Monterey Bay Aquarium Seafood Watch®

Seafood Watch® Criteria for Salmonid Fisheries

Summary of comments from Public Consultation 2 and Public Consultation 3 and Responses

Preamble

Seafood Watch assesses the environmental sustainability of fisheries and aquaculture by compiling relevant science-based information and evaluating that information against our standards (called 'Criteria' elsewhere on this website). We periodically revise our standards to ensure we account for developments in the scientific understanding of the ecological impacts of fisheries and aquaculture operations, as well as in our understanding of what producers and managers can do to mitigate those impacts. Seafood Watch initiated public comment periods from July 2, 2015 to August 2, 2015 and 1 July, 2016 to 31 July, 2016 and received comments from ENGO's, producers, certification schemes, and other interested stakeholders.

The comments received have been summarized, grouped together by similar themes or by criterion and are presented in the left hand columns of each table below, with Seafood Watch responses in the right column. Seafood Watch has carefully considered all comments received in addition to reviewing many of them with our Technical Advisory Committee and/or Expert Working Groups. Below we present our responses to all comments received as part of the official Public Comment Period as per the requirements of the ISEAL Code of Good Practice Standards-Setting Code[1].

General Comments

Comment	Response
Guiding Principles: Suggest including 'freshwater' wherever the term 'marine' is used as salmonid fisheries can take place in freshwater environments and impact freshwater species.	While we typically do not make adjustments to our guiding principles, this change was made to clarify the impact fisheries can have on freshwater species and ecosystems.
Guiding Principles: Suggest adding 'productivity'	While we typically do not make adjustments to our

[1] 1 http://www.isealalliance.org/our-work/defining-credibility/codes-of-good-practice/standard-setting-code

to guiding principle 10.	guiding principles, this change was made as we believe it more accurately conveyed the theme of this principle.
Structure: The effects of artificial production appear to be scattered among several criteria. I think that artificial production management should be its own criterion with all artificial production concerns addressed in one place.	We agree that grouping the assessment of artificial production in one criterion would be an improvement as it would allow a clearer assessment of the issues connected with a particular fishery. All artificial production concerns are addressed in Criterion 5X. This is an exceptional criterion meaning that it is only assessed when there is artificial production associated with salmonids caught within a fishery.
Scope of Assessment: One of the complexities with these assessments, when trying to take into consideration hatchery risk, is that fisheries are managed in one sphere and hatcheries are managed in another, and rarely do the two mix. They may be managed by quite different jurisdictions, for example, the fishery may be in Alaska and the hatchery in Oregon. One of the things you could do, because fishery managers know this information, is require that they list all hatchery stocks that make up more than 5% of their catch. And then they can cooperate with their managers to obtain pertinent hatchery management plans for each of those.	We agree that this an area of particular complexity and have clarified the guidance to highlight that hatchery impact should be assessed for all major Stock Management Units (SMUs) caught within a fishery. Major SMUs are defined as those that make up 5% or more of the catch from a particular fishery.
Scope of Assessment: Will this standard apply to other species that have an aquaculture stage as part of their production, for example invertebrates such as oysters?	No, the scientific information considered when compiling this standard specifically looked at salmonids and it may not be appropriate to apply these standards to other finfish or invertebrate species.
Definitions: There is a lack of definition of acronyms.	All acronyms and abbreviations have been defined at first use.
Definitions: Need to clarify the definition of stock management units (SMUs) as different regions manage salmon populations at different levels. SMU is a group of fish managed together. Finer scale designations for conservation purposes referred to as sub-stocks. Terms sub-stocks and populations are used interchangeably. Assessment should take place at the SMU level, and HCR should be assessed to determine whether it is adequately precautionary to conserve nested sub-stock or population diversity.	A number of commenters noted that there was a need for a clear and standard definition of Stock Management Unit to clearly identify the level of assessment. Seafood Watch staff thoroughly researched this area and identified that definitions of 'stock' can vary widely, as can the level at which fisheries are managed. The most consistent definition across Pacific salmon fisheries was Stock Management Unit which we have defined as: *A group of one or more stocks for which fishery management objectives have been established (for salmon, typically a spawning escapement goal) and that fisheries will be regulated to achieve. The*

	Stock Management Unit is a broad management concept, such that not every population with a defined goal need be an individual SMU, but can be part of a collection of such populations within an SMU (adapted from MSC 2014).

Criterion 1: Impacts of the Fishery on the Stock for which you want a Recommendation.

