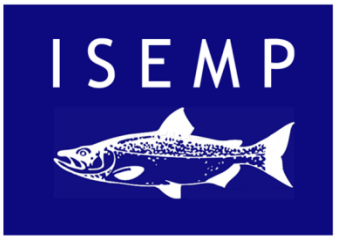
Response to Comments on the Scientific Protocol (Working Version 1.0) for Salmonid Habitat Surveys within the Columbia River Habitat Program (CHaMP)

Draft

September 26, 2011

Prepared and funded by the
Bonneville Power Administration's
Integrated Status and Effectiveness Monitoring Program



for
Bonneville Power Administration's Columbia Habitat Monitoring Program

This document was funded by Bonneville Power Administration's Integrated Status and Effectiveness Monitoring Program (ISEMP; Project # 2003-017) for use with BPA's Columbia Habitat Monitoring Program (CHaMP; Project #2011-006).

This document should be cited as:

Walker, S.W. and M.B. Ward, 2011. DRAFT Response to Comments on the Scientific Protocol (Working Version 1.0) for Salmonid Habitat Surveys within the Columbia River Habitat Program (CHaMP). Prepared by the Integrated Status and Effectiveness Monitoring Program and published by Terraqua, Inc., Wauconda, WA. 93 pages.

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SECTION 1: INTRODUCTION

This document has been prepared to respond to comments received on the Scientific Protocol for Salmonid Habitat Surveys within the Columbia River Habitat Program (CHaMP).

In addition to the comments on the CHaMP Habitat Protocol, described below, principle recommendations from the Northwest Power and Conservation Council (NPCC) regarding the entire CHaMP program from their Research, Monitoring and Evaluation and Artificial Production Project Review Decision Document June 2011 are included herein. These principles receive particular focus in Chapter 2 but are not included in Table 1 (*as of this draft*).

Comments on the spring 2010 version of the Habitat Protocol were received from the USFS/BLM and the Washington Department of Ecology (WDOE). Comments on the CHaMP Salmonid Habitat Protocol (Working Version 1.0, dated January 25, 2011) were received from:

- Independent Scientific Review Panel (ISRP)
- Columbia River Inter-Tribal Fish Commission (CRITFC)
- Yakama Nation (YN) – Klickitat Fisheries Program
- US Forest Service/Bureau of Land Management (USFS/BLM)
- Oregon Department of Fish and Wildlife (ODFW)

The focus of this document is to address comments received on the CHaMP Salmonid Habitat Protocol Version 1.0. All comments received are included in their original form in Appendices A-G.

1.1 Document Structure

In order to facilitate response generation, all comments received are grouped by topic and habitat indicator when possible. Each topic is numbered and is cross-referenced to the original comment(s) (also numbered) within Table 1. Within each subsection, comments are listed first and are followed by the response of the CHaMP program.

Comments are also assigned to one of three Action Categories:

- Immediate Change for 2011: For this action category, the CHaMP protocol will be redrafted and conducted differently in 2011 than described in Working Version 1.0 to accommodate suggestions made by the comment(s). The CHaMP program will issue a final 2011 Working Version 2.0 in advance of the 2011 field season;

- Consider Change for 2012: The ability to respond to comments in this action category, prior to the 2011 field season, is constrained in several ways, especially due to the late date that comments were received relative to the 2011 field season and the fact that data management systems, study designs, and field training materials had necessarily been established, based on the January 25, 1011 Working Version 1.0, before many of these comments were received. Comments

that fall in this action category merit further consideration and may benefit from additional testing or development during the 2011 field season. The CHaMP program will examine these comments in greater detail after the completion of the 2011 monitoring season and in advance of subsequent protocol versions.

- No Change: Comments that fall in this action category usually suggest changes that would either violate the stated program objectives or fail to meet the metric inclusion rule set that was used to identify methods and metrics to be used in CHaMP. Often, ideas conveyed by comments in this action category had been considered, and rejected, during the protocol development process.

Table 1. Comments received and addressed in this document, grouped by topic/indicator.

