Review of Seafood Watch Criteria for Salmon Fisheries
Kathryn Kostow July 29, 2015
Although I currently work for Oregon Department of Fish and Wildlife, I am not conducting this review on behalf of ODFW. Please consider me to be an Independent Reviewer affiliated with Coffee Creek Bioscience, a consulting firm in Oregon City, Oregon, USA
You may acknowledge my name as a reviewer

Thank you for the opportunity to review this document. The Monetary Bay Aquarium has taken on an important and very complicated mission in this effort to rate world fisheries. Your effort and progress is commendable. I see the potential for Seafood Watch to become an incentive to improve and even renovate some aspects of fishery management, simply by posing questions and perspectives. Given the complexity, I suspect this product will continue to evolve over time. Hopefully my present comments will be helpful.

I have the following comments on this current document:

1. In the wording of the principles, particularly notable on page 3-4: Instead of "marine…" always use "marine and freshwater" for salmon fisheries. Some salmon fisheries occur in freshwater; also salmon management can affect freshwater species.

2. Page 4, principle 10: insert productivity:

Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, productivity, abundance or genetic integrity of wild stocks.

3. It seems to me that the hatchery effects are scattered among several criteria. Most of the language appears to be under 1.2, although later there is a reference to material being under criteria 3, and there is discussion about it being removed from criteria 5. In any case, I think hatchery program management should be its own criteria, with all hatchery issues included in the same place. Start by asking: is this fishery supported by a hatchery program or not; if not they get a "green" score, if so, they proceed through the evaluation and may get a green, yellow or red score depending on the results.

4. I think one of the complexities in this assessment, 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, the hatchery in Oregon). One of the things you could do, because fisheries 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 co-managers to obtain the pertinent hatchery management plans for each of these.

   It might be useful for you, down the line, to establish a data base that links hatchery stocks and the fisheries that catch them. So for example, Big Creek fall Chinook hatchery stock

from Oregon contributes 5% or more to fisheries x, y and z, ranging from the Columbia River to the coast of Alaska. Possibly you may need to combine hatchery stocks, similar to what you discuss in Appendix 9. If that is the case, SMU "Lower Columbia River Tules" hatchery stocks include Big Creek fall Chinook stock, and also x, y and z other hatchery stocks from this geographic area. These are already being grouped by fisheries managers, and you could adopt these groupings.

5. Just a question, here, but do you also evaluate invertebrate fisheries (shrimp, crab, etc)? How about shell fish (oysters)? Some of these have aquaculture also.

6. General comments on Criteria 1, factors 1.1 and 1.2 starting on page 7:

    a. There is a general lack of definitions of acronyms and terms in the text. I see that there is a glossary in the back, but maybe it should be reference better up front, or moved to the front. The document also seems to rely on citations, which are apparently expected to provide explanation. However, all terms should be defined at their first use in this document in order to avoid confusion. Readers do not necessarily have the references. Some examples:
        - Step 1 refers to a "PSA" method and gives a citation. But what is a "PSA" method?
        - Define everything in the tables, starting on page 10.

    b. I'm having some difficult applying the attributes in the tables, starting on page 10, to salmon. I realize this is trying to be universal, and primarily has marine species in mind, but is that really the right approach? Perhaps a different set of criteria for different species would have more utility? A better set of criteria could be developed that are unique to salmon. Step 2 seems geared more toward salmon, but be aware that salmon can also be of unknown abundance.

    c. Regarding the table starting on page 13: How do you know the "management targets" that are set are good ones in the first place? You should require that the management targets that are use have been demonstrated to be compatible with population viability and where appropriate, with population growth.

    It has been my experience that S_{msy} is often used as a management target for salmon without actually demonstrating that the abundance at S_{msy} is viable. The population viability literature (examples include Lande 1987 Am Nat 130:624-635, Lande & Barrowclough 1987 Chap 6 IN Viable Populations for Conservation (ed) Soule, Lande 1993 Am Nat 142:911-927; Lynch & Lande 1993 Chap 14 IN Biotic Interactions and Global Change (eds) Kareiva et al.) and the literature about harvest management thresholds has not been well reconciled. Some critiques and alternatives have been discussed (ie, Myers et al. 1994 ICES J Mar Sci 51:191-205; Larkin 1977 Trans Am Fish Soc 106:1-11; Sissenwine & Shepard 1987 Can J Fish Manag 44:913-918, Beverton 1995 Reviews Fish Bio Fisheries 8:229-249.)

d. Some salmon fisheries (most of them in the Columbia River, some in adjacent ocean fisheries) are managed to maximum allowed impact rates. That option should be allowed/considered in these criteria.

e. Factor 1.2 page 14-15: While the HSRG 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. In the table on page 15, I do not agree that just meeting the pNOB and pHOS standards actually provide a minor impact; it really depends on what is assumed in the modeling, and in fact those standards could represent serious impact if the assumptions are a little bit different. Some recent studies of poorly represented risks include: Christie et al Evolutionary Apps 2014, doi:10.1111/eva.12183, Kostow & Zhou 2006 Trans Am Fish Soc 135:825–841, Buhle et al 2009 Bio Cons 142:2449-2455; also see new ideas in https://www.nwcouncil.org/fw/isab/isab2015-1/).

