

SUMMARY OF ANTICIPATED EVIDENCE

Dr. Carrie Holt

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Conservation Unit benchmarks generally under the Wild Salmon Policy

- Dr. Holt will explain her contribution to the implementation of Strategy 1, Step 1.2 of the Wild Salmon Policy (WSP), and specifically her role in designing DFO's methodology to identify indicators and benchmarks for the status of Conservation Units (CU).
- She may summarize the concept of lower and upper benchmarks for CUs under the WSP using Figure 3 of the WSP (p.17), and her understanding of the purpose and function of CU benchmarks
- If asked, she can generally explain the differences and similarities between WSP benchmarks, as set out in the text of the WSP, versus limit reference points (LRPs) and target reference points (TRPs). She will say that LRPs are generally more prescriptive than WSP benchmarks which are not intended to direct a specific management action like a harvest control rule. Rather, lower benchmarks under the WSP are intended to reflect biological status.
- She will say that if a CU falls below a lower benchmark under the WSP, this is meant to trigger management concerns to identify what the response should be but is not intended to dictate a specific action or outcome. She will say that while harvest control rules may be common in other marine fisheries, the WSP intended that poor conservation status would not automatically trigger a specific management response.
- If asked, she will say that while she personally favours the accountability of harvest control rules with reference points, Pacific salmon fisheries may arguably be too complex for that approach particularly if one seeks to consider less quantitative factors like ecosystem values and socio-economic values, and the large number of stakeholders in the fishery with numerous, often competing objectives.
- If asked, she will say that there is no single international approach to LRPs and TRPs. She can explain the relationship between LRPs, as they are generally understood, and the precautionary approach.
- She will be asked about the requirement in Strategy 1, Step 1.2 of the WSP that DFO prepare and publish operational guidelines regarding the level within the "red zone" where a CU is at risk of extirpation. She will say that, to her knowledge, nobody at DFO has ever been assigned responsibility for preparing those guidelines. . She has not been involved in preparing any such operational guidelines. She can explain that falling below the level of the lower benchmark reflects an increase in the possibility of extirpation, but that dramatic increases in the probability of extirpation will occur at levels farther below the lower benchmark.

The methodology for determining Conservation Unit benchmarks

- She can summarize the CU benchmark methodology that she developed, which was published by CSAS in 2009.
- Specifically, if asked, she will explain that she and her co-authors identified four dimensions of status on which the health of CUs could be evaluated: abundance, trends in abundance over time, distribution, and fishing mortality relative to productivity. She

can explain this with reference to Figure 4 of Holt et al. 2009, at page 9). These dimensions were chosen as they showed the many ways that CU status can vary and can be affected by anthropogenic influences. She and her co-authors selected candidate metrics for those four dimensions, and then selected a list of possible candidate benchmarks for metrics on three dimensions of status (abundance, trends in abundance, and fishing mortality relative to productivity). They then used a simulation model to evaluate the properties of candidate benchmarks on two dimensions of status (abundance and fishing mortality relative to productivity) to assess their production characteristics and probabilities of extirpation over the long term. In undertaking this evaluation, they were interested in the probability of recovery to a target reference point and the probability of extirpation of a CU if harvested to a limit reference point.