Comment	Response
Major vs Minor Stocks: It is uncertain whether these criteria will protect "weak stocks", especially ESA listed ones, in mixed-stock fisheries (most salmon fisheries are mixed stock). For example, if an ESA-listed stock is caught within a fishery, because it is rare relative to the target stock it makes up a very small component of the fishery, perhaps 1-2% of the catch. Therefore it would not be considered a 'major stock'. However, 1 or 2% of a very large catch, say 100,000 fish caught, might still be a substantial % of a rare stock: 2% of 100,000 = 2,000; what if escapement of that stock is only 1,000? You have a fishing rate of over 60% on that weak stock.	We consider the impacts of all stocks of concern caught within a fishery. If a particular stock is considered a minor stock, it will be assessed in Criterion 2 in the same way it would be if assessed in Criterion 1. The reason we have made this distinction is to enable us to identify where the concerns are in a particular fishery. Many fisheries are managed to avoid low abundance stocks, for example ESA listed stocks, and as such they make up a small proportion of the catch. We considered it important to identify where there were concerns due to major portions of the catch that are likely targeted, and where the impact may be on co-migrating stocks where management aims to minimize the impact without being able to remove the impact completely. If a fishery has a negative impact on a particular stock it will receive a red score, the differentiation between a major and minor stock is whether that red score appears in Criterion 1 or Criterion 2 respectively.
Major vs Minor Stocks: The Marine Stewardship Council have specific guidance for Inseparable or Practically Inseparable (IPI) stocks. Non-local stocks of the target species (P1/C1) are considered IPI if they are below 5% of the catch of that species. If determined to be IPI they do not need to be considered in Principle 1 or Principle 2, however if they are below biologically based limits (LRP) the CAB must demonstrate that the fishery is not a significant portion (>30%) of the total catch of that stock and the fishery is highly likely not to significantly hinder the recovery of the stock. Local stocks of the target species that are <5% of the catch are considered as part of the P1 assessment as far as I am aware.	We took the MSC criteria into account when developing the Salmonid Standard in order to ensure as much consistency as possible. In this instance, taking into account the conservation ethic embedded in our guiding principles and the comments we received urging us to be precautionary when considering the impact of fisheries on low abundance salmon stocks (e.g., see previous comment), we chose to design our standard to require a high degree of confidence that fisheries being assessed are not negatively impacting low abundance stocks. Therefore we maintained our proposal to assess all stocks that make up less than 5% of the catch in Criterion 2.
Productivity – Susceptibility Analysis: It does not appear that the implementation of the	We have maintained the PSA assessment in the standard as the standard is designed to be applied

Productivity and Susceptibility Analysis as outlined will be useful between the five North American Pacific Salmon species (salmon species). With respect to the Productivity attributes and rankings from Marine Stewardship Council 2014 table, all salmon species will have the same value that will not change between fisheries (Table 1). Therefore it does not appear that this would provide any useful intra species information. It may provide reference information if the common salmon species value were compared with other fish species. If that is considered useful, Monterey Bay Aquarium (MBA) staff should provide an analysis for several different fish species. With respect to the Susceptibility attributes and rankings from Marine Stewardship Council 2014 table, it also does not appear to be relevant for salmon species. The susceptibility analysis seeks to specify how much of the population is vulnerable to various fishery attributes. The inclusion of Quality of habitat is inappropriate. The other four criterion all relate to availability of fish to the fishing fleet while the critical salmon habitat, freshwater spawning and rearing, is not at all affected by the fishing fleet. In addition, even if the habitat is degraded, the sustainability needs to be evaluated against the management system for the stock not the habitat.	to all salmonids, including steelhead, char and Atlantic salmon, which may have different productivity characteristics. We will ensure that all Pacific salmon species are scored consistently across different assessments. The 'Quality of Habitat' scoring factor has been moved to the productivity assessment as it applies more to productivity than susceptibility.
Productivity – Susceptibility Analysis: Some of the attributes in the productivity and susceptibility analysis (PSA) table are difficult to apply to salmonids. Perhaps a different set of criteria for different species would be more appropriate?	Several commenters felt that the PSA assessment did no accurately reflect the vulnerability of salmonids. We spent a significant amount of time investigating whether different attributes would be more appropriate, or whether different methodologies existed to enable us to determine the vulnerability of a salmonid species to a particular fishery. While there are a number of studies in this area, there is currently no metric available against which to measure salmonid vulnerability to fisheries. Concerns regarding the difference between marine and freshwater species were considered. We were unable to find a PSA or similar metric that has been created for freshwater species. While there are concerns associated with comparing anadromous species to marine species, those concerns are also true when comparing
Productivity – Susceptibility Analysis: Vulnerability scores appear to be based on life history criteria for marine species. Salmon and steelhead are different from marine species in that they depend on freshwater ecosystems for reproduction and juvenile rearing. For many salmonids, mortality rates are highest during the freshwater phase of the life history. Because of their freshwater dependency, previous life history assessments have grouped salmon and steelhead more with freshwater fishes (Mims et al. 2010). Comparing life history trait diversity among North American freshwater fish species, Mims et al. (2010) classified Salmonidae (salmon and trout) as late-	