Unique ID	Commenter	Comment Type	Indicator	Major Topic No.	Comment	Orig Doc Page Ref	Action Category
1	ISRP	General		2.1	The utilization of CHaMP in other (non-IMW) watersheds where fish populations are being monitored was not thoroughly explained, including whether the sampling protocols would facilitate an evaluation of restoration effectiveness on fish populations.	6	
2	ISRP	General		2.1	Given CHaMP's approach for selecting watersheds, it remains to be demonstrated how well the results obtained through the CHaMP project can be extrapolated to unmonitored watersheds within the interior Columbia River Basin.	6	
3	ISRP	General		2.3	It was not clear to the ISRP how ISEMP and CHaMP, in evaluating restoration effectiveness, propose to accommodate factors affecting fish populations downstream from CHaMP sampling locations (non-wadeable areas downstream of CHaMP sampling sites, including the mainstem, estuary and ocean).	7	
4	ISRP	Logistics		2.3	At the workshop, CHaMP personnel stated that a 3-person crew could sample a site per day on average. We think this may be optimistic for sites that are located in roadless areas or sites that are otherwise difficult to access, given the large number of habitat attributes and the time required for digitizing channel morphology.	10	
5	ISRP	Coord w/other program data		2.2	The rationale for not adopting existing monitoring protocols (e.g., EMAP, PIBO, ODFW's Aquatic Inventories Project) could have been made more apparent by the CHaMP team.	11	
6	ISRP	Logistics		2.3	It was also unclear how much flexibility would be allowed in implementation of the protocols to deal with possible field constraints such as limited time available for sampling, problems posed by weather conditions, and logistic difficulties in sampling particular sites.	11	

7	ISRP	Protocol/Metrics		2.1	We are still not sure how habitat status and trend monitoring data will be related to (integrated with) status and trends of fish population data within CHaMP watersheds to evaluate the effectiveness of specific restoration strategies or general restoration effectiveness in a geographic area (e.g., are the co-managers in a given subbasin successful in restoring stream habitat in their area?).	11	
8	ISRP	Protocol/Metrics		2.1	It was unclear which entity or entities will be responsible for conducting fish status and trends monitoring at CHaMP sites, what kinds of fish data would be collected (e.g., site/reach-specific abundance sampling or fish in-fish out), and what kinds of analytical methods will be used to relate fish status and trends to habitat status and trends.	11	
9	ISRP	Protocol/Metrics		2.3	The ISRP believes that the description of life stages influenced by various habitat measurements could be more refined. In many cases, the life stage affected by a given habitat attribute was identified as "parr to smolt." However, we believe this may be too coarse. Where possible, seasonal or age class effects could be noted, and this would help illuminate how some restoration actions are influencing VSP parameters.	12	
10	ISRP	Protocol/Metrics		2.1	It is unclear how the results obtained from monitoring individual sites within a watershed can be "rolled up" to the entire watershed to advance generalizations about status and trends in habitat condition for the watershed as a whole.	12	
11	ISRP	Protocol/Metrics		2.3	However, it was also evident that these results can be confounded by several factors… Despite the progress and promise of simulation modeling, the protocols and application of CHaMP will be very much challenged by these limitations.	12, 13	
12	ISRP	Sample Design/Site Select		2.3	We therefore suggest that CHaMP re-visit the issue of number of sites, perhaps by designing a study that compares long-term monitoring results from paired CHaMP watersheds with more, less intensively sampled sites versus fewer, more-intensively sampled sites. We also suggest that CHaMP provide a clearer description of how site selection is influenced, if at all, by proximity to	14	