- If asked, she can explain how the model accounts for uncertainty in various ways. She can explain how the benchmark methodology considers more than one stock recruitment function, and considers stochastic variability in recruitment, age-at-maturity, measurement errors in observations of spawner abundances, and outcome uncertainty from implementing harvest regulations.
- She can describe how benchmarks do not all depend on traditional stock-recruitment analysis, which provide a poor fit to the data for certain stocks.
- She can explain that she and her co-authors evaluated and chose CU benchmarks based on their performance in that model (including the degree to which they were robust to uncertainties in stock productivity) and on their practical application to CUs.
- She can explain that some metrics were chosen as candidates, but are not realistic for current assessments because of the lack of data that exists for many CUs (e.g., metrics of distribution).
- She can explain that the CU benchmarks chosen were only for the dimensions on abundance, trends in abundance, and fishing mortality relative to productivity.
- Candidate metrics have been suggested for the dimension on distribution, but no benchmarks have been identified. With regards to the distribution dimension, she will say that the quantitative relationships between distribution and ecological sustainability, and resilience of salmon populations are not yet well scientifically understood. While it is understood that CUs are more resilient if broadly distributed (for example, due to the “rescue effect” where extirpated populations are recolonized by nearby populations), the most appropriate metrics for capturing characteristics of distribution are not known.
- She will say that monitoring WSP distribution metrics is complex and challenging, and that DFO does not currently put much effort into monitoring distribution. DFO Science does not yet know what type of sampling designs would provide the best (most accurate and unbiased) estimates for distribution metrics, and lacks the time and personnel to advance scientific understanding on this quickly. She will say that she is beginning to work on this question at DFO.
- She will say that, on September 23, 2008, she presented her methodology to the Operations Committee, which was satisfied with her direction on benchmarks and approved the continuation of her work on Strategy 1. With reference to the Record of Decision for that meeting (see CAN005396 and CAN018502), she will provide her recollections and understanding of the Regional Directors’ emphasis of the need to distinguish the biological status of CUs from the decision-making process.
- She will be asked to reflect on the statement in the Record of Decision that “It is important to characterize our work on benchmarks within the context of national-level priorities”. She will say that, aside from the possibility that what was being referenced by senior management was the “DFO Decision-Making Framework Incorporating the Precautionary Approach”, she was unclear from the meeting what other particular

national-level priorities might have been intended. She will say that the members of the Operations Committee did not provide direction on what this meant and told her to discuss this with Allison Webb, the Regional Director of Policy. She will say that she contacted Ms. Webb, who suggested that she recognize that the work on benchmarks is consistent with other national initiatives and that it should be contextualized within those other national priorities. Without further details, Dr. Holt will say that she has assumed that one of the relevant national priorities referred to by the Operations Committee is DFO's decision-making framework regarding the precautionary approach.

- In addition, Dr. Holt will say that the methodology for developing benchmarks includes considerations related to the Species at Risk Act. She will explain that the lower benchmarks were chosen to allow for a buffer between that level and the level that would be considered for listing by COSEWIC, the Committee on the Status of Endangered Wildlife in Canada (mandated by SARA to perform species assessments).

Efforts to implement Action Step 1.2 by determining benchmarks for specific CUs

- Dr. Holt will explain the membership and role of the WSP "Strategy 1 Oversight Group" led by Dr. Neil Schubert.
- She can discuss DFO Science's efforts to involve and assist Area staff in developing CU benchmarks, including the CU benchmark implementation workshop held in June 2010.
- She will say that she has been meeting periodically with Area and Science staff to discuss the implementation of the CU benchmark methodology.
- She will say concerns have been raised by Area staff and others about the challenges of determining CU benchmarks and monitoring status on the dimension, fishing mortality relative to productivity, which is causing DFO Science to rethink its benchmarks on fishing mortality.
- She agrees that the determination of CU benchmarks has partly stalled, and will provide her understanding of the reasons why that is so.
- She will say that Area staff generally has responsibility for defining CU benchmarks, with guidance from Science.
- She will say that she provides WSP-related guidance to Area staff approximately three times per year, through workshops or conference calls. She worked intensely for a couple of months in 2009 with Diana Dobson to identify methods for dealing with data deficiencies when developing benchmarks and assessing status based on CUs on the West Coast of Vancouver Island (WCVI), and has also worked over the fall of 2010 with Sue Grant on assessing status of Fraser River sockeye salmon CUs.
- She will say that she developed a software tool to assist Area staff with the implementation of benchmarks based on spawner abundance, and provided that software to Area staff in June 2010. Her intention is to further develop that software tool, which she has not yet had the capacity to do but hopes to in 2011.
- She will say that, to date, she is not aware of DFO determining benchmarks for any CU except those off the West Coast of Vancouver Island (WCVI) where CUs have had provisional benchmarks for approximately a year and the Fraser River sockeye CUs (where a preliminary assessment of CUs is under review by CSAP).
- She understands that development of benchmarks on the Nass and Skeena Rivers began in 2010. She will say that she was aware that work on benchmark derivation was beginning in the Nass and Skeena River systems in the winter of 2010, but is not aware of their progress.
- She will say that provisional Fraser River sockeye salmon CU benchmarks have been identified, but are currently under CSAP peer review.