maturing, large-bodied, and long-lived species. This indicates that, relative to freshwater fish experiencing similar ecological challenges, salmon and steelhead possess the same qualitative suite of life history traits that have been associated with high fisheries vulnerability in marine species. In order to be applied to salmon and steelhead, trait-based fisheries vulnerability scores need to be parameterized using species that experience similar ecological challenges to salmon and steelhead, not marine species. The susceptibility metrics would be improved by including additional or alternative habitat quality considerations. The draft susceptibility criteria only consider spawning habitat quality, but spawning habitat, even in moderately degraded conditions, may not limit freshwater habitat quality for salmon and steelhead. For salmonid species that rear for multiple years in freshwater, the quality of rearing habitat, particularly pools with sufficient cover, may be a metric that has a much greater influence on population susceptibility to fishing mortality. These types of rearing habitats are easily degraded due to non-fishery impacts, resulting in reduced capacity of natal streams to support the salmon and steelhead. Finally, steelhead and Pacific salmon are closely related but they differ in two major life history traits: parity mode and the ability to mature without undergoing marine migrations. Steelhead are capable of repeated spawning migrations in contrast to Pacific salmon, which spawn only once in their lifetime, and steelhead commonly give rise to freshwater resident forms (i.e., “rainbow trout”; McMillan et al. 2007; Sloat and Reeves 2014; Kendall et al. 2015). These major life history differences should be considered explicitly in salmonid fisheries vulnerability assessments. Steelhead fisheries probably warrant modified or additional vulnerability considerations due to the potential for fisheries to result in a relatively high proportion of young and first-time spawners (which may reduce egg viability), a reduction in the number of spawning age classes, and potential major life history shifts such as the increased	anadromous species to freshwater species. For example, the large size attained by salmonids, relative to freshwater species, is likely due to their migration to marine ecosystems where there is a greater availability of nutrients. We also considered it important to maintain a level of consistency with other Seafood Watch assessments. To that end, it was decided that the standard PSA should be used for salmonid assessments, however we did make some edits to the PSA by including an additional productivity parameter and salmonid specific guidance on susceptibility to account for their unique life history characteristics and how they may interact with fisheries, namely: - The addition of available habitat to the productivity assessment. This existed in a previous version of the Seafood Watch criteria for capture fisheries. Habitat availability is considered a major limiting factor in salmonid productivity. - The default score for salmonids for ‘selectivity of the fishery’ is ‘high susceptibility’ to account for the targeting of spawning migrations. If management measures are in place to limit the impact of a fishery this level of risk can be reduced. As previously stated, we consider it important to ensure a level of consistency across assessments, therefore we do not want to create species specific standards at this stage. The salmonid standard is being developed to incorporate significant concerns associated with artificial production as identified in the scientific literature, rather than to address specific concerns at a species level.

frequency of freshwater maturing residents (Theirault et al. 2008). Because there are few targeted wild capture steelhead fisheries, development of these additional vulnerability standards could be considered on a case-by-case basis.	
Reference Points: How do you know that 'Management Targets' are appropriate? You should require that management targets are demonstrated to be compatible with population viability.	We gave much consideration to whether assessments of abundance should be based on Minimum Viable Populations (MVPs) or Maximum Sustainable Yield (MSY), indeed it was a specific question in the third public comment period. From the comments it is clear that there is a difference of opinion among the stakeholders that responded. We researched this issue thoroughly to determine the best approach to take from a conservation viewpoint while ensuring that assessment were viable. We agree that in some instances it is possible that MSY –based management targets do not consider whether or not a population is viable. However, through research we determined that in many if not most cases information on MVPs was not available, making an assessment against these levels almost impossible; ultimately the result would be a score of 'unknown' would be applied to almost all stocks. We also determined that where this information was available it was for stocks that have been listed as endangered under the ESA. Any listed stocks will automatically be scored as a high concern, therefore assessing these stocks against an MVP-based target would likely not affect the scoring in any way. While there is some suggestion within the scientific literature that MSY-based approaches may not be sufficiently precautionary to protect fish populations, particularly when considering their role within marine and freshwater ecosystems, a viable alternative has yet to be identified for many taxa, including salmonids. At Seafood Watch we set the bar for sustainability high with the aim of advancing industry best practice, however targets must be achievable rather than theoretical. We concluded that in order to ensure our assessments were viable and that they could
Reference Points: Maximum Sustained Yield (MSY) based Reference Points (Escapement Goals) or other scientific or biologically based escapement goals are the appropriate standard for determining a sustainable salmon population. Minimum Viable Population (MVP) assessments are sometimes used to establish a recovery goal for a salmon population that has been listed or is being considered for listing under the United States Endangered Species Act. A salmon population that is at the MVP would likely not support a sustainable harvest.	
Reference Points: The Marine Stewardship Council funded desk-based research to help guide the development of the Modified Default Assessment Tree for salmon.	
Reference Points: While some salmon stocks may have MSY based escapement/harvest objectives, many do not. Most salmon fisheries are mixed stock fisheries and many are limited based on either exploitation rate or harvest rate limits to various weak stock components in these fisheries. Some more terminal fisheries also are managed based on escapement goals. I do not think assessing fisheries based on any kind of MVP standard is really going to improve the assessments. For ESA listed salmon populations, the primary factors limiting abundance and recovery are usually not fishery related. Things like habitat loss and dam construction and other non-fishing factors are generally the main reasons for both the stock decline as well as the limiting factors for recovery. If a population were below its MVP goal, fishing and the allowed fishing rate may have very little ability to solve this. It may be that other non-fishing actions are needed. Salmon recovery involves many types of actions both in	