					ongoing instream or riparian restoration actions.		
13	ISRP	Data Management/QC		2.1	It is not clear at this point in time how the data will be analyzed for long-term habitat status and trends, and whether CHaMP personnel or collaborators will perform the analyses.	15	
14	ISRP	Data Management/QC		2.16	Although the ISEMP team has an excellent record of issuing timely progress reports, we feel that more information should be published in peer-reviewed journals.	15	
15	ISRP	Data Sharing with Others		2.16	The ISRP encourages the periodic exchange of habitat status and trend data and analyses through annual meetings of those organizations engaged in collecting both habitat and fish population information. Periodic (annual or 2-year) habitat workshops would be a useful forum for information exchange between monitoring organizations, particularly with respect to questions about which protocols are and are not working effectively.	17	
16	ISRP	Coord w/other program data, staff		2.3	[Enfranchisement] It was not completely clear if the potential cooperators with CHaMP (agencies, tribes, regional NGOs, etc.) are to be mainly data collectors or if it is anticipated that the cooperators themselves will eventually have the staff expertise not only to collect the data using established protocols but to effectively understand and use the modeling programs and other analytical tools to support and document the benefits of their habitat restoration programs.	17	
17	ISRP	General		2.2	Prior to extensive implementation of CHaMP, a cautionary approach might be to initiate several modestly sized CHaMP protocol tests (focused, for example, on a range of watersheds across the Columbia Basin where both habitat and fish population monitoring efforts are occurring) in which different approaches to design, data collection, data storage, and data analysis, can be compared to provide a test of the efficacy of scaling up from past efforts while still allowing and encouraging other promising, or well proven, efforts to continue.	18	

18	ISRP	General		2.16	The ISRP recommends that a comprehensive review of this suite of projects (ISEMP, IMWs, CHaMP) be undertaken to determine if indeed they, as a whole, are sufficient to provide status and trends monitoring of habitat and fish and are capable of answering the central question of whether habitat restoration actions are achieving desired objectives.	19	
19	ISRP	General		2.16	The ISRP would be interested in learning more about the efficacy of different approaches to establishing the relationships between fish performance and habitat condition and would like to review CHaMP, ISEMP, PNAMP and other effectiveness monitoring efforts in one to two years.	20	
20	ISRP	Water Quality	Nutrients-Chemicals, Pesticides	2.4	Two water quality issues, in particular, should receive additional consideration by CHaMP. Agricultural pesticides and Pharmaceuticals, personal care products, and flame retardants.	20, 21	
21	CRITFC	Sample Design/Site Selection - Spatial Extent		2.3	Because it is not explicitly stated in the CHaMP protocol, we would like assurance that potential habitat is in fact included in CHaMP design	1	
22	CRITFC	Sample Design/Site Selection - Stream Classification Methods	Channel	2.11	[By using public vs. private] the sampling matrix will be empty or unbalanced in many cases (e.g., the absence of fish-bearing source reaches in private land). Additionally, we would like more information about how the Montgomery &Buffington valley types will be determined prior to sampling so that we can ensure it meets our project needs.	2	
23	CRITFC	Sample Design/Site Selection - Site length and delineation	Channel	2.11	Bankfull width is a characteristic that can be modified by land use such as cattle grazing, so some heavily impacted streams will be sampled in disproportionate lengths.	3	
24	CRITFC	Sample Design/Site Selection - Site length and delineation		2.11	Another issue that needs clarification is where to establish the boundaries of a reach with respect to natural channel unit boundaries.	3	

25	CRITFC	Sample Design/Site Selection - Location of subsurface sediment sampling	Subsurface Fines	2.6	we feel that fine sediment quantities in riffles is not necessarily a good indicator of spawning gravel quality and will be difficult to directly relate to a biological response (i.e., growth or survival), which is a primary goal of the CHaMP protocol. Instead, we suggest that subsurface samples should be collected in areas of potential spawning habitat as determined from an evaluation of suitable depth, substrate size, and velocity criteria (Schuett-Hames et al. 1999).	3	
26	CRITFC	Sample Design/Site Selection - Subsurface sediment Sample Processing	Subsurface Fines	2.6	The shovel method for collection of subsurface sediment samples may result in a loss of fine sediment particles as water currents may tend to wash the fine sediment out of the sample as it is retrieved, particularly in swift currents.	4	
27	CRITFC	Sample Design/Site Selection - Embeddedness Metric	Embeddedness of Fast Water Cobble	2.5	We recommend dropping embeddedness from the CHaMP protocol in order to save time, reduce redundancy, and eliminate collection of data that are prone to measurement error and subjectivity.	4	
28	CRITFC	Sample Design/Site Selection - Fish Cover Metric		2.12	CHaMP has dropped some of the cover elements from the original EMAP protocol. ...we think it is a mistake to exclude them from the protocol. Removal of these categories makes it impossible to cross walk between CHaMP and EMAP datasets.	4	
29	CRITFC	Sample Design/Site Selection - Fish Cover Metric		2.12	The category of artificial structures needs to be clarified. We suggest counting artificially placed LWD in the ―woody debris‖ category, artificial boulders in the ―boulder‖ category, and not including these elements as artificial structures.	5	
30	CRITFC	Sample Design/Site Selection	Benthic Macroinvertebrates	2.9	The current version of CHaMP does not include benthic macroinvertebrate sampling, relying completely on drift sampling. ...why does the protocol exclude benthic sampling?	5	
31	CRITFC	Sample Design/Site Selection - Measurement of surface sediment samples	Riffle Particle Size	2.1	The CHaMP protocol recommends measuring surface sediment particles using a ruler. We suggest using a gravelometer (i.e., template) instead.	5	