But I agree that until better guidelines are developed, the HSRG guidelines are a reasonable place to start given that you must start somewhere. However, I would rank compliance with the HSRG as only "Yellow"/Moderate. A "Green" /Minor rating should require a demonstration of no hatchery program influence, or a demonstration that hatchery risks and hatchery-wild interactions are in fact not impacting the productivity and survival of any wild population. "Red" would be if the HSRG guidelines are not being met or impacts to wild populations have been demonstrated regardless of the guidelines.

In the second table, missing measures of pHOS/pNOB, I would change "minor" to less than 1% hatchery fish; moderate to 5% - 10%, and high over 10%. There is no literature that defends a general guideline of more than 10% hatchery fish being OK. (see for example, Ford 2002 Con Bio 16:815-825, Lynch and O'Hely 2001 Con Gen 2:363-378).

Meanwhile, expect to need to revise this section as the science evolves over the next several years.

7. General comments on Criteria 2

a. Under Factor 2.1, Abundance, starting page 20: Include the concept of not impairing viable abundance levels, along with recruitment and productivity. This is a similar concern as the one I had about whether management reference points actually represent viable abundances (see comment above).

b. In the table on page 21, shouldn't US, Canadian or state Endangered Species Act listings also be included. Perhaps by default they fall under one of those listed categories, but I'm not sure they do.

c. Table on Page 23: under fishing mortality, also include recreational and subsistence fishing. It isn't clear that non-commercial fishing is currently included.

d. Bycatch and discard section about 26 onward: You probably need some special consideration of bycatch of salmon in Columbia River fisheries. Many of the non-tribal commercial fisheries (and nearly all recreational fisheries) in the Columbia River are moving toward release requirements for all unmarked salmon (the fisheries will be targeting hatchery fish; all unmarked fish are considered bycatch). The managers are required to develop low-impact gear, and adopt release mortality rates. In these fisheries, an incidental harvest rate will be measured (# released fish x release mortality).

8. General comments on Criteria 3

a. Factor 3.4, starting on page 36. Where USA ESA 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 the allowed impacts are exceeded, there are regulatory consequences. One of the factors in this section should require that all programs demonstrate that they have their permits in proper order, are operating consistent with their permits, and have not been cited for violations.

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.

9. General comments on Criteria 5

a. Page 43: I agree with your proposal to establish criteria 5 to address ecological/trophic impacts of fisheries. I also agree that ecological effects of hatchery programs should be addressed as part of the hatchery assessment, since often genetic and ecological impacts are compounded, and since the ecological effects of hatchery programs are very different than the ecological effects of fisheries.

However, I do not agree that the ecological effects of hatcheries are unknown or poorly known (but I agree most of the impacts are on species, not particularly on ecosystems). It is true, however, that the HSRG assessment failed to deal with them, which is a shortcoming of the HSRG guidelines. Since the current language under your criteria 1.2 (not 3 as stated here) depends on the HSRG, these impacts are currently unaddressed. Hopefully, there will be improvements in the HSRG approach (I understand some updates are in the works). Meanwhile, I would suggest that you look at the guidelines and information provided in Kostow 2009 Rev Fish Biol

Fisheries 19:9-31, Kostow 2012 Environ Biol Fish 94:285-310, which provide specific risk avoidance strategies, and in the link I provided earlier https://www.nwcouncil.org/fw/isab/isab2015-1/ and pull some guidelines together from these documents for your use in this assessment. Put them with the other hatchery criteria/standards.

b. Ecologic effects, page 44: It is not clear whether evolutionary effects of fisheries is being captured here, or is intended to be captured here? (See for example Hard 2004 Chap 11 IN Evolution illuminated: salmon and their relatives, or Kuparien and Merila 2007 Trends Ecol and Evol doi:10.1016/j.tree.2007.08.011).

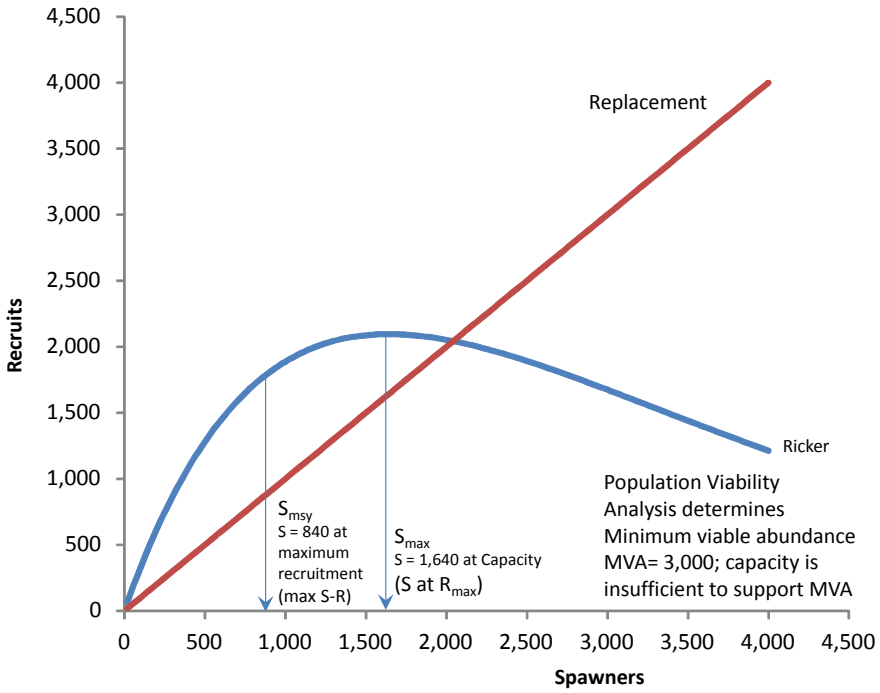
10. General comments on Glossery:

a. Page 47: Reference points: In addition to the consideration of maximum yield and unimpaired recruitment, concepts about viable abundance should be considered. Reference points that are frequently used in salmon fisheries, like S_{msy}, intentionally keep population abundance below carrying capacity in order to optimize "yield", or the number of recruits produced per parent. However, that target abundance may be below a minimum viable abundance.

Further, if habitat capacity for a population is severely impaired (as is the case for many salmon in the lower USA) abundance may not be viable even at maximum capacity (R_{max} and/or S_{max}, which are typically much larger than S_{msy}).

The relationship between these reference points are given in a hypothetical population in the figure below. The disconnect between minimum viable population analyses and salmon fisheries reference points is likely one of the major short comings in fisheries management that is contributing to over fishing.

It would also be of interest to ask, if capacity is insufficient to support an MVA for a population, should that population be fished on at all? Also, many salmon populations in the US now have recovery goals. Those also can be used as reference points.



b. Under bycatch: page 48: need to incorporate mark-selective fisheries, where hatchery fish are kept and unmarked fish are released with some mortality rate; all are of the same species in a mixed fishery.

c. Under Threatened or Endangered starting page 49: Since it is pertinent to salmon in the USA, the USA Endangered Species Act listings should specifically be listed here.

d. Page 53: discussion of hatchery impacts under genetic or ecological effects: I think the impacts of hatcheries are quite well documented and understood (although often argued in political discussions). There are thousands of papers available. The science since about 1995 has become extremely rich and is quite consistent.

It is important to recognize that the primary reason for hatchery programs is to support fisheries. Without the fisheries, there would be no need for most hatchery programs.

I would agree that the link between a particular fishery (for example, consider the Chinook fishery in the Gulf of Alaska) and hatchery programs that support it has been poorly pulled together in the sense of a risk assessment. On the other hand, the information about which hatchery programs contribute to which fishery is very well known to all fisheries managers. They do stock assessments on their catch; they

know which hatchery stocks contribute to it. They just haven't looked at that information from the perspective of doing a risk assessment.

Instead, hatchery risk assessments have been done in their own vacuum, even though most hatchery reform guidelines, including those from the HSRG, argue that hatchery risks have to be assessed in a management context.

I'm not sure what the Monterey Bay Aquarium could do to encourage a risk assessment that links fisheries (for example managed by Alaska) and the hatchery programs that support them (for example managed by Oregon & Washington). Ask for one, I suppose, and let them know it could improve their ratings. There are multi-jurisdictional forums under which these could be done.

11. Appendix 1: 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.

    Since it is possible that few (or maybe no) current fishing reference points consider whether the abundances they target are viable, perhaps extra credit could be given if they do take this into consideration. The question can be asked.

12. Appendix 3: 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. (Have them provide demonstration studies, etc).

13. Appendix 9:

    a. My comments about minimum viable abundance reference points particularly apply to salmon because i) PVA analyses can be readily performed on these species; and ii) many populations in the lower USA already have Minimum Viable Abundances (MVAs) identified for them.

    b. To clarify your SMUs (and maybe this is already what you mean): Individual salmon populations can be combined into SMUs (or we call them ESUs (evolutionarily significant units), or at a smaller scale, MGPs (major population groups)): A fishery likely catches multiple SMUs. Any SMU that is 5% or more of the catch needs to have its own reference point or impact rate. The fishery is managed to protect the weakest SMU. If smaller scale groupings are used, perhaps the fishery can be managed to protect the n^{th} weakest MGP.

    c. Some salmon fisheries can be 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.

d. Regarding pHOS or pNOB: These are only pertinent for integrated hatchery programs. Alternatively, and some people think it 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. So you need to move the paragraph about integrated and segregated programs to above the pHOS/pNOB discussion.

e. Actually most integrated hatchery programs are also implemented for the purpose of providing fish for harvest. There is a bit of double-speak that goes on in this arena because somehow providing fish for harvest seems less "nice" than using them for some purported conservation function. Actually, few hatchery programs successfully provide any conservation function.

f. 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 these with some skepticism, and stay open to revisions.

g. I have provided a copy of Kostow 2012, which is a sequel to Kostow 2009 and may offer some additional information.