controlling fishing and resolving other non-fishing impacts. If NMFS has determined through ESA consultations fishing rates that are compatible with recovery efforts, then fisheries should be viewed as sustainable.	differentiate between abundant and depleted stocks we should maintain an assessment of abundance against MSY-based reference points. The addition of an assessment of fishing mortality in factor 1.2 allows us to assess fisheries managed to exploitation goals as well as those managed to escapement (or other abundance based metrics) in factor 1.1. In both of these instances we will determine whether the management goals have been set to achieve MSY and will be scored accordingly. More conservative abundance and exploitation goals will be considered in the same manner as MSY-based goals. Additional guidance has been given in Appendix 8 regarding the use of trends in assessing the stock status of salmonid fisheries.
Reference Points: There is an extensive literature describing the demographic, ecological, and economic risks associated with using MSY-based fisheries targets. MSY-derived reference points require estimates of stock-recruitment parameters, which are often imprecise for salmonid populations because of short data time series and high inherent variability in salmon population trajectories. MSY-based targets often do not adequately recognize the uncertainty associated with the models and data on which they are based. MSY-based targets also assume stationarity in the demographic and ecological processes controlling salmon population productivity. However, non-stationarity in the flow and temperature regimes of freshwater salmon and steelhead rearing habitats is now the norm and this will likely have knock-on demographic effects influencing the productivity of salmon and steelhead populations, including sustainable harvest levels. Given these uncertainties, in many cases MSY-based targets may not be sufficiently precautionary to ensure the long term sustainability of salmon and steelhead production. Space should be given in the assessment for an examination of trends in total run size, whenever available, in addition to management targets such as escapement. This would give analysts some indication as to whether MSY-based targets, when met, are helping to facilitate sustained population sizes. Additionally, both long-term and near-term population trends should be examined, when available. Salmon and steelhead abundance are strongly influenced by a number of phenomena operating at decadal time scales, which can confound the interpretation of recent population trends when taken out of context from their longer-term trends.	
Fishing Mortality: Some salmonid fisheries are managed by a maximum allowable impact rate (fishing mortality or exploitation rate). There	By removing all hatchery considerations in to Criterion 5, we have reverted back to the previous assessment model where fishing mortality is

should be some consideration of this in the criteria.	assessed in Factor 1.2.
Fishing Mortality: How do you demonstrate that the impact rate is "sustainable"? If it is only 1-5% it may be a rounding error in the monitoring data and difficult to demonstrate whether it is or is not "sustainable" even for a very small stock, but there are cases where much higher harvest rates are currently being used, especially cumulative across all fisheries. Regarding criteria 1.2, fishing mortality. This still assumes that there is some fishing mortality on a weak stock that is "sustainable", but that is not likely true in all cases of weak stocks. As we have discussed, this remains a difficult problem that warrants further research and discussion. Possibly the interim approach, until such questions are resolved, is to allow some "rounding error"-level impact to be considered "sustainable".	A sustainable impact is considered to be one that is below a fishing mortality or exploitation rate target that is consistent with MSY. For a 'low concern' to be achieved it must be probable that fishing mortality is below the MSY-based target, which is defined as a 50% chance. Information on the uncertainty associated with a particular estimate is typically available in stock assessments which enables us to determine how likely an estimate is to be below the management target.
Fishing Mortality: Not all stocks have escapement goals as the fisheries are simply based on harvest rates. Many fisheries especially marine salmon fisheries share their allowed exploitation rate limits with other commercial and recreational fisheries. The actual impact of a particular fishery on a particular weak stock may vary based on annual allocation decisions between fisheries as much as specific management rules tied to that fishery. Mixed stock fisheries often have incidental impacts to a wide variety of weak stocks some of which may be stocks which originate a long distance from the fishery in question. For instance, the South East Alaskan troll fisheries have impacts on a variety of weak Puget Sound and Columbia River stocks as well as abundant hatchery runs from these and other areas. Any particular fishery is very unlikely to by itself be able to exert an unacceptably high level of mortality on any particular population. The combination of all fisheries could in total have an unacceptably high level or mortality, but fishery management rules are designed to avoid this. More and more fisheries are moving towards abundance based management using exploitation or harvest rates. The allowed rates may also	As previously mentioned, factor 1.2 will assess whether fishing mortality or exploitation rates are within sustainable limits. When considering fishing mortality or exploitation rate, we consider the cumulative impact of all fisheries, including commercial, recreational and subsistence. It is important for all stakeholders, including fishery managers, to set targets and allocations appropriately to ensure that cumulative impacts are sustainable not only from an environmental perspective but also form an economic, social and cultural perspective in order to ensure future harvest is available. We will consider the findings of Biological Opinions on ESA listed stocks in a similar way to how we consider the results of a stock assessment. If the Biological Opinion has considered cumulative impacts from all fisheries, including commercial, recreational and subsistence, and determined that there is no negative impact on the stocks of concern then we would consider this a sustainable level of impact. This approach is consistent with our guidance for consideration of Biological Opinions for other species (typically bycatch species) within the general fisheries standard.

change and go up and down as abundance goes up and down. All salmon fisheries are trying to catch abundant hatchery and sometimes abundant wild fish that occur in these fisheries, but they tend to all have some impact on (often many) weak stocks that also occur in that fishery. Because impact limits will be based on the weak stocks, salmon fisheries typically have lower impacts on the stronger components than these components can support. I think that most any kind of assessment of a fishery's impact on its target stocks is going to show that the fishery is sustainable. A more important question would be the total fishery impacts on weak or ESA listed stocks. But to assess this, it would be necessary to look at the total fishery impacts for all fisheries that have measurable impacts on that stock. If the total fishery impact on a stock were determined to be too high, you wouldn't be able to really place the "blame" on any particular fishery, but would have to rate all fisheries that impacted this stock accordingly. For ESA listed stocks, NMFS already has to go through a process of determining an acceptable harvest impact for that stock and provides incidental take limits so the fisheries can legally proceed under the requirements of the ESA. If Seafood Watch were to be of the opinion that impact rates determined through ESA consultation are sustainable, then an assessment of any fishery could be simplified to look at whether or not a fishery is being managed to stay within in its allowed limits. If Seafood Watch were of the opinion that ESA based impact rates are not necessarily sustainable, then by implication, only a relatively small number commercial salmon fisheries could be considered sustainable because the suite of fisheries that impact ESA listed stocks are managed to stay just within the ESA harvest limits.	