32	CRITFC	Sample Design/Site Selection - Measurement of surface sediment samples	Riffle Particle Size	2.1	Rather than zigzagging to collect particles, why not collect on 2 transects spaced at a certain distance apart. Bunte and Abt recommend spacing between particles > the largest particle.	5	
33	CRITFC	Sample Design/Site Selection - Drift Sampling	Total Drift Biomass	2.8	We recommend a more standard mesh size of 500 μm.	5	
34	CRITFC	Sample Design/Site Selection - Drift Sampling	Total Drift Biomass	2.8	to capture more variability in the invertebrate composition (e.g., terrestrial invertebrates or invertebrates living in shallower water), nets should be placed in (a) the thalweg and (b) stream edge	5	
35	CRITFC	Sample Design/Site Selection - Drift Sampling	Total Drift Biomass	2.8	We recommend estimating biomass of drift by taxa, terrestrial vs. aquatic, and size class	6	
36	CRITFC	Sample Design/Site Selection - Total Station Survey		2.11	The terms monuments, benchmarks, and control points need to be more clearly defined (p. 46).	6	
37	CRITFC	Sample Design/Site Selection - Total Station Survey		2.11	Is it necessary to see other benchmarks from the starting benchmark (p. 56)? Can't intermediate points be used to link all survey points to a single benchmark?	6	
38	CRITFC	Channel Unit Classification	Channel	2.11	Definitions of cascade and rapid seem to be reversed.	6	
39	CRITFC	Channel Unit Classification	Channel	2.11	Unit classification types such as ―dry channel‖ and ―puddled unit‖ are not included in the protocol, but are likely to be frequently encountered in the field. We recommend that CHaMP includes these unit types.	6	
40	CRITFC	LWD	LWD Volume	2.14	Methods for measuring or estimating the width and length of lwd are not clearly defined. We recommend visually estimating width at the midpoint of each piece and visually estimating length, and measuring a systematic subset (e.g., every tenth) of each piece. We recommend expanding the width and length size classes to incorporate all potential size classes encountered in the field using width increments of 15cm and length increments of 3m.	6	

41	CRITFC	Solar Pathfinder	Solar Input	2.7	The Solmetric Suneye 200 allows precise measurement to be made and also stored on the computer for further processing digitally if required. This device should be investigated as a more updated and reliable method for solar loading.	6	
42	CRITFC	Site Evaluation		2.15	CHaMP states that site evaluation will be completed using a ―to be developed‖ manual (p. 45). What will site evaluation consist of?	7	
43	YN	Logistics		2.3	We have reservations about the feasibility of completing one site per day.	1	
44	YN	Program		2.15	It was unclear what the current status of the CHaMP Program is or the likelihood of funding subbasins such as the Klickitat.	1	
45	YN	Macroinverts	Total Drift Biomass	2.8	...we question the utility of drift collection. It is unclear what interferences will be made from this data….Due to limitations imposed by sampling sites at most once a year, we recommend excluding the macroinvertebrate component from the sampling protocol.	1	
46	YN	Sample Design		2.3	It does not appear that the proposed number of topographic points (500-1000) collected is scaled to longer site lengths based on bankfull widths ≥ 20 m. An average point density may be more appropriate.	1	
47	YN	Sample Design		2.3	In the Klickitat subbasin the White Creek subwatershed is the focal point of several habitat enhancement projects and intensive *O. mykiss* monitoring and evaluation efforts. Therefore, we would like to weight the number of CHaMP sampling sites similarly to the example of Trout Creek in the Wind River subbasin.	2	
48	YN	Sample Design		2.2	Has an analysis been done regarding the ability to crosswalk data collected between TFW and CHaMP protocols (ex. LWD)? How compatible certain metrics are will dictate whether or not we need to incorporate a subsample of legacy TFW sites within the CHaMP site selection.	2	
49	USFS/BLM	Coord w/other program data		2.2	Lack of discussion on how CHaMPs data will be used in conjunction with similar data collected by the federal land management agencies under their long-term aquatic habitat monitoring programs.	1	
50	USFS/BLM	Coord w/other program data		2.2	It is not clear why there is a need to fund and implement another untested monitoring approach (protocols) until it	1	

