an amended Salmon FMP in time for implementation of regulations affecting ocean salmon fisheries commencing May 1, 2011. However, the exact form and wording of the final recommendations depended on the results of the analyses and findings that are presented in this document. To facilitate this effort an *ad hoc* Salmon Amendment Committee (SAC) was appointed to develop and analyze alternatives and to report to the Council on the progress of the overall initiative.

The committee structure included representatives from NMFS Northwest Region, Southwest Region, Northwest Fisheries Science Center, Southwest Fisheries Science Center, and National Oceanic and Atmospheric Administration (NOAA) General Counsel, plus members of the Salmon Technical Team (STT) representing state and tribal agencies, and a member of the Scientific and Statistical Committee (SSC). The committee was responsible for preparing the draft amendment and Council/public review documents, including modeling and analytical components and written narratives, and for Federal regulatory streamlining responsibilities, including the Council/NMFS interface and Federal internal policies to allow for timely Secretarial review and an approval/disapproval decision of the final Council action at the November 2010 meeting. Individual SAC members were called upon to prepare or submit report sections depending on their particular area of expertise and availability to assist in Council activities. The names of committee members and their affiliations appear in Appendix A.

1.4 Background and Related Documents

1.4.1 Scoping Summary

The Council initiated the FMP amendment process in March 2009, after NMFS had published the final rule for NS-1 Guidelines. The Council initially identified the following topics for tentative inclusion in the amendment process:

- ACL and AM;
- Revised SDC for overfishing and overfished designations;
- Revising stock conservation objectives to include updated MSY values, exploitation rate approaches and *de minimis* fishing provisions for stocks without such measures,
- Exceptions for stocks managed under the Pacific Salmon Treaty, and ;
- Sector ACL/AM for multi-jurisdictional fisheries

The Council directed that preliminary alternatives be developed to facilitate further scoping of issues at the September 2009 meeting. The SAC held a meeting in August 2009, which was open to the public, to

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; MSA-Magnuson Stevens Act; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; SDC-status determination criteria

discuss and further develop issues for Council consideration, and to consider possible alternatives that could exemplify approaches to those issues.

At the September 2009 Council meeting, the SAC presented its scoping summary to the Council and its advisory bodies (SSC, STT, and Salmon Advisory Subpanel [SAS]). After receiving the SAC report, statements from the advisory bodies, and providing an opportunity for public comment, the Council directed that the amendment process focus on issues directly related to the MSA requirements and NS-1 Guidelines related to ACL/AM and SDC, including:

- Determine which stocks or stock complexes would be subject to ACLs and AMs;
- Establish ACLs and AMs for appropriate stocks or stock complexes;
- Revising SDC for Overfishing and Overfished designations;
- Characterization of stock conservation objectives relative to specified reference points (MSY, ABC. ACL, and ACT), and;
- Council action required under the FMP overfishing criteria relating to *de minimis* fishery provisions and fishery closures.

The Council directed the SAC to develop suites of alternatives that would encompass the range of options for the above topics. Alternatives were to include formation of stock complexes with indicator stocks to facilitate setting ACL/AM, with options for quota management in salmon fisheries south of Cape Falcon, and options for using buffers to facilitate traditional time/area salmon fisheries south of Cape Falcon.

The SAC met several times between the September 2009 and June 2010 Council meetings to develop alternatives for presentation to the Council at its June 2010. All meetings of the SAC were noticed in the Federal Register, were open to the public, and provided formal opportunity for public comment.

1.5 Relevant Issues

The alternatives in this EA were initially screened to determine if they deserved further consideration and analysis. The criteria used for the initial screening were based on meeting the purpose and need statement, including requirements of MSA and NS1Gs. Specific criteria evaluated included:

- OFL/ABC/ACL framework includes exploitation rate or catch based reference points such that OFL>ABC≥ACL, or escapement based reference points such that OFL<ABC≤ACL
- SDC are measurable and objective
- The probability of overfishing is less than 50 percent

Viable alternatives were then analyzed to provide a basis for comparing and contrasting alternatives and selecting a preferred alternative. In addition to the above criteria, the analysis consisted of evaluating the following:

- Administrative implementation feasibility
- Scientific assessment capability
- The relative short and long-term economic effects on the fishery
- The effects on cultural resources and activities
- The relative effects on biological factors

Section 6.02 of NOAA Administrative Order 216-6 enumerates a specific set of guidelines for identifying potentially significant environmental impacts resulting from a fishery management action. During the scoping process several of the factors were dropped from further consideration based on the conclusion that they would not be affected by the action. The remaining factors for this EA are:

- The relative affects of the Alternatives to jeopardize the sustainability of any target species that may be affected by the action.
- The relative affects of the Alternatives to jeopardize the sustainability of any non-target species.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; MSA-Magnuson Stevens Act; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; SDC-status determination criteria

- The relative affects of the Alternatives to have a substantial adverse impact on public health or safety.
- The relative affects of the Alternatives to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species.
- The relative affects of the Alternatives to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species.

2.0 DESCRIPTION OF ALTERNATIVES

2.1 Stock Classification

The MSA requires that an FMP describe the stocks[1] of fish involved in the fishery. The NS1 Guidelines provide a structure for classifying stocks in and around the fishery, and organizing stock complexes. These organizing principles are an important first step in developing an FMP that is consistent with the NS1Gs since they affect how other key provisions of the MSA and NS1Gs may be applied including, for example, SDC, and ACLs and AMs. The NS1Gs recommend that stocks identified in an FMP be classified as in or out of the fishery. Target stocks are in the fishery and some non-target stocks could also be in the fishery; ecosystem components stocks are not. This classification scheme helps conceptualize how the fishery operates, which stocks are affected by various fishery sectors, and how SDC and ACL provisions may be applied.

This section identifies alternatives for how salmon stocks currently listed in the FMP could be classified in the FMP consistent with the NS1Gs § 600.310(d). It includes specific recommendations for designating several Chinook and pink stocks as ecosystem components. The section also provides recommendations for application of the international exception. Although the international exception is not directly related to how the fishery is classified, dealing with it here helps simplify the subsequent consideration of alternatives for reference points. Stocks that are subject to an international agreement may be excepted from ACL and AM requirements, but still must have SDC and MSY.

2.1.1 Current Stocks in the FMP

Currently in the Pacific Salmon FMP, there are 12 stock complexes identified that consist of 69 stocks.

- 22 stocks are coho salmon (Table 1)
- 45 stocks are Chinook salmon (Table 2)
- Two stocks are pink salmon (Table 3)
- 23 stocks are listed under the Endangered Species Act (ESA). These are non-target stocks in the fishery and the fishery is managed to minimize impacts on these species. In doing so, the level of harvest of target stocks is limited by these species to varying degrees each year.
- 11 stocks are hatchery stocks (artificially produced stocks comprised exclusively of hatchery production). These make up many of the target stocks in the fishery.
- 64 stocks originate in U.S. streams south of the U.S./Canada border. Most of these are harvested in the Council area salmon fisheries. However, there are some Chinook stocks that originate in southern U.S. streams but have ocean residence primarily north of the U.S./Canada border; these stocks are called "north or far-north migrating (FNM) stocks". These include the fall (CR F) stocks, Washington coastal and Columbia River spring/summer stocks (WA/CR Sp/S), and Washington

[1] The MSA and NS1 Guidelines refer to species and stock as they may be applied to different fishery situations. For the salmon fishery, we are generally trying to distinguish between stocks of salmon and so generally use that term throughout this document.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; MSA-Magnuson Stevens Act; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; SDC-status determination criteria

coastal and northern Oregon summer/fall stocks (WA/OR S/F). Columbia River summer (CR S) Chinook are also currently classified as FNM; however their status is under review. FNM stocks have lower vulnerability to Council area fisheries, and for some stocks, especially the WA/CR Sp/S stocks, to all ocean fisheries.

- Five stocks originate in Canadian streams. The Canadian stocks are highly diverse and generally composed of many individual stocks (e.g., Coastal and Fraser River stocks). Some components of these stocks migrate south into U.S. waters where they are subject to significant harvest.
- 30 FMP stocks are managed jointly with Canada under the Pacific Salmon Treaty (PST), a bilateral agreement between the U.S. and Canada. These stocks include CR S, CR F, WA/OR S/F, and Canadian Chinook stocks, natural coho stocks from the Washington Coast and Puget Sound, and both pink stocks.

Currently in the Pacific Salmon FMP, stock complexes are identified as a way to organize stocks that have similar geographic origins as other stocks (Table 1 and 2). However, they are not necessarily managed as a group as is often the case with many non-salmon stock complexes. Stock complexes in the current FMP were designated for reasons that were applicable at the time, but may no longer serve the purpose of a complex that is described in the NS1 Guidelines. For instance, many of the stocks have their own conservation objectives and their status (i.e., overfishing, overfished) is determined at the individual stock level rather than for the complex as a whole. In some cases, one or more stocks in the current complexes lack sufficient information with which to specify the individual conservation objective, and in these situations, surrogates or indicator stocks from the same complex are used as the basis for their conservation objectives and subsequent management and conservation actions by the Council. For example, there is no aggregate complex-level management or conservation objective for the current Central Valley Chinook complex; fisheries are managed to achieve a conservation objective for Sacramento River Fall Chinook (SRFC) of 122,000-180,000 adult spawners. In general, current salmon stock complexes are used as a convenient grouping of stocks of similar geographic origin, not as a single management unit. As a result, conservation and management actions designed to protect one stock in the complex may or may not provide a similar level of protection for the other stocks in the complex.

The NS1Gs suggests that stock complexes may be identified, but they have a particular purpose. Stock complexes are groups of stocks that are sufficiently similar in geographic distribution, life history, and vulnerabilities to the fishery such that the impacts of management actions on the stocks are similar. At this point in the classification process, we are unsure of the need to designate stock complexes and associated indicator stocks as such. The decision to designate stock complexes and indicator stocks or not will be revisited if the need for them becomes apparent.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Table 1. Coho complexes and stocks listed in the current Pacific Salmon FMP.

Coho Complexes	Coho Stocks	Target	Non-target	ESA Listed	Hatchery stock	Far North Migrating	Subject to PST
Oregon Production Index All Washington, Oregon, and California natural and hatchery coho stocks from streams south of Leadbetter Pt., WA	Central California Coast		X	Threatened			
	Southern Oregon-Northern California Coastal		X	Threatened			
	Oregon Coastal Natural		X	Threatened			
	Columbia River Late - Hatchery	X			X		
	Columbia River Early - Hatchery	X			X		
	Lower Columbia River - Natural		X	Threatened			
Washington Coastal All pertinent natural and hatchery stocks originating in Washington coastal streams north of the Columbia River through the western Strait of Juan de Fuca (West of the Elwha and south of the Sekiu River).	Willapa Bay - Hatchery	X			X		
	Grays Harbor	X					X
	Quinault - Hatchery	X			X		
	Queets	X					X
	Hoh	X					X
	Quillayute - Fall	X					X
	Quillayute - Summer - Hatchery	X			X		
Puget Sound All pertinent natural and hatchery stocks originating from U.S. tributaries to Puget Sound and the eastern Strait of Juan de Fuca (east of Salt Creek).	Strait of Juan de Fuca	X					X
	Hood Canal	X					X
	Skagit	X					X
	Stillaguamish	X					X
	Snohomish	X					X
	South Puget Sound - Hatchery	X			X		
Southern British Columbia Coast	Coastal Stocks						X
	Fraser River						X
4	22						

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Table 2. Chinook complexes and stocks listed in the current Pacific Salmon FMP.