Criterion 2: Impacts on other Capture Species

Include the concept of not impairing viable abundance levels along with recruitment and productivity, in a similar way to criterion 1.	Seafood Watch uses the same scoring factors for criterion 1 and criterion 2, therefore salmonids will be assessed using the scoring factors in criterion 1 and non-salmonids will be scored using the scoring

	factors from Criterion 1 of the Fisheries Standard.
National and state endangered species listings should also be included when determining stock status scores.	Seafood Watch considers all state and national endangered species listings when conducting our assessments. This has been clarified in the text.
Under fishing mortality, there should be a consideration of recreational and subsistence fishing impacts. It isn't clear that non-commercial fishing is considered.	Additional guidance has been provided to ensure that all sources of fishing mortality are considered when assessing the impact of a fishery on a particular stock. A fishery receive a good score when cumulative fishing mortality is high if there is evidence to demonstrate that the fishery in question is not a substantial contributor.

Criterion 4: Impacts on the Habitat and Ecosystem

Ecosystem-based Fisheries Management: It is not clear whether the evolutionary effect of fisheries is being captured here, or is intended to be captured here.	The evolutionary effects of fishing are not explicitly considered in this scoring factor; however evidence of such impacts would give cause for greater concern.

Criterion 5X: Impact of Artificial Production

Typical/Average Impact: While I sympathize with your concern about manageability, and I generally agree with your approach here, I'm not sure you can assume "average operations" across the range, at least not yet. Perhaps you should add to your "Highly Effective" a question that asks if this assumption is true. It would be easy for managers to answer because they would have management plans in place and effectively implemented across the range if it is true, and they won't if it's not true.	A range of comments were received on this issue, and many thought that assessing an 'average' impact was inappropriate. We followed up with each commenter to discuss the issue in more detail and clarify the approach we aimed to take and there was general agreement with the proposed approach. An average or typical impact will not be applied to the whole Pacific basin, rather the average or typical impact for artificial production associated with each SMU should be considered. The reason for this is that within an individual SMU there may be upwards of 100 artificial production programs, and with multiple SMUs interacting with an individual fishery it would be unrealistic to assess each individual program. We also consider it important that the cumulative impacts of artificial production and supplementation are considered (at the SMU, watershed, regional and ocean basin level), which requires some level of coordinated management plan at the SMU level. Therefore we aim to assess the existence and content of such management plans and whether programs are compliant with said plans.
Typical/Average Impact: We support separate assessment of enhancement and suggest a general consistency with the MSC Salmon Standard.	
Typical/Average Impact: Most salmon fisheries are mixed stock fisheries that catch not only a wide variety of strong and weak natural origin stocks, but also catch a very large variety of hatchery stocks. As an example, the Lyons Ferry Hatchery fall chinook are caught in measurable numbers in nearly every marine chinook fishery from California to SE Alaska. If a program such as this happened to be assessed as having a high risk to wild fish (I would vehemently disagree that this program does), then would you be forced to reflect this in every fishery that catches these fish?	

I think it is going to be a really complex and challenging task to realistically assess fisheries based on the various hatchery programs that may be caught in those fisheries. Additionally, hatchery programs have a huge variety of goals and objectives. The HSRG recommendations for things like pHOS and pNOB are just that, recommendations. They were developed using models which had assumptions that may be more or less reasonable for different groups of fish. Managers sometimes accept these recommendations and use them, and sometimes do not. They are not the only reasonable scientific criteria. Managers look at a variety of factors. Hatcheries in the Columbia Basin as well as many other areas have developed or are developing Hatchery Genetic Management Plans (HGMP) which can determine on a case by case basis standards for managing the program in a way to avoid unacceptable risk to wild populations. These standards may or may not be different from the HSRG recommendations. If a hatchery program has an HGMP that has been reviewed and determined to be acceptable, then if it varies from HSRG standards, it would not be appropriate to penalize this program as having an in appropriate impact on wild fish.	We will consider the impact and management of artificial production programs associated with all major SMUs caught within a fishery, regardless of whether they are in the same jurisdiction of the agency responsible for the management of the fishery. If an SMU is a major component of a fisheries catch, we consider the fishery to be reliant on that resource and therefore there is a level of responsibility for how that resource is produced. As previously stated, we expect a level of cooperation in determining the appropriate level of artificial production across a range of scales and expect cross-agency collaboration when developing targets and management strategies. We have edited the language in the standard to make clear that the recommendations of the HSRG should be viewed as best practice guidelines, but that with proper supportive evidence alternative management strategies may be viewed as best practices and scored accordingly, on a case by case basis.
Typical/Average Impact: Our experience suggests that assuming that most hatcheries within a region operate at a similar level of performance is potentially very misleading. The ecological and genetic impacts of hatcheries are often site-specific. The strength of the assessment will be much greater if it includes an assessment of the hatchery systems associated with a given fishery, not just a "typical or average" production system.	
Typical/Average Impact: Not appropriate to assess a "typical" hatchery system – wide variation in production and strategies; this should be tailored based on the stocks and not be representative.	
Impact Assessment: The data-limited method for assessing the possible negative impacts of artificial production is straightforward and reasonable. However, the data-rich method has dual problems of 1: being on the very leading edge of science with the thresholds that it incorporates, and 2: including statistics that may be impossible to	We pilot tested the standard during each of the public comment periods to determine whether it was usable. While the data for pHOS and pNOB are often not available, we did find them in some instances. While this data is at the leading edge of scientific understanding we believe that it provides a greater understanding of the impact, or potential