					can be demonstrated that data can be correlated with those collected by other programs, or that it is considerably better.		
51	USFS/BLM	Total Station		2.11	Utilization of the *total station* protocol will only be as good as the rapid protocol method used by PIBO if accurate measurements of stream reaches can be achieved in a one day time period.	2	
52	USFS/BLM	Total Station		2.11	The difference between CHaMPs and Harrelson et al. (2004) is that CHaMPs fails to require the survey to be closed or discuss what an acceptable level of accuracy is. The CHaMPs protocol instead relies on the ability to relocate the top and bottom of reach markers. This will add error (especially between surveys occurring over years) versus requiring the survey to be closed out.	2	
53	USFS/BLM	Total Station		2.11	To maximize precision and accuracy (the reason *total station* approach is used), we recommend that the survey be closed with a predetermined allowable error (see Harrelson et al. 2004, page 24). This will allow for an estimate of the error and closer agreement in the DEM's derived from multiple surveys.	2	
54	USFS/BLM	Total Station	Channel	2.11	For streams with greater bankfull width, there will be insufficient data to accurately compare DOD (less than one point every three square meters). At present, there is no science to support that the total station approach can be used to detect changes in high gradient channels.	3	
55	USFS/BLM	Total Station		2.11	CHaMPs suggests that one improvement in their approach (versus others) is that it allows the taking of "smart" points, meaning sampling crews will have the discretion to take measurements where stream topography changes. This has not been our experience.	3	
56	USFS/BLM			2.2	It appears then that there is no value (cost-effectiveness, efficiencies) in implementing CHaMPs for metrics where data is already being collected.	3	
57	USFS/BLM	Total Station		2.11	Since the highest upslope point established by each observer will be based on what he/she determines to be bankfull, there is no guarantee true bankfull will be correctly identified. Therefore, the use of a revised total station protocol, which relies on the observer to measure just past what they identify as bankfull, may end up having little value as taking measurements far out into the	3	

					floodplain was what was needed.		
58	USFS/BLM	Total Station		2.2	We found no explanation on how data collected using a revised *total station* protocol will be summarized by individual metric, how this information will be used in any broader scale analysis, and how it will be related to data in the same subbasins/watersheds where other monitoring programs are collecting data (e.g. PIBO, AREMP).	4	
59	USFS/BLM	Macroinverts	Benthic Macroinvertebrates	2.9	Another substantive issue with the CHaMPs approach is the movement away from collecting benthic macroinvertebrates and instead focusing on macroinvertebrate drift.	4	
60	USFS/BLM	Macroinverts	Benthic Macroinvertebrates	2.9	We also believe that the use of benthic macroinvertebrate data is the only way CHaMPs can tie their habitat metrics to conditions in reference (low to no management)/unmanaged streams (Stoddard et al 2006). The current CHaMP design does not include a reference (low to no management)/managed design component so it will not able to provide data to determine expected taxa.	4	
61	USFS/BLM	Macroinverts	Total Drift Biomass	2.8	CHaMPs uses two nets placed at mid-day for three hours. This is significantly lower resolution than in Hayes et al. (2007) and the use of two nets will unlikely will be sufficient to overcome variability in macroinvertebrate drift in either time or space (Weber 2009).	4	
62	USFS/BLM	Macroinverts	Benthic Macroinvertebrates	2.9	Instead of eliminating benthic macroinvertebrate samples, we suggest adding one metric to these samples, specifically biomass.	4	
63	USFS/BLM	Survey Design		2.1	Implementing the survey design as stated in CHaMPs will make it almost be impossible to detect a trend in any stream habitat in a reasonable time frame. With about 25 samples per year (a total of 50-75 with a three year sample frame), it is unlikely that a 10 to 20% response in stream metrics over the timeframe of a decade would be detected (Roper et al. 2002).	4	
64	USFS/BLM	Survey Design		2.3	We recommend less emphasis on sampling small, higher gradient streams since it is unlikely these streams will tell you much about either the status or trend of stream habitat	5	