Chinook Complex	Chinook Stocks	Target Stock*	Non-target Stock*	ESA Listed	Hatchery stock	Far North Migrating	Subject to PST
California Central Valley All fall, late-fall, winter, and spring stocks of the Sacramento and San Joaquin Basins	Sacramento River - Fall	X					
	Sacramento River - Spring		X	Threatened			
	Sacramento River - Winter		X	Endangered			
Northern California Coast All fall and spring stocks of California streams north of the entrance to San Francisco Bay	Eel, Mattole, Mad, and Smith Rivers - Fall and Spring	X Smith	X Incidental to harvest of SRFC and KRFC	Eel, Mattole and Mad River stocks - Threatened			
	Klamath River - Fall	X					
	Klamath River - Spring		X Incidental to harvest of SRFC and KRFC				
Oregon Coast All Oregon fall and spring stocks south of the Columbia River	Southern Oregon	X					
	Central and Northern Oregon	X				X	X
Columbia River Basin All pertinent fall, summer, and spring stocks of the Columbia River and its tributaries	North Lewis River - Fall		X	Threatened			X
	Lower River Hatchery - Fall	X			X		
	Lower River Hatchery - Spring		X		X		
	Upper Willamette - Spring		X	Threatened		X	
	Mid-River Bright Hatchery - Fall	X			X	X	
	Spring Creek Hatchery - Fall	X			X		
	Klickitat, Warm Springs, John Day, and Yakima Rivers - Spring		X			X	
	Snake River - Fall		X	Threatened			X
	Snake River - Spring/Summer		X	Threatened		X	
	Upper River Bright - Fall		X			X	X
	Upper River - Summer	X				X; Under Review	X
	Upper River - Spring		X	Endangered			

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Chinook Complex	Chinook Stocks	Target Stock*	Non-target Stock*	ESA Listed	Hatchery stock	Far North Migrating	Subject to PST
Washington Coast All pertinent fall, summer and spring stocks from coastal streams north of the Columbia River through the western Strait of Juan de Fuca (west of the Elwha River)	Willapa Bay Fall (natural)	X				X	
	Willapa Bay Fall (hatchery)	X			X		
	Grays Harbor Fall	X				X	X
	Grays Harbor Spring	X				X	
	Quinault Fall (Hatchery)	X			X		
	Queets Fall	X				X	X
	Queets Spring/Summer	X				X	
	Hoh Fall	X				X	X
	Hoh Spring/Summer	X				X	
	Quillayute Fall	X				X	X
	Quillayute Spring/Summer	X				X	
	Hoko Summer/Fall	X				X	X
Puget Sound All fall, summer, and spring stocks originating from U.S. tributaries to Puget Sound and the eastern Strait of Juan de Fuca (east of Salt Creek)	Eastern Strait of Juan de Fuca Summer/Fall		X	Threatened		X	X
	Skokomish Summer/Fall		X	Threatened		X	X
	Nooksack Spring - early		X	Threatened		X	X
	Skagit - Summer/Fall		X	Threatened		X	X
	Skagit - Spring		X	Threatened		X	X
	Stillaguamish - Summer/Fall		X	Threatened		X	X
	Snohomish - Summer/Fall		X	Threatened		X	X
	Cedar River - Summer/Fall		X	Threatened		X	X
	White River - Spring		X	Threatened		X	
	Green River - Summer/Fall		X	Threatened		X	X
	Nisqually River - Summer/Fall		X	Threatened		X	X
Southern British Columbia Fall and spring stocks of B.C. coastal streams and the Fraser River	Coastal Stocks	X				X	X
	Fraser River	X					X
7	45	25	20	19			

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Table 3. Pink complexes and stocks listed in the current Pacific Salmon FMP.

Pink Complex		Target Stock*	Non-target Stock*	ESA Listed	Hatchery stock	Far North Migrating	Subject to PST
Puget Sound			X				X
Fraser			X				X

2.1.2 Classification Issues

The NS1Gs provide guidance on what stocks would be "in the fishery" or could be considered ecosystem component species; these characteristics were used in establishing the proposed alternatives.

The first step in the classification process is to review the stocks currently listed in the FMP and determine which stocks are still in need of conservation and management measures in Council area fisheries; these stocks will be classified as "in the fishery" (i.e., for which MSA Section 303(a) requirements apply), consistent with the NS1Gs § 600.310(d). Stocks "in the fishery" will include target stocks (stocks that fishers seek to catch for sale or personal use, including "economic discards"), and non-target stocks (fish caught incidentally during the pursuit of target stocks in a fishery, including "regulatory discards") in need of conservation and management. Examples of target stocks in Council area fisheries are hatchery stocks and productive natural stocks with ocean distributions primarily within the Council area. Non-target salmon stocks include ESA-listed stocks or depressed natural stocks (e.g., Strait of Juan de Fuca coho).

Stocks currently in the FMP that are not recommended to be classified as "in the fishery" can either be omitted altogether, if determined not to be in need of conservation and management measures; or can be classified as EC (see NS1Gs § 600.310(d)(5)). If classified as an EC, they would be assessed as to their vulnerability to the fishery and monitored, but not actively managed in Council area fisheries under the Pacific Salmon FMP. ECs do not require specification of reference points. Including these stocks as ecosystem components would, however, allow for continued status monitoring and Essential Fish Habitat (EFH) designation and consultation.

2.1.2.1 Ecosystem Components

Ecosystem component stocks are not considered to be "in the fishery," and do not require specification of reference points. Knowing which stocks are designated as ECs shortens the list that requires more detailed treatment and therefore simplifies the consideration of alternatives for references points that comes later in the process. Section (d)(5) of the NS1Gs provides criteria for classification of EC stocks. Such stocks should:

- Be a non-target species or non-target stock;
- Not be determined to be subject to overfishing, approaching overfished, or overfished;
- Not be likely to become subject to overfishing or overfished, according to the best available information, in the absence of conservation and management measures; and
- Not generally be retained for sale or personal use.

However, The NS1Gs also indicate that retention of the stock would not, in and of itself, preclude consideration of the species under the EC classification. A stocks relative vulnerability is also an important consideration when designating EC stocks.

For this FMP amendment the SAC recommends designating 13 of the FNM Chinook stocks and both pink stocks as ecosystem components. Unique circumstances related to salmon are such that there are some ambiguities related to criteria for classifying EC stocks, but their classification as ECs is consistent with the intent of the NS1Gs and the overall MSA conservation and management requirements related to preventing overfishing and achieving optimum yield (OY).

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Individual salmon caught during the fishery can be distinguished at the species level (e.g., Chinook can be distinguished from coho), but stocks within a species cannot otherwise be identified and selectively released. FNM Chinook stocks are distinguished from other Chinook stocks in the fishery by their low contribution to the fishery. In the current Salmon FMP these FNM stocks were identified as having minimal harvest impacts if the cumulative exploitation rate in Council fisheries during the 1979-1982 base period was less than five percent. Fisheries are now much reduced relative to what they were thirty years ago so Council fishery exploitation rates on these stocks are generally at the low end of the zero to five percent range. A more contemporary analysis of the vulnerability of the FNM stocks is provided in Appendix B. The vulnerability analysis shows that these stocks have low vulnerability relative to other Chinook stocks that are in the fishery, and are very low on the vulnerability scale relative to all stocks and species considered in that overall vulnerability analysis.

Another consideration for an EC designation relates to whether they are retained in the fishery. The abundance of FNM stocks in the fishery is such that they cannot be targeted. Far north migrating Chinook are instead caught incidentally while targeting the abundant hatchery and natural-origin stocks that drive the fishery. Although these stocks are retained, the NS1Gs provides that occasional retention does not itself preclude consideration of the species for EC classification.

Although Council fisheries have little impact on the FNM stocks, they are subject to management and related protections by other management jurisdictions. Some of the FNM stocks are caught in fisheries north of the U.S. Canadian border and are managed under the Pacific Salmon Treaty. All of these FNM stocks are caught in inland fisheries and are thus subject to management controls provided by the states of Washington and Oregon and treaty tribes. As a result, these EC stocks would not be subject to determinations for overfishing, overfished, or approaching an overfished condition. Impacts are such that the reduced attention to stock specific conservation and management measures in Council fisheries associated with an EC designation would have no material effect on whether the stocks become overfished or subject to overfishing in the future.

For similar reasons, the SAC recommends designating the Fraser River and Puget Sound pink stocks as ECs. Pink salmon have a two year life cycle and are abundant only in odd numbered years. Because the pink stocks are returning to Puget Sound and the Fraser River they are only caught in Council fisheries in the northern catch areas off Washington. The catch in Council fisheries in odd numbered years totals a few hundred or at most a few thousand fish relative to run sizes of hundreds of thousands or millions. Exploitation rates in Council area fisheries are therefore fractions of one percent. The vulnerability analysis indicates that pink salmon are one of the least vulnerable species of all the species and stocks in the overall analysis (Appendix B).

Pink salmon are caught incidentally in the fisheries directed at other species and retention is allowed because of the absence of any conservation constraints. As indicated above retention of a stock does not necessarily preclude consideration of an EC designation. Pink salmon are not targeted in the fishery. Recreational fishermen target Chinook and coho salmon which are larger and greatly preferred in terms of table fare. Pink salmon are also not targeted in the Council area commercial fishery because of their low value (cents per pound). Commercial pink salmon fisheries are viable only in cases where there is localized, high volume opportunity. The inland fisheries where these stocks are caught are managed under the Pacific Salmon Treaty. The pink salmon stocks are also not subject to overfishing, and are not overfished or approaching an overfished condition. Impacts are such that the reduced attention to stock specific conservation and management measures in Council fisheries associated with an EC designation would have no material effect on whether the stocks become overfished or subject to overfishing in the future.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

The overriding consideration when making a EC designation is whether it is consistent with MSA conservation and management requirements to prevent overfishing while achieving OY on a continuing basis. Designating the FNM Chinook and pink stocks as proposed is consistent with these requirements. The fisheries that do affect these stocks to the north and in inland areas are managed responsibly. The state, tribal, and federal entities involved with Council area management are also directly involved in the Pacific Salmon Treaty and inland management processes. Since all of these stocks return to Washington and Oregon, except Fraser pinks, the interest in protecting them is clear. Impacts to these stocks in Council fisheries are low, to the point where Council fisheries have no material effect on their status or to achieving OY. Impacts are too low to cause overfishing or contribute to rebuilding if needed. Designating these stocks as ECs does not diminish their protection, it simply defers it to those with the ability and responsibility for their direct management. Because the EC stocks would remain in the FMP, they would continue to be monitored in order to evaluate their status. If circumstances change, their classification as ECs can be reconsidered.

2.1.2.2 The International Exception

The NS1Gs require that FMPs establish ACL mechanisms and AMs for all stocks and stock complexes in the fishery, but provides an exception from the requirement for stocks or stock complexes that are managed under an international agreement in which the U.S. participates. Several coho, Chinook, and pink stocks in the Salmon FMP are subject to management under the Pacific Salmon Treaty (PST). The PST is a bilateral treaty between the U.S. and Canada that relates to the management of salmon stocks affected by the fisheries of both nations. Under MSA Section 3(24) "The term 'international fishery agreement' means any bilateral or multilateral treaty, convention or agreement which relates to fishing and to which the United States is a party." The PST clearly meets the criteria specified in the Magnuson-Stevens Act and NS1G related to international agreements. Although FMP stocks managed under an international agreement may be excepted from the ACL and AM requirements (including specification of ABC), they still require the specification of SDC.

The need for an international exception depends to a degree on how stocks are classified. In the preceding section the SAC recommended classifying the FNM Chinook stocks and two pink stocks as ECs. Ecosystem components are "out of the fishery", and as a result, do not require specification of ACLs or other reference points. These stocks might have been considered for the international exception, but such a designation is moot since ACLs and AMs are not required for EC stocks. Because of the close relationship between stock classification and application of the international exception, the alternatives for use of the international exception are combined with the alternatives for stock classification described below.

The SAC recommends applying the international exception to the five Puget Sound and five Washington coastal coho stocks, to Columbia River summer Chinook, to the two Canadian coho stocks, and to the two Canadian Chinook stocks.

2.1.3 Proposed Alternatives for Stock Classification

In this section, the following alternatives are described:

- Alternatives for stocks currently included in the FMP that will be classified as "in the fishery"
- Alternatives for stocks currently included in the FMP that will be classified as EC
- Alternatives for application of the international exception to the ACL requirements.

The proposed alternatives are broken out separately for coho, Chinook, and pink stocks. To simplify the presentation of the proposed alternatives for stock classification, current stocks listed in the FMP have been organized into groups based on the following characteristics: similar geographic area, life history,

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

ESA-listed, and hatchery produced (Table 4). Some of these stock groupings correspond to complexes identified in the current FMP, although the intent of displaying these stock groupings here is not to reference or establish stock complexes; only to simplify the presentation of alternatives. There are only two pink stocks so no further simplification was required.

Table 4. Coho and Chinook stock groups and abbreviations used in classification alternative descriptions.