- She does not believe the reason benchmark estimation has been stalled is a technical issue, as other areas like the WCVI, led by Diana Dobson, have had no difficulty implementing provisional benchmarks.
- She will say that – except for the Fraser River sockeye CUs, WCVI, and the Skeena/Nass system – it is much less clear as to which individuals have direct accountability within the Area or the Region for implementing benchmarks.
- She will say that for Fraser River sockeye CUs, the lead scientist assigned to determining CUs benchmarks is Sue Grant.
- She will describe generally the objectives and methods of the draft paper to be presented by Sue Grant for CSAP peer review on November 15-16, 2010, on which Dr. Holt is a co-author.
- She will be asked how far the draft paper brings DFO towards determining specific benchmarks for specific Fraser River sockeye CUs.
- She will say whether, to her knowledge, there has been any formal decision about which CUs are priority CUs for benchmark determination.
- She can explain some of the specific technical challenges in developing benchmarks on some dimensions of status.
- If asked, she will say that one challenge has been the metric for fishing mortality. Fishing mortality, F , was chosen as the fourth dimension to address situations where there is a lack of abundance data on CUs. The lower benchmark on this metric, F_{MSY} , (the fishing mortality that will result in maximum sustainable yield) has been criticized as being inconsistent with the lower benchmark on spawner abundances (S_{gen} , the spawner abundances that will result in recovery to S_{MSY} within one generation in the absence of fishing). This discrepancy was also noted in the original paper by Holt (2009) (p.29).
- She will say that Science is now considering new lower benchmarks on fishing mortality to be more consistent with the spawner abundance benchmarks. She will say that this shift would be inconsistent with the international approach to limit reference points which guided her initial use of F_{MSY} as the lower benchmark on fishing mortality. She will say that this issue was not raised at the peer review of the benchmark methodology, but arose in subsequent conversations including at the June 2010 workshop and with Steve Cox-Rogers.
- She will say that another challenge in determining CU benchmarks has been deficient data sets, with temporal or geographic gaps. This issue was also discussed at the June 2010 workshops, where she presented a preliminary set of options for methods of data infilling or aggregating data across geographic sites. She is attempting to provide a consistent set of guidelines that the Area offices can apply and adjust in the same way, to avoid each Area developing inconsistent solutions to the problem of data deficiency.
- She will say that another challenge in determining CU benchmarks relates to non-stationarity in productivity, in the situation where productivity is declining as with many Fraser River sockeye CUs.
- She will be asked whether, to her knowledge, Area staff are developing benchmarks for Fraser River sockeye CUs in consultation with the public or First Nations.
- She has presented on the CU benchmark methodology to stakeholders including the Integrated Harvest Planning Committee (IHPC) and the Salmon Enhancement and Habitat Advisory Board (SEHAB).
- She will say that she and Mark Saunders have discussed the possibility of working with SEHAB and stewardship volunteer groups to monitor CU status using a DFO-designed survey, although she has not had the capacity in 2010 to work on designing a statistically rigorous and biologically relevant survey
- Based on her occasional involvement with the larger WSP Implementation Team, she

understands that DFO Policy has initiated steps toward the Strategy 6 five-year review by way of interviews with DFO staff, though she is not currently aware of any independent reviewers.

- In her view, a lack of human resources at DFO is the largest challenge to the implementation of the WSP including Strategy 1. She will say that the Fraser River is a complex system and that the complexity can sometimes paralyse implementation efforts.
- If asked, she can explain how maintaining biodiversity is essential to the conservation of Pacific salmon including Fraser River sockeye