gather for any salmonid fishery at this time (i.e. pNOB). With respect to the second concern, unless a trial assessment is accomplished that succeeds in using the data-rich method in full we recommend removing the data-rich method and applying the data-limited approach to all fisheries.	impact, of artificial production on associated wild populations of salmonids and we want to incentivize the collection of this data as recommended by the HSRG. We believe that including this assessment in the standard, with an option of a better score if the data demonstrates a low impact or low level of risk, will incentivize the collection of this data.
Impact Assessment: While the Hatchery Scientific Review Group (HSRG) recommendations are guidelines for improving hatchery management, and are much better than nothing, problems remain. The guidelines make assumptions about what managers are trying to do, and fall way short of dealing with some kinds of risk factors. But I agree that until better guidelines are developed, the HSRG guidelines are a reasonable place to start somewhere. However, I would rank compliance with the HSRG guidelines as only "Yellow/Moderate". A "Green/Minor" rating should require demonstration of no hatchery program influence. "Red" would be if the HSRG guidelines are not being met or impacts to wild populations have been demonstrated, regardless of the guidelines.	Where there is no artificial production associated with major SMUs caught within a fishery, Criterion 5X is not assessed. Where there is evidence of no impact in all associated artificial production programs a very low concern (5) can be achieved. A low concern (4) can be achieved if the appropriate levels of pHOS and pNOB are met. We consider this to be a high bar that may not be met in many cases. As previously stated, the Seafood Watch standards aim to set a high bar while also being achievable. With regards to management of artificial production, while there is uncertainty in the HSRG recommendations, we believe that they represent the best available option and set a high bar for management and meeting each of the recommendations (or an appropriate equivalent) would be considered a highly effective management strategy. We have set up the scoring within the standard such that a perfectly managed artificial production system with evidence of no negative impacts will score the same as a fishery with no associated artificial production, all else being equal. This decision was made based on feedback from commenters and the expert working group. As such we consider the scoring of Criterion 5X appropriate as the best case scenario is that an overall recommendation will be comparable with a fishery where the is no artificial production (i.e. the recommendation cannot be improved by the presence of artificial production).
Impact Assessment: The impact of artificial production guidance is difficult to understand. It appears to define two categories; data-rich and data-poor, and establish two types of hatchery programs; integrated and segregated, within each category.	The text in Table 5.1.2 has been edited to clearly identify the requirements for segregated programs and integrated programs. We recognize that the recommendations from the HSRG are based on studies for particular species

The table *{on page 41 (no title or reference number but apparently for data rich)}* would benefit by clearly stating in the description for each impact what relates to integrated and segregated programs (the tables in this section would also benefit by having reference numbers and titles). The pHOS levels of 1% and 5% used in the description are very low values and apparently are for all species. Note that the document, MSC Fisheries Standard and Guidance (Extracted from the Fisheries Certification Requirements, Annexes SA-SD) states: These guidelines are based primarily on studies of riverine species such as Chinook, coho, and steelhead. They may be modified for pink and chum salmon, and for other species, with sufficient reasoned argument and justification. Accommodations should be made for different species, differing hatchery practices and fitness studies. {*The top table on page 42*} (Influence table) is apparently for data poor instances, meaning lack of data for pHOS or pNOB. Wild/Hatchery Composition of the population or harvest in not a meaningful manner in which to describe the "influence". The objective of hatchery fish should be to harvest or use for broodstock all of the production. If all of the production falls into one of these categories, then there will be no concern. Perhaps a more meaningful statistic would be the percentage of hatchery fish that are not harvested or used for broodstock. With respect to the table on the bottom of page 42 (Conservation concern), it is not clear what the purpose of this table is as scores could be developed within the two mutually exclusive tables above. One is for data rich, the other for data poor, there is essentially no overlap. This table confuses the scoring.	and may not be representative of all salmonids, however they set a high bar which we consider to be precautionary and in the absence of specie specific information they provide a useful metric. The scoring descriptions in Table 5.1.1 of the Standard provide an option for stock/program specific studies to demonstrate that there is no impact on wild salmonid stocks. This language also applies to studies that demonstrate that different metrics are suitable in a given situation. The language in table 5.1.3 (Influence table) has been changed substantially. Through pilot testing and public comments we found that the data requirements were similar for both our data-rich and data-limited approaches. Recognizing this would not prove useful, we have changed the text in table 5.1.3 to allow consideration of management strategies that aim to reduce the potential impact of artificial production on wild populations. We have rearranged the tables for Factor 5.1 in an attempt to clarify that there is one scoring table (5.1.1) which utilizes information from either a data-rich (5.1.2) or a data-limited (5.1.3) approach.
Impact Assessment: The criteria are a bit confusing to me. The minor and moderate ratings refer to "less than 1%" and "less than 5%", which are very good, but then refer to the HSRG pHOS criteria, which could allow a much higher % hatchery fish under some situations (ie, in the minor category, you refer to their criteria "less	We have edited the text to clarify that the requirement for a low impact is that most (>50%) of SMUs in a fishery have less than 1% artificially produced fish, and of those that have more than 1% they meet the appropriate pHOS and pNOB requirements.