Coho			**Chinook**		
Stock Group	**Abbreviation**	**# Stocks**	**Stock Group**	**Abbreviation**	**# Stocks**
Endangered Species Act	ESA	4	Endangered Species Act – California origin	CA ESA	3
Hatchery	HAT	6	Endangered Species Act – Columbia River origin	CR ESA	5
Puget Sound	PS	5	Endangered Species Act – Puget Sound origin	PS ESA	11
Washington Coastal	WA C	5	Hatchery	HAT	5
Canadian	CAN	2	Columbia River Summer	CR S	1
			Columbia River Fall	CR F	1
			Washington Coastal/ Columbia River Spring/Summer	WA/CR Sp/S	5
			Washington Coastal/ Northern Oregon Summer/Fall	WA/OR S/F	8
			California/S. Oregon Coastal	CA/S OR C	4
			Canadian	CAN	2
Totals		22			45

Alternative 1 in the tables below generally represents status quo, or an adaptation of status quo to conform as closely as possible to the new MSA requirements and NS1Gs. Alternatives for coho, Chinook, and pink stocks were structured to correspond to similar classification schemes as much as possible (i.e., Alternative 2 generally proposes that some stocks be designated as EC or are subject to the international exception).

2.1.3.1 Classification Alternatives for Coho Stocks

Table 5. Alternatives for classification of coho stocks.

Classification	**Alternative 1 – Status Quo**	**Alternative 2**
In the Fishery	HAT – 6 PS – 5 WA C – 5 ESA – 4 CAN – 2	HAT – 6[a/] ESA– 4[a/] PS – 5[b/] WA C – 5[b/] CAN – 2[b/]
Ecosystem Component Stocks	None	None

a/ Reference points would be based on hatchery goals and ESA consultation standards. (50 CFR 600.310(h)(3)).
b/ Stocks to which the MSA international exception to specification of ACL will be applied. Specification of ABC will also not be required but specification of SDC reference points are required.

- Alternative 1 reflects status quo with all stocks in the fishery.
- All of the U.S. origin coho stocks have ocean distributions primarily in Council waters and are substantially affected by Council area fisheries. Canadian coho stocks are also affected by U.S fisheries. Therefore no alternatives include coho stocks as ECs.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

- Under Alternative 2 all stocks remain in the fishery, but Puget Sound and Washington Coastal coho stocks, and the two Canadian stock are subject to the MSA international exception to ACLs and AMs.

2.1.3.2 Classification Alternatives for Chinook Stocks

Table 6. Alternatives for classification of Chinook stocks.

Classification	Alternative 1 – Status Quo	Alternative 2
In the Fishery	CA/S OR C – 4 HAT – 5 CA ESA – 3 CR ESA – 5 PS ESA – 11 CR S – 1 WA/OR S/F[a/] – 8 CR F[a/] – 1 WA/CR Sp/S[a/] – 5 CAN – 2	CA/S OR C – 4 HAT – 5[b/] CA ESA – 3[b/] CR ESA – 5[b/] PS ESA – 11[b/] CR S – 1 CAN – 2[c/]
Ecosystem Component Species		WA/OR S/F[a/] – 8 CR F[a/] – 1 WA/CR Sp/S[a/] – 5

a/ Far north migrating (FNM) stocks.
b/ Reference points would be based on hatchery goals and ESA consultation standards. (50 CFR 600.310(h)(3)).
c/ Stocks to which the MSA international exception to specification of ACL will be applied. Specification of ABC will also not be required but specification of SDC reference points are required.

- Alternative 1 reflects status quo with all stocks in the fishery.
- Alternative 2 proposes to classify FNM Chinook stocks as ecosystem component species because they are non-target stocks of the fishery, have low vulnerability to Council area fisheries (see Appendix B), and because exploitation rates in Council area fisheries remains below 5 percent and does not affect stock status. Including these stocks as ecosystem components would, however, facilitate continued status monitoring and EFH consultation.
- Alternative 2 proposes that the two Canadian stocks remain in the fishery, but are subject to the international exception to ACLs and AMs.

2.1.3.3 Classification Alternatives for Pink Stocks

Pink salmon are generally abundant in odd numbered years only. Council area fisheries frequently provide additional opportunity to retain pink salmon (e.g., increased bag limits), but overall impacts are negligible, generally fractions of 1 percent over the last 20 years, and occur only in the northern part of the Washington coastal fishery.

Table 7. Alternatives for classification of pink salmon stocks.

Classification	Alternative 1-Status Quo	Alternative 2
In the Fishery	PS Fraser (CAN)	None
Ecosystem Component Species	None	PS Fraser (CAN)

- Alternative 1 reflects status quo including both pink stocks as "in the fishery" as they are in the current FMP.
- Alternative 2 reflects the low vulnerability of pink stocks to Council area fisheries (see Appendix B), and classifies them as ecosystem components because they are non-target stocks and retention in

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Council area fisheries does not affect stock status. Including these stocks as ecosystem components would, however, facilitate continued status monitoring and EFH consultation.

2.2 Alternatives for Reference Points – Status Determination Criteria

Status Determination Criteria must be specified in fishery management plans to determine the status of a stock or complex.[2] This section presents alternatives to use as SDC to determine:

I. Overfishing
II. Overfished
III. Approaching overfished
IV. Rebuilt

SDC will be applied to natural stocks for which specification of these reference points is appropriate and possible based on the best available science. These reference points will not be specified for any stocks that are identified in the FMP as EC. NS1Gs § 600.310(d)(5)(iii) specify that EC stocks are not considered in the fishery , and specification of reference points is not required.

SDC reference points will not be specified for hatchery stocks and ESA-listed stocks identified in the FMP, consistent with the NS1Gs' provision on flexibility, which cites hatchery and ESA-listed stocks as examples where alternative approaches may be necessary. For hatchery stocks as defined in Table 1, hatchery goals will continue to serve as their conservation objective, rather than specification of MSY-based reference points. For ESA-listed stocks, specification will be deferred until such time that the stocks are de-listed; in the interim, ESA consultation standards will continue to be implemented to meet the stocks' conservation and management needs and to ensure compliance with the ESA. Some natural stocks listed in the FMP currently are managed on the basis of indicator stocks. SDC will be applied to and specified only for indicator stocks; the status of other stocks will not change as a result of indicator stock status changes.

Stocks managed under an international agreement can be excepted from specification of ABC and ACL reference points (50 CFR 600.310(e)(2)(ii)), but they are still required to have MSY and SDC specified.

2.2.1 Criteria Used to Analyze the Alternatives

The criteria used to analyze SDC alternatives were consistency with the NS1Gs and feasibility of implementation. Considerations within the criterion for NS1Gs consistency include:

- The SDC should be objective and measurable[3]
- The SDC should be assessed annually[4],
- The SDC to determine overfishing[5]:should be based on either:
    1. the fishing mortality rate (F) exceeding the maximum fishing mortality threshold[6] (MFMT), i.e**.,** **F > MFMT**, or

[2] See MSA §303(a)(10) and 50 CFR 600.310(e)(2)
[3] MSA §303(a)(10)
[4] 50 CFR 600.310(e)(2)(ii) explains that if SDC should be specified and expressed in a way that enables monitoring of each stock or complex to determine annually, if possible, whether overfishing has occurred or if a stock or complex is overfished.
[5] 50 CFR 600.310(e)(2)(ii)(A)
[6] MFMT is the level of fishing mortality (F), on an annual basis, above which overfishing is occurring. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

2. the annual catch exceeding the overfishing limit (OFL), i.e., **annual catch > OFL**

- The SDC to determine overfished[7] should be based on the minimum stock size threshold[8] (MSST) must be expressed in terms of spawning biomass or other measure of reproductive potential, and should equal whichever of the following is greater: One-half (½) the MSY stock size (S_{MSY})[9], or the minimum stock size at which rebuilding to S_{MSY} would be expected to occur within 10 years, if the stock or complex were exploited at the MFMT.
- SDC to determine approaching overfished[10]: is when a stock is projected to have more than a 50 percent chance that the stock size (S)[11] will decline below the MSST within two years.
- SDC to determine when a stock is rebuilt should be based on a stock achieving S_{MSY}.[12]

2.2.2 Overview of Alternatives

For all of the alternatives:

- SDC are specified for each stock, as opposed to a stock complex;
- all determinations, except approaching overfished, are made postseason; and
- all status determinations are made annually.

Table 8 provides a brief description of the SDC alternatives, including formulaic representations. More detailed descriptions of the alternatives and assessment relative to the evaluation criteria above are provided in the subsequent sections below.

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or F value), or as a function of spawning biomass or other measure of reproductive potential. 50 CFR 600.310(e)(2)(i)(C)

[7] 50 CFR 600.310(e)(2)(ii)(B)

[8] MSST means the size below which the stock or stock complex is considered to be overfished. 50 CFR 600.310(e)(2)(i)(F)

[9] MSY stock size (S_{MSY}) means the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate measure of the stock's reproductive potential that would be achieved by fishing at F_{MSY}. 50 CRF 600.310(e)(1)(i)(C). For salmon, the appropriate measure of the stock's reproductive potential is the number of adult spawners (S).

[10] 50 CFR 600.310(e)(2)(i)(G)

[11] Size (S) of the stock or complex for salmon is the number of adult spawners.

[12] 50 CFR 600.310(j)(3)(i)

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Table 8: Overview of SDC alternatives for overfishing, overfished, approaching overfished, and rebuilt.

Status Category	Alternative 1 Status Quo	Alternative 2 Determination Based on a Single Year	Alternative 3 Determination Based on Multiple Years
I. Overfishing	Not defined in FMP. Assessment conducted upon 3 consecutive years of not meeting conservation objective and determined "overfishing" occurred if fishing was identified as a factor.	F > MFMT in 1 year, with MFMT = F_{MSY}. F used is most recently available postseason value.	Same as Alternative 2
II. Overfished	Not defined in FMP. Interpreted by NMFS as 3 consecutive years of not meeting conservation objective ("overfishing concern" in FMP).	S < MSST in 1 year, with MSST = $S_{MSY}/2$. S used is most recently available postseason value.	GM(S)[13] < MSST over 3 year period, with MSST = $S_{MSY}/2$. S used are 3 most recently available postseason values.
III. Approaching overfished	Not defined in FMP. Approaching "overfishing concern" is 2 consecutive years of not meeting conservation objective and forecast not to meet it in 3rd year.	S < MSST in 1 year, with MSST = $S_{MSY}/2$. S used is current preseason value.	GM(S) < MSST over 3 year period, with MSST = $S_{MSY}/2$. S used are 2 most recently available postseason values and current preseason value.
IV. Rebuilt	Conservation objective met for 1 year, or as otherwise determined in rebuilding plan.	S ≥ S_{MSY} in 1 year. S used is most recently available postseason value.	GM(S) ≥ S_{MSY} over 3 year period. S used are 3 most recently available postseason values.

The status categories for overfished, approaching overfished, and rebuilt within each alternative should be considered together, given the need to have comparable metrics among these abundance-based SDC:

- Alternative 2 - single-year basis
- Alternative 3 - multiple-year basis using a geometric mean

2.2.3 Alternative 1: Status Quo

The current Salmon FMP does not explicitly define when a stock is considered to be experiencing overfishing, overfished, or is approaching overfished; SDC are not currently specified. Rather, the FMP has identified indicators of a declining status for a stock that trigger Council action.

A **"conservation alert"** is triggered during the annual preseason process[14] if a stock is projected to fall short of its conservation objective (MSY, MSY proxy, MSP, or spawning escapement floor).

An **"overfishing concern"** is triggered if a stock fails to meet its conservation objective (evaluated postseason) for three consecutive years. If an overfishing concern is triggered, the FMP requires an assessment of factors that led to the shortfall. The Council directs its STT to work with state and tribal fishery managers to complete an assessment of factors that led to the overfishing concern within one year. Based on the results of the assessment, the STT will recommend management actions (i.e., a rebuilding plan) that will result in recovery of the stock in as short a time as possible, preferably within ten years or less, and provide criteria for identifying stock recovery and the end of the overfishing concern. In

[13] GM(S) denotes geometric mean of S.

[14] See Chapter 9 of the Salmon FMP

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

addition the Council directs its Habitat Committee (HC) to work with federal, state, local, and tribal habitat experts to review the status of the essential fish habitat affecting this stock and, as appropriate, provide recommendations to the Council for restoration and enhancement measures within a suitable time frame. The timing of this process is described in Figure 1 below.

Because the FMP provides no specific guidance about when or under what circumstances a stock should be considered subject to overfishing or overfished, it has resulted in confusion and inconsistent status determinations. Absent clearly defined SDC, NMFS made a policy decision in 2009 to declare a stock "overfished" if it triggers an "overfishing concern" under the FMP. The Council directed the SAC to propose new SDC that provide clearer criteria for making status determinations, as required by the MSA. The proposed alternatives to the status quo all incorporate the reference points identified in the NS1Gs (e.g., F_{MSY}, MFMT, MSST). However, the proposed definitions of some of these references points differ slightly from those in the NS1Gs to accommodate the life history of Pacific salmon, where reproduction is semelparous and a stock's full reproductive potential can be spread out over a multi-year period. These modified approaches are proposed in accordance with the provision allowing for flexibility in the application of the NS1Gs.[15]

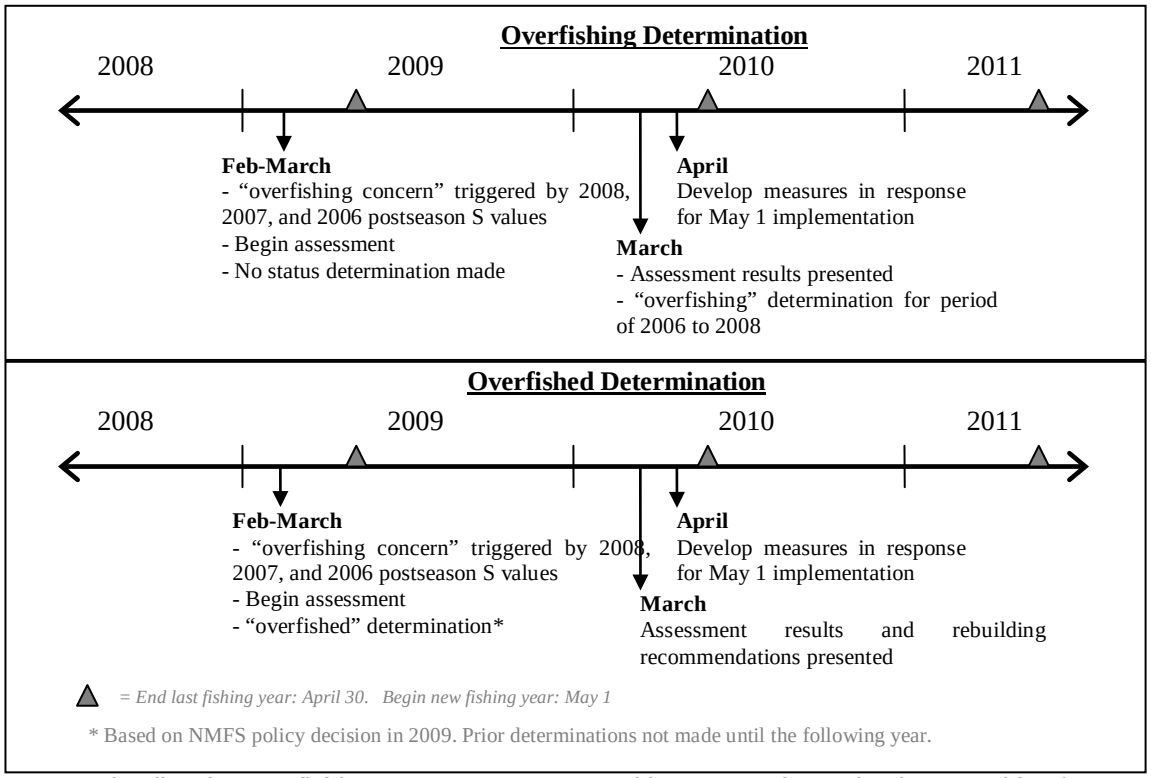

Figure 1. Timeline for overfishing concern process, making status determinations, and implementation of management response. Example timeline assumes "overfishing concern" is triggered in 2009.

2.2.3.1 Status quo definition of "overfishing".

Overfishing status is undefined in the FMP. After the triggering of an "overfishing concern", the STT conducts an assessment to determine whether overfishing occurred. If the STT assessment concludes that excessive fishing contributed to a stock not meeting its conservation objective for three years in a row, overfishing is said to have occurred.

[15] 50 CFR 600.310(h)(3)

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

2.2.3.2 Status quo definition of "overfished"

Overfished status is undefined in the FMP. As of 2009, a NMFS policy decision was made to interpret a stock that has not met its conservation objective for three consecutive years (i.e., an "overfishing concern" under the FMP) to be overfished.

2.2.3.3 Status quo definition of "approaching overfished"

The FMP does not have explicit criteria for approaching an overfished condition status; however, when a stock has failed to achieve its conservation objective for two consecutive years and is projected not to meet the objective in the third year (a conservation alert), the FMP requires some specific action by the Council. The Council must notify pertinent fishery and habitat managers, advising them the stock may be temporarily depressed or approaching an overfishing concern and request the pertinent state and tribal managers to do a formal assessment of the primary factors leading to the shortfalls and report their conclusions and recommendations to the Council no later than the March meeting prior to the next salmon season.

2.2.3.4 Status quo definition of "rebuilt"

The default criterion in the FMP for when a stock is considered rebuilt is when its conservation objective is met for one year. In cases where a rebuilding plan has been adopted, the stock is considered rebuilt when the criteria defined in the rebuilding plan have been met.

2.2.3.5 Assessment of Status Quo SDC Alternatives

The status quo status determination criteria are not completely objective and measurable. Determination if overfishing occurred is not measurable for some stocks and is not objective. Overfishing determinations are case-specific; based on the STT assessments made after a stock has triggered an overfishing concern, not on an annual basis. Overfishing has generally been determined based on an amount of catch (analogous to an OFL) as opposed to a rate of fishing (analogous to a MFMT), and specification of the catch amount that results in overfishing has been determined differently for various STT overfishing assessments. This process has not resulted in a consistent definition of overfishing across stocks and is ambiguous.

Overfished status, while not defined in the FMP, is interpreted by NMFS as a stock subject to an overfishing concern. The NMFS interpretation of overfished is both objective and measurable. The assessments of whether stocks have met conservation objectives are made annually during the preseason planning process. The overfished status has been based on S.

The approaching overfished status is measurable and objective as both postseason estimates and preseason forecasts of S are routinely made during the preseason process. Approaching overfished status is based on postseason estimates, and preseason forecasts of S.

Rebuilt status may or may not be predicated upon an adopted rebuilding plan, which may specify rebuilding benchmarks that are or are not objective or measurable. Also, it is unclear in the FMP when the "default" rebuilding plan should be implemented versus development of a separate rebuilding plan and associated criteria for defining the end of the "overfishing concern".

The combination of terminologies used under the status quo has also proven very confusing. Even though a stock is determined as "overfished" under the status quo, an "overfishing concern" under the FMP is nevertheless triggered, leading to a great deal of confusion among stakeholders and the public about the true status of the stock. For instance, the stock might be determined as "overfished" but not "subject to overfishing", yet it has triggered an "overfishing concern".

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

Consistency with NS1Gs: The status quo alternative is partially consistent with NS1Gs, but is deficient in several important areas.

Overfishing: Determination if overfishing occurred is not measurable for some stocks and is not objective. Overfishing determinations are case-specific; based on the STT assessments made after a stock has triggered an overfishing concern, not on an annual basis. Overfishing has generally been determined based on an amount of catch (analogous to an OFL) as opposed to a rate of fishing (analogous to a MFMT), and specification of the catch amount that results in overfishing has been determined differently for various STT overfishing assessments. There is also a time lag of up to one year after the overfishing concern is triggered to conduct an assessment. During the interim, no status determination is made. This process has not resulted in a consistent definition of overfishing across stocks and is ambiguous.

Overfished: Overfished status, while not defined in the FMP, is interpreted by NMFS as a stock subject to an overfishing concern. The NMFS interpretation of overfished is both objective and measurable. The assessments of whether stocks have met conservation objectives are made annually during the preseason planning process, and are made in the year immediately following triggering of an overfishing concern. The overfished status is based on the MSY conservation objective, which in this case is equivalent to an MSST.

Approaching Overfished: The status quo alternative is consistent with NS1Gs in that there are specific objective and measurable criteria to use for determining when a stock is approaching an overfishing concern, which has been interpreted as overfished. Approaching overfished determinations are made annually during the preseason planning process. If the stock has failed to meet its conservation objective for the two previous years, and the forecast of S equals the conservation objective, the probability of becoming overfished in the current year is 0.5, assuming an unbiased predictor. If the forecast of S is lower than the conservation objective, the probability of becoming overfished in the current year is greater than 0.5, assuming an unbiased predictor.

Rebuilt: The default criterion in this alternative is compatible with the NS1Gs because it requires a stock to achieve its MSY based conservation objective. The overfishing assessment process, which includes specifying rebuilt criteria in a formal rebuilding plan, could result in criteria that is not consistent with the NS1Gs because rebuilding benchmarks may not measurable or objective. It is also unclear when the default rebuilding plan should be implemented versus development of a separate rebuilding plan.

Feasibility of Implementation: Implementation is feasible as status quo is the current status determination process. However, the requirement for STT overfishing assessments, including development of criteria for overfishing, overfished, and rebuilt, can be burdensome given time constraints and can lead to inconsistencies in status determination.

2.2.4 Alternative 2: Single Year Basis SDC

Single year based SDC are used for many fish species, and the NS1Gs recommend a default overfished criteria (MSST) of $S_{MSY}/2$. This alternative would require determination of overfishing, overfished, approaching an overfished condition, and rebuilt based on annual evaluations. Status determinations would be predicated upon meeting various fishing mortality (F) or escapement (S) benchmarks in the previous year only.

2.2.4.1 Overfishing.

A stock would be considered subject to overfishing when the postseason estimate of F exceeds the MFMT, where the MFMT is defined as $F_{MSY.}$ Stock-specific estimates of F_{MSY} based on spawner-recruit

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

data would be used if available. Otherwise, species-specific proxy values of F_{MSY} = 0.75 for Chinook, and F_{MSY} = 0.60 for coho, based on species-specific meta-analyses, would be used. Stock specific overfishing determinations would be made annually and based on exploitation during a single biological year. Figure 2 illustrates SDC reference points for KRFC and SRFC relative to the current conservation objectives and the estimated and proxy values for F_{MSY} and S_{MSY}.

2.2.4.2 Overfished.

A stock would be considered overfished if S falls below its MSST in a single year, with MSST defined as $S_{MSY}/2$. Stock specific overfished determinations would be made annually.

2.2.4.3 Approaching an Overfished Condition.

An approaching overfished determination would be made when the preseason forecast of S is falls below MSST in a single year. Stock specific determinations would be made each year during the preseason planning process.

2.2.4.4 Rebuilt

A stock would be rebuilt when S exceeds S_{MSY} for one year. The determination would be made annually during the preseason process.

2.2.4.5 Assessment of Single Year SDC Alternatives

Consistency with NS1Gs: The Alternative 2 SDC are consistent with NS1Gs.

Overfishing: Alternative 2 SDC to determine overfishing are based on MFMT, which is objective and measurable. Determinations would be made annually, and for most stocks could be made in the year immediately following the year in which exploitation may have occurred. However, estimating F for some stocks may take longer due to the availability of stock specific run reconstruction information. An overfishing SDC based on MFMT is consistent with one of the definitions in the NS1Gs.

Overfished: Alternative 2 SDC to determine overfished are based on MSST, which is objective and measurable. Determinations would be made annually, and generally could be made during the preseason planning process following the most recent return year. MSST is adopted as defined in the NS1Gs. Defining MSST in terms of S is consistent with the NS1Gs' requirement to define MSST as a measure of reproductive potential. Defining MSST as $S_{MSY}/2$ is appropriate because salmon populations are relatively productive (see Appendix B).

Approaching Overfished: Alternative 2 SDC to determine approaching overfished are objective and measurable. The criterion would be determined annually during the preseason planning process. If the preseason forecast of S equals the MSST, the probability of becoming overfished in the current year is 0.5, assuming an unbiased predictor. If the forecast of S is lower than the MSST, the probability of becoming overfished in the current year is greater than 0.5, assuming an unbiased predictor.