than or equal to pNOB", which may result in more than 1%). Possibly the issue is that your 1%/5% apply to the entire "management unit" (ie management stock) while the HSRG criteria are applied to a particular wild population? Maybe, for example, there is only one hatchery program associated with one wild population in the management unit and it complies with the HSRG criteria for that one population, and makes up less than 1% of the whole management unit? In any case, this is my interpretation and you might want to clarify what you mean. Possibly a better, consistent definition of management unit would be very helpful here as well as elsewhere in your assessment (see my comment on SMUs also). Keep in mind that the pHOS criteria from the HSRG assumed certain rates of genetic change that are likely not realistic, as indicated by more recent pedigree studies, and therefore their pHOS is likely higher risk than they assumed. On the other hand, many hatchery programs can't meet their criteria anyway, and doing so would be an improvement. *{On page 42:}* If the managers don't know pHOS and pNOB, I'm not sure they know the wild juvenile production. I assume that "SMU" is defined? This might help with addressing my previous comment on page 41. Perhaps you could say "less than 1% of the SMU" and meets the HSRG criteria for each individual wild population involved.	As stated above, the Influence scoring language (table 5.1.3) has changed substantially as we recognized that the previous version still required a large amount of high quality data and did not serve the purpose of a data-limited assessment approach.
Impact Assessment: I think it would be more appropriate to assess hatchery programs on whether or not they have an HGMP in place or other planning document analyzing impacts to wild fish.	We aim to assess both input and output metrics in our assessments, therefore there is an assessment of impact (or in the absence of data risk), and an assessment of management measures to control or mitigate any potential impacts.
Impact Assessment: This requirement currently focuses heavily (only) on spawning impacts and genetic diversity. It should also include consideration of impacts throughout the salmon's life cycle, and specifically at the juvenile stage (i.e. potential impacts of hatchery fish on the growth and survival of wild fish, especially during "critical periods").	While the metric being considers looks at the spawning stage of the lifecycle, we believe that it provides a proxy throughout the lifecycle of the salmonid.
5.2.1 Management Strategy: For Highly Effective, it is not clear what is meant by "Scale of artificial production is appropriate to meet, but not exceed population goals"	Added explanation to text

5.2.1 Management Strategy: A Hatchery Genetic Management Plan (HGMP) will generally cover these factors in the tables and then should just be a matter of asking if the hatchery program is being managed to the objectives in its HGMP. If it is, then I think an assessment would indicate that it the program is being managed in a sustainable way.	We assessment of artificial production management systems, whether HGMPs or otherwise, will be assessed against the criteria developed and compliance of artificial production programs against these plans will be considered.
5.2.1 Management Strategy: We also are concerned that the ranking of management programs depends on the setting of targets and goals, not the meeting of those targets and goals. More weight should be placed on management performance with regard to reaching targets for minimizing the effects of artificial production.	Added text to highlight the importance of management to minimize impacts on wild populations and the need for management measures to be implemented and to be effective in order to obtain the highly effective score. Moderately effective requires implementation and the expectation that it would be effective e.g. follows best practice.
5.2.1 Management Strategy: To be Highly Effective, the management system should explicitly protect wild stocks. The current requirements do not focus enough on ensuring there are appropriate strategies in place to address and minimize the effects of enhancement. The requirements for the Moderately Effective category are much too weak; does not appear to actually consider the implementation or effectiveness of the strategy, nor the prevention of negative impacts on wild populations.	The criteria focus on the artificial production as that is the issue being assessed; however the protection of wild populations is the overarching aim and focus of the standard. This has been clarified in the guidance in Appendix 8.
5.2.1 Management Strategy: An ongoing problem in the lower USA is that many hatchery programs do not have approved ESA hatchery management guidelines – have in fact been operating for years which is one of the reasons for the plethora of law suits currently underway in the region. The hatcheries should not receive good/moderate standing unless those guidelines are in place and the programs are demonstrated to be implemented consistently with them.	If there is no management strategy, or the management strategy is not founded on scientific understanding and evidence, a score of ineffective is given for management strategy which would be considered a high concern.
5.2.2 Research and Monitoring: For Moderately effective: Change "annual" to "appropriate time basis" in; contribution of artificially produced fish to natural spawning escapement is estimated with reasonable accuracy on an (annual) appropriate time basis."	Language changed to: "The contributions of artificially produced fish and natural origin fish to fisheries are known and measured regularly;"
5.2.2 Research and Monitoring: Highly Effective research must include consideration of all potential impacts on wild systems, including such	Guidance has been added in Appendix 8 to ensure that consideration is given to the potential impacts of artificial production throughout the lifecycle of