Rebuilt: Alternative 2 SDC to determine rebuilt are objective and measurable; benchmarks would be clearly identifiable. Rebuilt status determinations would be made annually during the preseason planning process. The NS1Gs generally refer to a rebuilt condition as achieving a stock or complex's S_{MSY}.

Feasibility of Implementation: Implementation of Alternative 2 is generally feasible. Postseason estimates of both F and S are routinely made for many stocks, though new methods may be needed for some stocks to obtain postseason estimates for these quantities in the immediately previous year. In some cases, postseason estimates of F made in the following year may be of lower quality than estimates made

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

two or three years later. This alternative will also streamline the FMP assessment and reporting to Congress processes.

Other Considerations: While it is, or can be, possible to make an overfished determination based on metrics estimated one year prior, it is not clear whether this accurately represents the status of salmon stocks. Salmon stock abundances can be quite variable owing in part to the semelparous nature of reproduction and short generation times. Hence, falling below the MSST in a single year may not be indicative of a longer term trend toward depressed abundance or the ability of the stock to produce MSY on a continuing basis. This reasoning also applies to the rebuilt determination. A single strong year class resulting in one year of exceeding S_{MSY} for a severely depressed stock may not truly represent that the stock is rebuilt.

2.2.5 Alternative 3: 3-Year Geometric Mean Basis SDC

Salmon are relatively short-lived species with spawning escapements of coho and pink salmon dominated by a single year-class, and Chinook spawning escapements dominated by no more than two year-classes. The abundance of year-classes can fluctuate dramatically with combinations of natural and human-caused environmental variation. Therefore, it is not unusual for a healthy and relatively abundant salmon stock to produce occasional spawning escapements which, even with little or no fishing impacts, may be significantly below the long-term average associated with the production of MSY. Therefore, low stock size in one year is not necessarily a cause for concern; however, when longer-term stock depression could signal the beginning of a critical downward trend, which may jeopardize the capacity of the stock to produce MSY over the long term if appropriate actions are not taken.

Alternative 3 would require determination of overfished, overfishing, approaching overfished, and rebuilt based on annual postseason evaluations. The definition of overfishing in Alternative 3 is equivalent to Alternative 2. However, the definitions of overfished, approaching overfished, and rebuilt are different in that they require multi-year postseason estimates of S to be assessed.

2.2.5.1 Overfishing

Same as 2.3.4.1: A stock would be considered subject to overfishing when the postseason estimate of F exceeds the MFMT, where the MFMT is defined as $F_{MSY.}$ Stock-specific estimates of F_{MSY} based on spawner-recruit data will be used if available. Otherwise, species-specific proxy values of F_{MSY} = 0.75 for Chinook, and F_{MSY} = 0.60 for coho, based on species-specific meta-analyses, will be used. Stock specific overfishing determinations are made annually and based on exploitation during a single biological year.

2.2.5.2 Overfished

A stock would be considered overfished if the 3-year geometric mean of S fell below the MSST, defined as $S_{MSY}/2$. Overfished determinations would be made annually using the three most recently available postseason estimates of S.

2.2.5.3 Approaching an Overfished Condition

An approaching overfished determination would be made if the geometric mean of the two most recent postseason estimates of S, and the current preseason forecast of S, is below the MSST.

2.2.5.4 Rebuilt

A stock would be rebuilt when the 3-year geometric mean of S exceeds S_{MSY}.

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

2.2.5.5 Assessment of 3-Year Geometric Mean SDC Alternatives

Consistency with NS1Gs: The Alternative 3 SDC are consistent with NS1Gs.

Overfishing: Same comments as Alternative 2.

Overfished: Alternative 3 SDC to determine overfished are based on MSST, which is objective and measurable. Determinations would be made annually, and generally could be made during the preseason planning process following the most recent return year. MSST is not defined in a single year as in the NS1Gs (CFR 600.310 (e)(2)(ii)(B); however, the multi-year criterion does more accurately reflect the risk to reproductive potential as discussed above. Defining MSST in terms of S is consistent with the NS1Gs' requirement to define MSST as a measure of reproductive potential. Defining MSST as $S_{MSY}/2$ is appropriate because salmon populations are relatively productive (see Appendix B).

Approaching Overfished: Alternative 3 SDC to determine approaching overfished are objective and measurable. The criterion would be determined annually during the preseason planning process. If the stock has failed to meet its conservation objective for the two previous years, and the forecast of S equals the conservation objective, the probability of becoming overfished in the current year is 0.5, assuming an unbiased predictor. If the forecast of S is lower than the conservation objective, the probability of becoming overfished in the current year is greater than 0.5, assuming an unbiased predictor.

Rebuilt: Same comments as Alternative 2.

Feasibility of Implementation: Same comments as Alternative 2.

Other Considerations: Overfished, approaching overfished, and rebuilt status defined in Alternative 3 are designed to acknowledge the variability common in salmon populations. Salmon stock abundances can be quite variable owing in part to the semelparous nature of reproduction and short generation times. Use of the geometric mean of the most recently available 3-year postseason estimates of S would decrease the probability of a stock being declared overfished as a result of a single weak year class. Conversely, a single strong year class would be unlikely to result in a rebuilt status for an otherwise severely depressed stock. Reproductive potential of a stock, given the inherent variability of salmon populations, may best be described using a multi-year metric. The multi-year approach to status determination is currently used in the FMP to identify an overfishing concern for the same reasons, although the metric is different.

2.2.6 Stock Specific Considerations

Based on the proposed action (Alternative 2) in Section 2.1 of this document, the relevant stocks for specifying SDC reference points include KRFC, SRFC (Figure 2), Columbia Upper River summer Chinook, Washington Coast coho, and Puget Sound coho. These stocks are relatively data rich, having age-structured information and models to assess compliance with both S and F based SDC.

Puget Sound coho have conservation objectives based on stepped exploitation rates associated with abundance break points. These objectives were established through the *U.S. v. Washington* process, and subsequently adopted into the PST and the Salmon FMP. The abundance break points correspond to MSY under average and low survival conditions. Using an SDC of $S_{MSY}/2$ would result in overfished status criteria at stock sizes that were less than the lower break point estimate of S for all Puget Sound coho stocks except Strait of Juan de Fuca. For this stock the lower break point estimate of S corresponds to $0.426S_{MSY}$. While this lower abundance break point does not correspond with $S_{MSY}/2$, it may be appropriate to use the lower abundance break point for the overfished and approaching overfished criteria because additional management constraints are already required under the FMP and PST, and it would be duplicative and inconsistent to require similar actions at two different, but similar reference points. It

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

would be unnecessarily burdensome to require additional management actions at two such similar reference points that are intended to address similar circumstances. Therefore, the Strait of Juan de Fuca coho SDC for overfished and approaching overfished under Alternatives 2 and 3 correspond to the S associated with the low/critical abundance break point and the low exploitation rate established in its FMP conservation objective. For the other PS coho stocks, the lower break point estimate of S range from $0.731S_{MSY}$.to $1.090S_{MSY}$. Adopting SDC for overfished status that is greater than S_{MSY} (i.e., Hood Canal coho) is obviously untenable and the low break point abundance for other stocks are also comparatively close to S_{MSY}. Therefore, the Hood Canal, Skagit, Stillaguamish, and Snohomish coho SDC for overfished and approaching overfished under Alternatives 2 and 3 correspond to $½S_{MSY}$.

The current conservation objective and control rule for Oregon South Coast Chinook could allow for S based SDC; however, there is insufficient information to directly assess F based SDC. Oregon South Coast Chinook, or some stock components thereof, may have soon have new objectives that would facilitate setting F based SDC, pending an ongoing review/revision of management objectives for that stock complex. Another option for that stock would be to use a surrogate stock for F based SDC (e.g., KRFC).

The Canadian Chinook and coho stocks identified in the FMP are actually large stock complexes, made up of many individual stocks. The Canadian management agencies are responsible for determining the status of these individual stocks as they relate to provisions of the PST and other Canadian statutes. The Council has no authority to monitor or assess status of these individual stocks, or to specify their management objectives. The Council also has no authority to establish reference points for the larger stock complexes. Therefore, specification of SDC for Canadian stocks in the Council's Salmon FMP is not feasible. The Council will continue to abide by the terms of the PST and manage its fisheries accordingly.

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

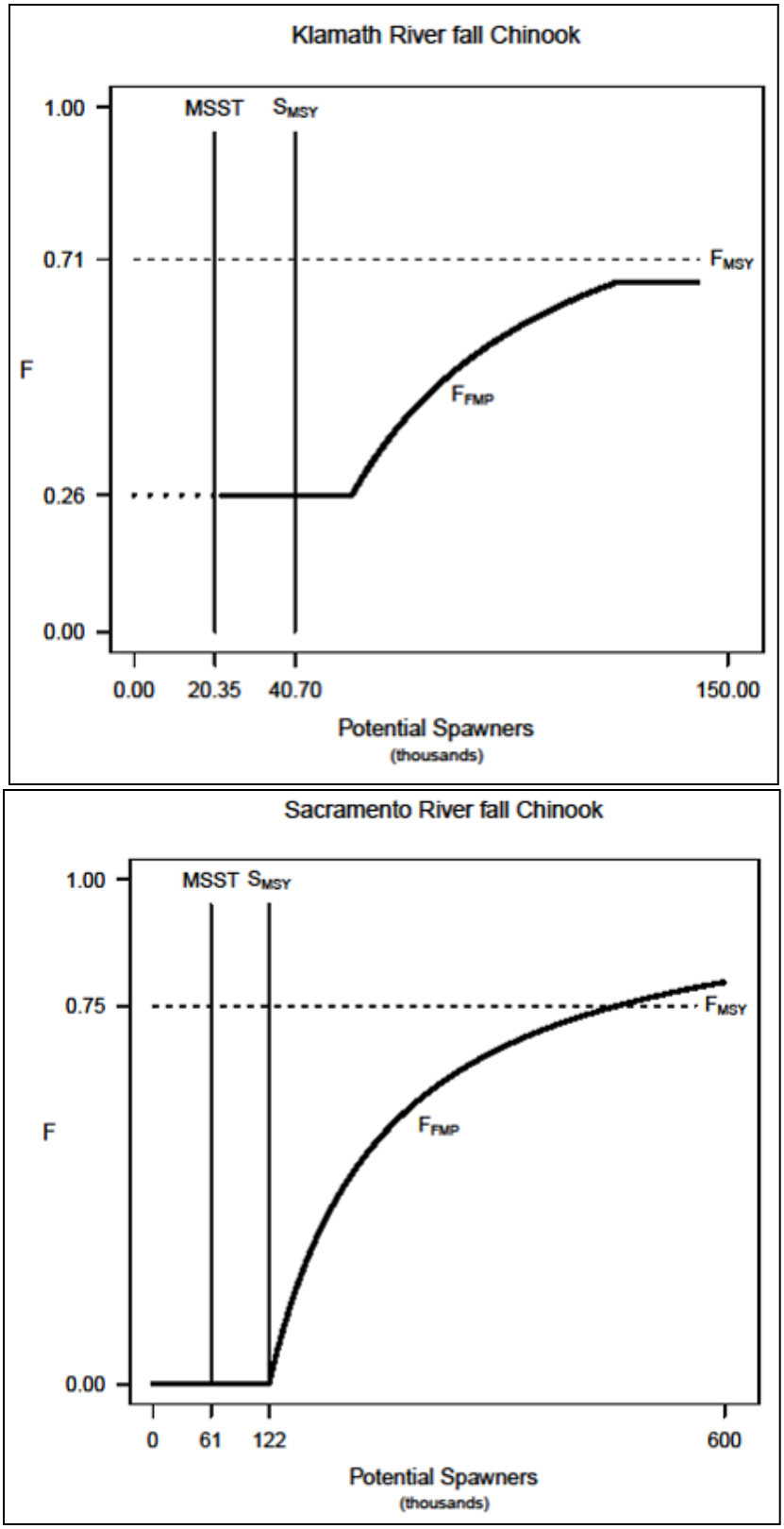

Figure 2. Current conservation objective control rule and Alternative 2 and 3 SDC reference points for Klamath River fall Chinook and Sacramento River fall Chinook.

F-fishing mortality rate; MFMT-maximum fishery mortality threshold; MSST-minimum stock size threshold; MSY-maximum sustainable yield; NS1Gs-National Standard 1 Guidelines; OFL-overfishing limit; S-spawning escapement; SDC-status determination criteria

2.3 Reference Points – OFL/ABC/ACL Framework

Alternatives for specification of OFL, ABC, and ACL reference points will be made on an individual stock basis for all stocks as required, and to the extent possible based on the best available science. These reference points will not be specified for any stocks that are identified in the FMP as ecosystem component species or stocks that are internationally managed. A statutory exception exists to the requirement for specification of an ACL where they are "otherwise provided for under an international agreement…". The NS1Gs state that with respect to the language regarding international agreements that "this exception applies to stocks or stock complexes subject to management under an international agreement." The NS1Gs also state that for internationally-assessed stocks, an ABC as defined in the NS1Gs is not required if they meet this international exception (see Section 2.1.3 for a list of salmon stocks proposed for classification as ecosystem components and stocks proposed as meeting the international exception).

The reference points identified in this section will not be specified for hatchery stocks and ESA-listed stocks identified in the FMP. This is consistent with the NS1Gs' provision on flexibility, which cites hatchery and ESA-listed stocks as examples where alternative approaches are necessary. For stocks classified as hatchery stocks (Tables 1 and 2), hatchery goals will continue to serve as conservation objectives rather than specification of MSY-based reference points. For stocks classified as ESA stocks (Tables 1 and 2), ESA consultation standards and recovery plans will continue to serve as conservation measures and SDC.

Based on the SAC recommended stock classifications (Alternative 2) in Section 2.1 of this document, the relevant stocks for specifying OFL/ABC/ACL reference points are KRFC and SRFC. It is possible that South Oregon Coast Chinook, or some stock components thereof, may also require specification of these reference points prior to or shortly after implementation of this FMP amendment, depending on the outcome of an ongoing review/revision of management objectives for that stock complex.

The NS1Gs allow flexibility in specification of OFL/ABC/ACL reference points if non-standard approaches do not fit well within the NS1Gs (50 CFR 600.310(h)(3)). This flexibility includes specification of ACLs for stock complexes, Pacific salmon as an example of an appropriate application of stock complex management[16]. However, complex-level OFL, ABC, and ACL reference points are not being considered for Chinook fisheries south of Cape Falcon in the Salmon FMP amendment process at this time. These fisheries have been managed for the most part by time-area specific regulations on the number of days open to fishing, with small, mixed-stock quotas used occasionally in some areas. The harvest management models used by the Council for south of Cape Falcon Chinook fisheries, the Klamath Ocean Harvest Model (KOHM) and Sacramento Harvest Model (SHM), would require new, currently unavailable data, as well as extensive structural modifications to be successfully used to forecast harvest and escapement of KRFC and SRFC exclusively from large mixed-stock quota fisheries. In particular, the data richness differences between KRFC (data rich; age structured catch and escapement data available) and SRFC (data poor; age structured catch and escapement data not available) results in different model structures which does not allow for direct translation of catch expectations into large-scale mixed-stock quotas. The models, however, are well suited for forecasting catch and escapement of their respective stocks given the current and historic blend of days-open and mixed-stock quota fisheries for Chinook, and have performed well as assessment tools for Council management in the area South of Cape Falcon.

[16] 50 CFR 600.310(d)(8)

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

2.3.1 Alternative Reference Points for OFL, ABC, and ACL

Alternatives for these reference points are not sufficiently developed to present more than a cursory overview of possible approaches. The proposed classification of stocks will have considerable effects on the viability of approaches for specifying these reference points, as will the specification of SDC for overfishing. Regarding the latter, implementation feasibility and assessment capability will be of particular interest. At this stage, the SAC anticipates moving forward with development of alternatives for OFL, ABC, and ACT based on the alternatives presented in Sections 2.1 and 2.2. Table 9 presents a conceptual view of stock specific based alternatives to be further considered. Other alternatives may also be considered if it becomes apparent that none of these alternatives are viable, or that other alternatives are viable. As mentioned above, flexibility in specification of these reference points is permissible under the NS1Gs; any use of such flexibility will be thoroughly documented, and reviewed for consistency with the MSA.

Table 9. Overview of alternatives for OFL, ABC, ACL, ACT, and the associated framework.

Alternatives	OFL	ABC	ACL[a/]	ACT[b/]	Framework
1) Status Quo	Not identified	Not identified	Not identified	Not identified	--NA— Current conservation objectives specified not to exceed (S_{MSY})
2) Fishing Mortality Rate (F) Based	F_{MSY}	F_{ABC}	F_{ACL}	F_{ACT} [b/]	$F_{MSY} > F_{ABC} = F_{ACL} > F_{ACT}$ Buffer between F_{MSY} and F_{ABC} is 5% or 10%[c/]
3) Catch (C) Based	C_{OFL}	C_{ABC}	C_{ACL}	C_{ACT} [b/]	$C_{OFL} > C_{ABC} = C_{ACL} > C_{ACT}$ Buffer between C_{OFL} and C_{ABC} is 5% or 10%[c/]
4) Spawning Escapement (S) Based	S_{OFL}	S_{ABC}	S_{ACL}	S_{ACT} [b/]	$S_{OFL} > S_{ABC} = S_{ACL} > S_{ACT}$ Buffer between SE_{OFL} and S_{ABC} is 5% or 10%[c/]

a/ In addition to the ACL representing total mortality, a sector or Federal (Council area) ACL may be considered An ACL_{PFMC} would be that portion of the ACL taken in Council area fisheries, including state water fisheries inside three nautical miles of the Federal EEZ (i.e., ocean waters between the U.S./Canada border and the U.S./Mexico border. It would not include inland marine, freshwater, Canadian, Alaskan waters, or Federal waters off the coast of Alaska.

b/ ACT could be used, as needed, but undefined at this time.

c/ The buffer is either 5% or 10%, depending on whether the F_{MSY} value represents a stock-specific estimate (Tier 1) or proxy value (Tier 2), respectively.

Salmon present a complicated situation for establishing MSA reference points such as ABC and ACL because ultimately, all stocks are vulnerable to ocean fisheries to the north of the U.S./Canada border and/or inland fisheries that are not under Council authority. Therefore, projected increases to spawning escapement from Council area management measures can potentially be harvested by intercepting fisheries to the north or subsequent inland fisheries, resulting in no net benefit to spawning escapement, and a net economic transfer of benefits from MSA fisheries to other fisheries. In practice, Council fisheries are coordinated with those of other management jurisdictions and designed to meet conservation objectives for each stock while anticipating impacts in other fisheries. The record indicates that these cooperative management arrangements do in fact work as the Council's conservation objectives are generally being met. Nonetheless, for many stocks a significant proportion of the overall harvest impact

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

occurs in fisheries that are outside the Council's jurisdiction. Therefore, Council area sector ACLs (ACL_{PFMC}) may be considered in this amendment.

2.4 Alternatives for Accountability Measures

The NS1Gs describe AMs as management controls to both prevent ACLs from being exceeded, and to correct or mitigate overages of ACLs if they occur. AMs are intended to minimize the frequency and magnitude of overages, and correct any problems that caused the overage. They can be categorized as either inseason or postseason AMs. They can also be associated with total ACLs or sector ACLs (e.g. ACL_{PFMC})

2.4.1 Alternative 1: Status Quo

There are no measures in the FMP identified currently as AMs; however, a number of actions meet the intent of AMs, and could be defined as such. Inseason measures in the FMP include:

- Inseason closure authority
- Mixed stock quota monitoring
- Quota partitioning
- Quota trading
- Allocation schedules
- Changes to gear/bag/size/trip limits
- Boundary modifications
- Landing restrictions, and
- Reporting requirements.

All of these measures are associate with Council area fisheries only, and do not apply to northern or inland fisheries. Therefore, if adopted as AMs, these measures would be associated with ACL_{PFMC}.

There are also a number of actions that meet the definition of postseason AM:

- Annual SAFE document
- Overfishing concern assessment
- Conservation alert assessment
- EFH assessment
- Notice to state/tribal managers, and
- The methodology review process

All of these measures include effects from non-Council area fisheries, and would therefore be associated with total ACLs.

The SAC recommends adopting the above as AM

Depending on the alternatives for ACLs, other AMs may be necessary to meet the intent of the MSA. For example, ACLs for individual stocks may include inseason genetic stock identification (GSI) monitoring.

2.4.2 ACT

ACTs are specific type of AMs intended to reduce the probability of exceeding an ACL due to management uncertainty. Specification of ACT may or may not be appropriate, and will depend on the form of ACLs (and possibly ACL_{PFMC}) specified. At this time, the SAC has not developed any ACT alternatives, but may do so pending development of ACLs.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

2.5 De Minimis Fishing Provisions

The FMP conservation alert currently requires closure of all Council area salmon fisheries affecting stocks that are projected not to meet their conservation objective. This provision has in some cases resulted in the closure of fisheries and foregone harvest of more abundant stocks, and in other cases the promulgation of emergency rules to gain access to more abundant stocks. However, due to a number of reasons, this provision is not applied uniformly to all salmon stocks. Stocks that are subject to U.S. Court orders under *U.S. v. Washington* and *Hoh v. Baldrige* may be exempt if the Parties agree on annual management objectives that differ from those of the FMP. Stocks that have exploitation rate (ER) based management objectives are permitted a minimum exploitation rate regardless of stock status. KRFC have an explicit *de minimis* fishing provision as a result of Amendment 15 (Figure 2). FNM stocks with minimal impacts (less than 5 percent base period exploitation rate) in Council area fisheries are currently exempt from the conservation alert provisions in the FMP, as are ESA listed and hatchery stocks. In this amendment, FNM stocks are proposed to be classified as EC stocks (i.e., out of the fishery) and therefore would remain unaffected.

Currently, only SRFC must either comply with the conservation alert provision or require an emergency rule to implement fisheries. This is by virtue of having both a spawning escapement based conservation objective and an available preseason forecast. Oregon South Coast Chinook may also soon be subject to the provision, pending completion and adoption of new conservation objectives and development of preseason forecasts for those stocks.

De minimis fishing provisions give more flexibility to the rule-making process when the conservation objectives for limiting stocks are projected not to be met; and provide appropriate opportunity to access more robust salmon stocks that are typically available in the Council management area when the status of one stock may preclude all ocean salmon fishing in a large region. At a minimum, this should allow for Council action without the need for NMFS to approve an emergency rule while providing for *de minimis* salmon fishery impacts. This will reduce the risk of fishery restrictions that impose severe economic consequences to local communities and states. While this action seeks to provide management flexibility in times of scarcity, there is an overriding mandate to preserve the long-term productive capacity of all stocks to ensure meaningful contributions to ocean and river fisheries in the future, and to ensure that the total fishing mortality rate does not exceed F_{MSY}.

2.5.1 *De minimis* Fishing Alternatives

For stocks that are managed for a spawning escapement objective, like SRFC, *de minimis* fishing provisions will modify the conservation objective control rule to permit limited exploitation at low abundance levels (See Figure 2 for examples of control rules with [KRFC] and without [SRFC] *de minimis* provisions). For stocks that currently have a *de minimis* fishing mechanism through the *Hoh v. Baldrige* or *U.S. v. Washington* processes, any additional *de minimis* fishing provisions would not affect the ability of the Parties to exercise their options. For stocks without a minimum exploitation rate included in its conservation objective control rule, or otherwise excepted from the Conservation Alert action, alternative *de minimis* fishing provisions could include maximum ER limits as follows:

2.5.1.1 Total Exploitation Rate Alternatives

Alternatives based on ER in all fisheries provide more certainty to the effects of fisheries in any given year; however, more input from non-Council area managers would be required so the Council could set appropriate limits on its fisheries. There are a number of current conservation objectives based on total ER, including:

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

- $F_t \leq 20\%$ adult equivalent (AEQ) ER in all fisheries. This is similar to the Puget Sound coho critical stock status maximum ER.
- $F_t \leq 8\%$ AEQ ER in all fisheries. This is similar to the OCN coho workgroup matrix lowest status category.
- $F_t \leq 35\%$ AEQ ER in all fisheries. This is similar to the ESA guidance for LCR tule Chinook.