things as density dependence, food competition, genetic mixing. It may be inaccurate to frame this as "effective research" as there is no requirement for application of results nor effectiveness. Information quality should be considered in the Highly Effective and Moderately Effective categories. Also, at both the high and moderate levels there must be a requirement for application of the research – both an analysis of actual impact on productivity and genetic diversity and application of research results to decision making.	salmonids, including freshwater rearing, marine growth phases, and migration and spawning. Application of research findings is considered under 'Management Strategy and Implementation' consistent with management factors in Criterion 3. The quality of the data is considered when determining whether the research and monitoring is sufficient to test the assumption made within the management strategy.
5.2.3 Compliance and Enforcement: Highly Effective: Should this be that permits are required and the regulations must be effectively enforced and complied with (instead of the permits themselves enforced)?	Compliance and Enforcement considers the application and enforcement of permitting laws and compliance with said laws, rather than the existence of laws/requirements themselves (as some of these laws exist outside the remit of fishery managers). The existence of laws that require permits for water quality or fish transport, for example, are considered under 'Management Strategy and Implementation' or 'Ecosystem Based Management' dependent on whether the impact is on salmonids or broader ecosystem functionality.
5.2.3 Compliance and Enforcement: Where USA ESA listed species are encountered, an allowable harvest impact, and allowable hatchery impacts are covered by biological opinions and hatchery management guidelines. Also certain hatchery activities, such as water quality of effluents, are regulated under the Clean Water Act whether there is an ESA listing or not. If allowed impacts are exceeded, there are regulatory consequences. One of the factors in this section should require that all programs demonstrate that they have permits in order, are operating consistent with their permits and have not been cited for violations.	
5.2.4 Ecosystem Based Management: I do not agree that the ecological effects of hatcheries are unknown or poorly known (but I agree that the impacts are mostly on species, not particularly on ecosystems). It is true that the Hatchery Scientific Review group failed to deal with them, however there are other guidelines and information provided in the scientific literature that should be considered.	Guidance for scoring 'Ecosystem Based Management' has been expanded in Appendix 8 to ensure effective assessment of these concerns. The language for factor 5.2.4 has been left broad deliberately as this is a developing area of science that may change rapidly. We will provide additional guidance on new scientific thinking as it develops.
5.2.4 Ecosystem Based Management: This section seems very vague; please provide detailed guidance for analysis and scoring.	

Appendix 1: Further guidance on the health of stocks and fishing mortality

Consider adding minimum viable population criteria to the mix. Reference points that are set should be able to demonstrate that they maintain spawning abundances at or above some minimum viable abundance.	As previously noted, we believe it is unrealistic to compare abundance to MVP-based reference points as they have not been established for most populations. Where these reference points do exist the stocks are typically listed as endangered under the ESA and are therefore considered of high conservation concern by Seafood Watch.

Appendix 3: Appropriate management strategies

There are nuances in these gear types. For example, depending on how gill net mesh sizes are regulated and how the gear is fished, the gear can be very selective toward the target species. You might consider inviting particular fisheries to demonstrate selectivity of some gears that otherwise are not considered to be selective.	Seafood Watch will consider additional scientific information regarding the selectivity of fishing gears where available and can adjust the main species assessed in a report according to said information.

Appendix 8: Scoring salmonid fisheries that include artificial production

Need to clarify the definition of stock management units (SMUs) as different regions manage salmon populations at different levels.	As previously noted, we have defined and SMU as: *A group of one or more stocks for which fishery management objectives have been established (for salmon, typically a spawning escapement goal) and that fisheries will be regulated to achieve. The Stock Management Unit is a broad management concept, such that not every population with a defined goal need be an individual SMU, but can be part of a collection of such populations within an SMU* (adapted from MSC 2014).
Some salmon fisheries are managed on a sliding scale that changes the allowed impact depending on abundance, that management approach can be very conservative where weak stocks are present and should be recognized in the assessment.	Harvest controls rules of this type are considered according to guidance set forth in Appendix 3 regarding management of wild capture fisheries.
Regarding pHOS and pNOB: these are only pertinent for integrated hatchery programs. Alternatively, and some people think this is better; the risk avoidance strategy can focus on decreasing all hatchery/wild interactions to the maximum extent possible. A pHOS may still be used to monitor the level of hatchery/wild interaction, but pNOB is expected to be zero.	The language in the standard has been altered to allow different approaches to the management of potential hatchery impacts to be considered providing evidence of their success can be demonstrated, including the use of avoidance strategies to reduce the chance of interactions to the extent possible.
Actually most integrated hatchery programs are	The distinction in the text is to highlight the

also implemented for the purpose of providing fish for harvest. Few hatchery programs successfully provide any conservation function.	different uses of the two strategies. Integrated programs can provide conservation and harvest benefits whereas segregated systems are unlikely to provide conservation benefits as they by definition do not supply fish to existing wild populations.
The pHOS/pNOB rates provided by the HSRG are only risk-adverse if assumptions in the modeling that use them are actually true. There is developing evidence that the assumptions are quite wrong. So view them with some skepticism and stay open to revisions.	We have broadened the language in the standard so to account for this uncertainty and other possible approaches to managing the impact of artificial production on salmonid populations and related ecosystems. Seafood Watch standards and criteria are reviewed on a regular basis and will take into account any changes in scientific thinking.