2.5.1.2 Southern U.S. Exploitation Rate Alternatives

Alternatives based on ER in Council area and inland fisheries fit well into the Council process because negotiations between ocean and inland fisheries occur as part of the Council process, thus projected impacts in inland fisheries are generally known. There are a number of current *de minimis* policies based on southern U.S. ER, including:

- $F_t \leq 10\%$ AEQ ER in Council area and inland fisheries. This is similar to the WDFW policy.
- $Ft \leq 25\%$ AEQ ER in Council area and inland fisheries. This is similar to the expected outcome if the current FMP *de minimis* fishing provision for KRFC are invoked.

2.5.1.3 Council Area Exploitation Rate Alternatives

Alternatives based on ER in Council area fisheries alone would be easiest to implement and provide the most predictable outcome for Council area fisheries; however, impacts in other fisheries would have to be considered to ensure that total ER did not exceed the ABC control rule or F_{MSY}. Examples of current de minimis policies based on Council area ER include:

- $F_t \leq 5\%$ AEQ ER in Council area fisheries. This is similar to the current FMP ER exception for FNM stocks.
- $F_t \leq 13\%$ AEQ ER in Council area fisheries. This is similar to the current FMP de minimis fishing provision for KRFC.

2.5.2 Stock Specific Considerations

2.5.2.1 Sacramento River Fall Chinook

Setting an allowable ER presumes there are adequate data and models to derive preseason expectations of ER. These data and models are available for most Chinook and coho stocks. SRFC do not have sufficient age-structured run reconstruction information to forecast, or assess actual, ocean abundance or AEQ ER estimates. The Sacramento Harvest Model (SHM) could be used to forecast a harvest rate index, which could approximate an AEQ ER for the stock.

2.5.2.2 Oregon Coast Chinook

There are also no estimates of ocean abundance or exploitation rate for Oregon Coast Chinook stocks (as currently described in the FMP); however, this may change in the near future as ODFW pursues updated conservation objectives for those stocks.

2.5.3 *De Minimis* Fishing Provisions and Stock Rebuilding

De minimis fishing provisions could also serve as default rebuilding plans for stocks that become overfished (or depleted). This would provide management guidance for the stock immediately, rather than waiting a year or more for an assessment and/or formal rebuilding plan to be developed; however, this would not preclude development of a formal rebuilding plan through the current Overfishing Concern assessment process. Under the current process, when an Overfishing Concern is triggered the STT must complete an assessment of the cause, including the role of fishing and estimation error, within one year.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

Based on the recommendations in the Overfishing Assessment, the Council determines necessary steps to rebuild the stock, including establishing criteria and any necessary changes to management. These steps may take the form of a formal rebuilding plan, or simply implementing the default rebuilding feature of the FMP (i.e., managing to meet the conservation objectives for all stocks annually).

The Council is usually informed that an Overfishing Concern has been triggered at the March meeting, the same time as it is beginning the preseason management process. Thus, the Council does not have the benefit of the Overfishing Assessment in the first year of rebuilding an overfished stock. If the stock is projected to again fall short of its conservation objective, the Council must close its fisheries that impact the stock. However, if a formal rebuilding plan were in place, it is likely that there would be some level of fishing allowed that would not jeopardize the stock's rebuilding requirements. Providing a similar opportunity through *de minimis* fishing provisions in the first year of rebuilding would temper the impact to fishing communities, and provide a more stable transition to management under a formal rebuilding plan, if necessary.

2.6 Alternatives Eliminated From Detailed Study

At this stage of development, no alternatives have been definitively eliminated from further study, and other alternatives for all the issues may be developed. However, the SAC has tentatively eliminated consideration of stock complexes (and associated indicator stocks) under the OFL/ABC/ACL/ framework as discussed in Section 2.3 of this document. If the alternatives being considered are not feasible to implement or have other shortcomings, complex level management alternatives could be reconsidered.

3.0 LITERATURE CITED

Cooney, T. D. 1984. A probing approach for determining spawning escapement goals for fall Chinook salmon on the Washington North coast. Pp. 205-213. In: J. M. Walton, and D. B. Houston, eds. Proceedings of the Olympic Wild Fish Conference. Peninsula College, Port Angeles, Washington, 1984. 308 p.

Lestelle, L. C., G.S. Morishima, and T.D. Cooney. 1984. Determining spawning escapement goals for wild coho salmon on the Washington north coast. Pp. 243-254. In: J.M. Walton, and D.B. Houston, eds. Proceedings of the Olympic Wild Fish Conference. Peninsula College, Port Angeles, Washington, 1984. 308 p.

Goldwasser, L., M. S. Mohr, A. M. Grover, and M. L. Palmer-Zwahlen. 2001. The supporting databases and biological analyses for the revision of the Klamath Ocean Harvest Model. Unpublished report. National Marine Fisheries Service, Southwest Fisheries Science Center, Fisheries Ecology Division, Santa Cruz, CA.

PFMC. 2007. Pacific Coast Salmon Plan. PFMC Portland OR (see: _____. 1997. Pacific Coast Salmon Plan. PFMC Portland OR (see: http://www.pcouncil.org/salmon/salfmp/fmpthrua14.pdf).

_____. 2010a. Review of 2009 Ocean Salmon Fisheries. PFMC, Portland OR 97220. 331 p.

_____. 2010b. Pre-season Report I. PFMC, Portland OR 97220. 103 p.

_____. 2010c. Pre-season Report II. PFMC, Portland OR 97220. 44 p.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

_____. 2010d. Pre-season Report III. PFMC, Portland OR 97220. 38 p.

Prager, M. H., and M. S. Mohr. 2001. The harvest rate model for Klamath River fall chinook salmon, with management applications and comments on model development and documentation. North American Journal of Fisheries Management 21(3):533-547.

Reisenbichler, R.R. 1986. Use of spawner-recruit relations to evaluate the effect of degraded environment and increased fishing on the abundance of fall-run Chinook salmon, Oncorhynchus tshawytscha, in several California streams. Ph.D. dissertation. University of Washington, Seattle, WA. 175 p.

STT. 2005. Klamath River Fall Chinook Stock-recruitment analysis. Agenda Item G.1.b, Sept 2005. PFMC, Portland OR 97220. 36p. (see: http://www.pcouncil.org/wp-content/uploads/G1b_KlamathConsObj_STT_Rpt.pdf)

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

APPENDIX A: COMMITTEE MEMBER NAMES AND AFFILIATIONS

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Craig Foster, ODFW, STT	Fishery management and policy analysis
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Henry Yuen, USFWS, STT	Population dynamics analysis
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Michael Mohr, NMFS-SWFSC	Population dynamics analysis
Mike O'Farrell, NMFS SWFSC, STT	Population dynamics analysis
Peggy Busby, NMFS NWR	Fishery management and policy analysis
Peter Dygert, NMFS NWR	Fishery management and policy analysis
Pete Lawson, NMFS-NWFSC, SSC	Population dynamics analysis, scientific oversight
Sheila Lynch, NOAA GC, NWR	Legal compliance
Shelby Mendez, NMFS SWR	NEPA coordination
Robert Kope, NMFS-NWFSC, STT	Population dynamics analysis
Ron Boyce, ODFW	Fishery management and policy analysis

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

APPENDIX B: VULNERABILITY OF SALMON FMP STOCKS TO COUNCIL AREA FISHERIES

In the National Standard 1 (NS1) guidelines, the "vulnerability" of fish stocks is referenced as one of the bases for differentiating between stocks that are "in the fishery" versus those that are "ecosystem components." To clarify the definition of "vulnerability" a Vulnerability Evaluation Work Group (VEWG) was established to develop a methodology for determining the vulnerability of stocks managed under a fishery management plan (FMP) (Patrick et al. 2009). We applied the methodology developed by the VEWG to three salmon stock groups to help establish a basis for distinguishing stocks that can reasonably be considered "ecosystem components" in Council fisheries.

In general, stocks "in the fishery" include target stocks (those that are directly pursued by commercial fisheries) and non-target stocks (fish species that are not targeted but are caught incidentally in target fisheries). Stocks may be managed as single species or in stock complexes. All stocks "in the fishery" are generally retained for sale or personal use and/or are vulnerable to overfishing, being overfished, or could become so in the future based on the best available information. As a default, NMFS declares that all stocks and stock complexes currently listed in FMPs are considered "in the fishery." Because ecosystem component stocks are a type of non-target stock, occasional retention of the stock is not in and of itself a reason to classify it as "in the fishery. In addition, ecosystem component stocks must not be subject to overfishing, becoming overfished, or likely to become so in the future in the absence of conservation and management measures.

The vulnerability of a stock to becoming overfished was described by the VEWG as the potential for the productivity of the stock to be diminished by direct or indirect fishing pressure. Vulnerability is expected to differ among stocks based on their life history characteristics and susceptibility to the fishery. The definition developed by the VEWG followed Stobutzki (2001) and includes two key elements: 1) stock productivity (a function of the stock's life history characteristics) and 2) stock susceptibility (the degree to which the fishery can negatively impact the stock.) Stocks with low productivity are not necessarily vulnerable to overfishing unless they have some level of susceptibility to the fishery. The methodology developed to assess vulnerability is termed a "productivity and sensitivity analysis" (PSA).

The PSA was originally developed to classify differences in bycatch sustainability in the Australian prawn fishery (Stobutzki et al. 2001) and has been modified and adapted to include habitat and community components (Hobday et al. 2004). Both methods create numerical indexes of productivity (p) and susceptibility (s) separately using a variety of ranking factors. Based largely on these two studies the VEWG created a PSA designed to accommodate a wide variety of U.S. fisheries ranging from long-line tuna and swordfish to trawl groundfish.

The PSA adaptation developed by the VEWG included ten productivity attributes and twelve susceptibility attributes. Each attribute was scored from 1 (low productivity, low susceptibility) to 3 (high productivity, high susceptibility) and weighted from 0 to 4 (with a default of 2). Note that the least vulnerable stocks have high productivity (3) and low susceptibility (1). Factors can be weighted to emphasize those most relevant to a class of fishery and to de-emphasize factors that are uninformative or, even misleading. The weighed factors are combined in to an index for p and an index for s. These can then be combined to calculate a vulnerability score (v) or plotted to show p and s relative to other stocks and fisheries. Guidelines are provided for scoring, but ultimately there is an element of expert opinion involved in the evaluation. The VEWG also provided a data quality index to aid in evaluating data-poor

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stocks. Salmon, in general, are data rich, so we did not consider data quality in this analysis. More information, and a spreadsheet for doing the evaluation can be obtained at: http://www.nmfs.noaa.gov/msa2007/vulnerability.htm.

The Vulnerability Analysis Working Group assessed productivity and susceptibility scores for 166 non-salmonid species in U.S. fisheries. These included Atlantic sharks, Bering Sea and Aleutian Island Skates, California nearshore groundfish, California Current pelagics, Northeast groundfish, Hawaii pelagic longline swordfish, Hawaii pelagic longline tuna, and South Atlantic and Gulf of Mexico longline species (Patrick et al. 2009). Overall vulnerability can be visualized in a plot of productivity vs. susceptibility (Figure 1.) Since the least vulnerable stocks have high productivity and low susceptibility the x-axis in Figure 1 is reversed so that the stocks closest to the origin have the lowest vulnerability.

We applied PSA analysis to Pacific salmon to evaluate their vulnerability to Council-area fisheries in the context of other fish and fisheries. In the context of all U.S. fisheries, most Pacific salmon stocks are quite similar in productivity and susceptibility, so PSA analysis is not useful for differentiating individual stocks for management purposes. There are, however, two groups of stocks that differ from what might be considered generic salmon in the Eastern Pacific. These are Far North Migrating (FNM) Chinook stocks, with migration timings and patterns that separate them from southern U.S. Fisheries, and Fraser River and Puget Sound pink salmon, somewhat more productive, and caught at very low rates in Council-area fisheries. We developed a PSA for three salmon stock groups; 1) generic salmon, 2) FNM salmon, and 3) pink salmon. Generic salmon include most Chinook and coho salmon from Washington, Oregon, and California. These fish share productivity characteristics and are effectively targeted in Council-area fisheries. FNM Chinook stocks migrate north to Alaska as juveniles and have low susceptibility to Council-area fisheries. Pink stocks mature at a younger age and also have low susceptibility to Council-area fisheries.

Attribute scores were determined based on the criteria in the VEWG spreadsheet and discussion among several scientists knowledgeable about salmon biology and Council-area fisheries. Most factors were scored directly using the quantitative criteria specified by the VEWG. All weights were left at the default of 2 except for "r," intrinsic rate of increase, weighted at 4. We felt that this was one of the defining properties of Pacific salmon, and warranted stronger consideration.

Productivity for Pacific salmon stocks is quite high, with scores of 2.409 for generic and FNM salmon, and 2.455 for pink salmon (Table 1). Susceptibility was moderate to low, with scores of 2.208 (generic), 1.875 (FNM), and 1.708 (pink). In relation to other U.S. fisheries, these productivity scores are among the highest. Susceptibility scores range from average to low. Overall vulnerability scores (distance from the origin in Figure 1) were 1.345 (generic), 1.056 (FNM), and 0.894 (pink). Pink salmon and FNM salmon are among the least vulnerable to overfishing of all the stocks analyzed by the VEWG. Generic salmon are more vulnerable because, despite their high productivity they are susceptible to highly effective fisheries.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

Table B-1. The VEWG worksheet, including productivity and susceptibility attributes, with definitions, and attribute scores for three salmon stocks. "Generic Salmon" includes most Chinook and coho salmon in Council-area fisheries, "Far North Migrate" includes stocks of spring Chinook that migrate out of Council fisheries, and "Pink Salmon" includes mostly Fraser River pink salmon that are caught at very low rates in the Strait of Juan de Fuca and Puget Sound. Attributes that differ for individual stocks are in bold.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

					Generic Salmon		Far North Migrate		Pink Salmon	
Productivity Attributes	**High (3)**	**Moderate (2)**	**Low (1)**	**Weight**	**Attribute Score**	**Weighted Attribute Score**	**Attribute Score**	**Weighted Attribute Score**	**Attribute Score**	**Weighted Attribute Score**
r	>0.5	0.5-0.16 (mid-point 0.10)	<0.16	4	3.0	12.0	3.0	12.0	3.0	12.0
Maximum Age	< 10 years	10 - 30 years (mid-point 20)	> 30 years	2	3.0	6.0	3.0	6.0	3.0	6.0
Maximum Size	< 60 cm	60-150 cm (mid-point 105)	> 150 cm	2	2.0	4.0	2.0	4.0	**3.0**	**6.0**
von Bertalanffy Growth Coefficient (k)	> 0.25	0.15-0.25 (mid-point 0.20)	< 0.15	2	3.0	6.0	3.0	6.0	3.0	6.0
Estimated Natural Mortality	> 0.40	0.20-0.40 (mid-point 0.30)	< 0.20	2	2.0	4.0	2.0	4.0	2.0	4.0
Measured Fecundity	> 10e4	10e2-10e3	< 10e2	2	2.0	4.0	2.0	4.0	2.0	4.0
Breeding Strategy	0	between 1 and 3	≥4	2	2.0	4.0	2.0	4.0	2.0	4.0
Recruitment Pattern	highly frequent recruitment success (> 75% of year classes are successful)	moderately frequent recruitment success (between 10% and 75% of year classes are successful)	infrequent recruitment success (< 10% of year classes are successful)	2	3.0	6.0	3.0	6.0	3.0	6.0
Age at Maturity	< 2 years	2-4 years (mid-point 3.0)	> 4 years	2	2.5	5.0	2.5	5.0	**2.0**	**4.0**
Mean Trophic Level	<2.5	2.5-3.5 (mid-point 3)	>3.5	2	1.0	2.0	1.0	2.0	1.0	2.0
	Overall Productivity Scores					**2.409**		**2.409**		**2.455**
Susceptibility Attributes	**Low (1)**	**Moderate (2)**	**High (3)**	**Weight**						
Management Strategy	Targeted stocks have catch limits and proactive accountability measures; Non-target stocks are closely monitored.	Targeted stocks have catch limits and reactive accountability measures	Targeted stocks do not have catch limits or accountability measures; Non-target stocks are not closely monitored.	2	1.0	2.0	1.0	2.0	1.0	2.0
Areal Overlap	< 25% of stock occurs in the area fished	Between 25% and 50% of the stock occurs in the area fished	> 50% of stock occurs in the area fished	2	3.0	6.0	**1.0**	**2.0**	**1.0**	**2.0**
Geographic Concentration	stock is distributed in > 50% of its total range	stock is distributed in 25% to 50% of its total range	stock is distributed in < 25% of its total range	2	1.0	2.0	1.0	2.0	1.0	2.0
Vertical Overlap	< 25% of stock occurs in the depths fished	Between 25% and 50% of the stock occurs in the depths fished	> 50% of stock occurs in the depths fished	2	3.0	6.0	3.0	6.0	3.0	6.0
Fishing rate relative to M	<0.5	0.5 - 1.0	>1	2	3.0	6.0	**1.0**	**2.0**	**1.0**	**2.0**
Biomass of Spawners (SSB) or other proxies	B is > 40% of B0 (or maximum observed from time series of biomass estimates)	B is between 25% and 40% of B0 (or maximum observed from time series of biomass estimates)	B is < 25% of B0 (or maximum observed from time series of biomass estimates)	2	3.0	6.0	3.0	6.0	3.0	6.0
Seasonal Migrations	Seasonal migrations decrease overlap with the fishery	Seasonal migrations do not substantially affect the overlap with the fishery	Seasonal migrations increase overlap with the fishery	2	1.0	2.0	1.0	2.0	1.0	2.0
Schooling/Aggregation and Other Behavioral Responses	Behavioral responses decrease the catchability of the gear	Behavioral responses do not substantially affect the catchability of the gear	Behavioral responses increase the catchability of the gear [i.e., hyperstability of CPUE with schooling behavior]	2	3.0	6.0	3.0	6.0	3.0	6.0
Morphology Affecting Capture	Species shows low selectivity to the fishing gear.	Species shows moderate selectivity to the fishing gear.	Species shows high selectivity to the fishing gear.	2	3.0	6.0	3.0	6.0	3.0	6.0
Survival After Capture and Release	Probability of survival > 67%	33% < probability of survival < 67%	Probability of survival < 33%	2	1.5	3.0	1.5	3.0	1.5	3.0
Desirability/Value of the Fishery	stock is not highly valued or desired by the fishery	stock is moderately valued or desired by the fishery	stock is highly valued or desired by the fishery	2	3.0	6.0	3.0	6.0	**1.0**	**2.0**
Fishery Impact to EFH or Habitat in General for Non-targets	Adverse effects absent, minimal or temporary	Adverse effects more than minimal or temporary but are mitigated	Adverse effects more than minimal or temporary and are not mitigated	2	1.0	2.0	1.0	2.0	1.0	2.0
	Overall Susceptibility Scores					**2.208**		**1.875**		**1.708**
				Vulnerability		**1.345**		**1.056**		**0.894**

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

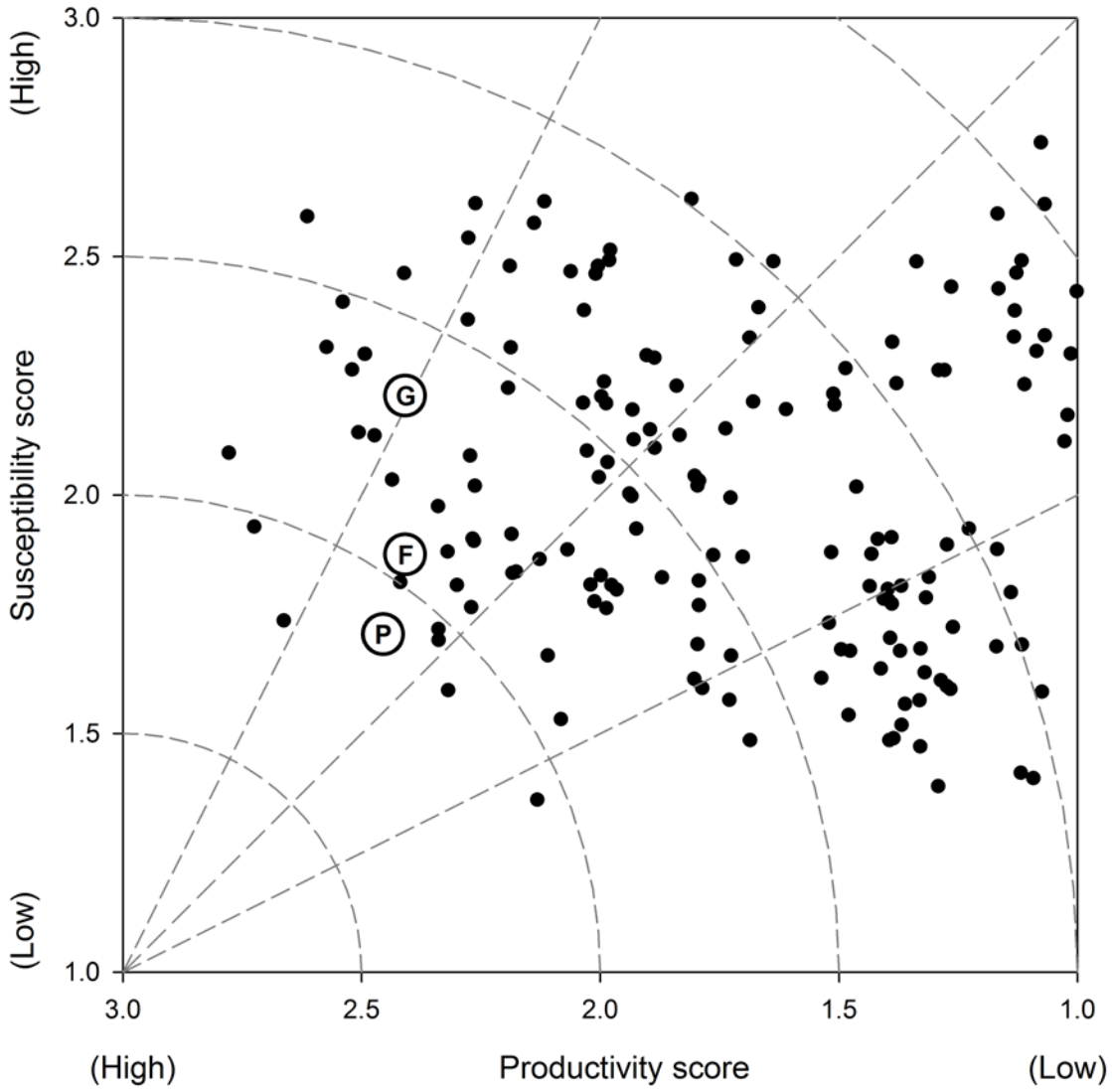

Figure B-1. Productivity and susceptibility scores for three Pacific salmon stocks (open circles) and 166 other species of fish (solid dots) in U.S. fisheries. Vulnerability is interpreted as distance from the origin, as indicated by the arcs, with higher vulnerability in the upper right and lower vulnerability in the lower left. The three salmon stocks are; G: generic, F: far north migrating, and P: pink. Figure is adapted from Patrick et al. 2009, Figure 2, using data from Table 5.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook

Literature cited

Hobday, A.J., A. Smith, and I. Stobutzki. 2004. Ecological risk assessment for Australian Commonwealth fisheries, final report. Report R01/0934 to the Australian Fisheries Management Authority, Canberra, Australia, 72 p. (http://www.afma,gov.au/researchy/reports/2004/r01_0934.pdf

Patrick, W.S., P. Spenser, O. Ormseth, J. Cope, J. Field, D. Kobayashi, T Gedamke, E Cortes, K. Bigelow, W. Overholtz, J. Link, and P. Lawson. 2009. Use of productivity and susceptibility indices to determine stock vulnerability, with example applications to six U.S. fisheries. NOAA Technical Memorandum NMFS-F/SPO-101. October 2009.

Stobutzki, I., M. Miller, and D. Brewer. 2001. Sustainability of fishery bycatch: a process for assessing highly diverse and numerous bycatch. Environmental Conservation 28:167-181.

ABC-acceptable biological catch; ACL-annual catch limit; ACT-annual catch target; AM-accountability measures; C-catch; F-fishing mortality rate; KOHM-Klamath Ocean Harvest Model; KRFC-Klamath River fall Chinook; MFMT-maximum fishery mortality threshold; MSY-maximum sustainable yield; OFL-overfishing limit; S-spawning escapement; SHM-Sacramento Harvest Model; SRFC-Sacramento River fall Chinook