					(Montgomery and MacDonald 2002).		
65	USFS/BLM	Logistics		2.3	The CHaMPs approach proposes to complete one sample per day. In our experience, the time to complete a survey must account for the time it takes to drive and hike to the surveyed site.	5	
66	USFS/BLM	Survey Design		2.3	There are many attributes that PIBO and AREMP evaluate which CHaMP chooses not to measure, including those that lead to an evaluation of the presence of invasive aquatic species that could affect fish survival	5	
67	USFS/BLM	Survey Design - Riparian	Riparian Structure	2.13	The CHaMPs approach does not directly survey riparian vegetation even though it has been shown that land management, including restoration efforts to improve riparian areas, provide survival benefits to fish.	5	
68	USFS/BLM	Survey Design		2.1	Some of the protocols suggested by CHaMPs, such as, embeddedness, fish cover, and sediment size are not well described nor have they been shown to be repeatable or responsive to management including restoration. One example is the estimation of substrate size using a pebble count: will pebbles be collected from bankfull to bankfull or only in the active channel?	5	
69	USFS/BLM	Sediment	Subsurface Fines	2.6	The reason Wolman (1954) limited the number of clasts to 100 was not because he found this number was sufficient to precisely describe the substrate size but because samples larger than this led to significant difference between observers. Therefore, the choice to measure 210 pebbles in CHaMPs means that you will have to account for biases among individual crew members (and crews), even as you get more precise estimates of streambed grain size.	5	
70	USFS/BLM	Visual Estimates		2.1	We are concerned that several attributes, such as fish cover, channel unit substrate, and large wood will be visually estimated rather than measured. The use of ocular estimates has been shown to have poor repeatability among different observers.	5	
71	ODFW	Design - Effort/Sites v. Sites/Effort		2.11	Are we better off collecting less precise data at more sites or more precise data at fewer sites? Do we really need the site precision provided by the total station approach? Can a spatial design be developed that incorporates a combination of less precise measurements at many sites	2	

					"calibrated" by more precise measurements at a subset of sites? Can the level of precision needed to meet an objective be determined?		
72	ODFW	Logistics		2.3	We are concerned that estimates of the time it will take field crews to conduct a site survey is underestimated.	2	
73	ODFW	Design - Effort/Sites v. Sites/Effort		2.3	The CHaMP survey protocol is currently restricted to summer surveys (with the exception of water temperature monitoring). Can less precise site survey design result in the ability to conduct surveys in the summer and winter?	3	
74	ODFW	Macroinverts	Benthic Macroinvertebrates	2.9	CHaMP has made a decision not to sample benthic macroinvertebrates.... We would like to see CHaMP investigate the use of benthic macroinvertebrate sampling more, not only in the context of how it is directly related to fish productivity models, but also in relation to habitat classification. Since it appears that another major issue of not sampling benthic macroinvertebrates is cost, we would like to again know what is the trade-off between less precise measurements of some metrics at a site so that other metrics (such as benthic macroinvertebrates) can be monitored?	3	
75	ODFW	Program Coord		2.2	We praise CHaMP for the work that it has done to compare program protocols and in many cases adopt protocols that are used by one or more regional monitoring program. We believe, however, that much more work is needed on indentifying common measurements, metrics, and indicators, and developing data crosswalks that will enable better data sharing among programs.	3	
76	ODFW	Program Coord		2.2	CHaMP should consider the coordination needed to link with fish monitoring. For example, ODFW's Oregon Plan approach is to conduct habitat monitoring and juvenile fish monitoring at a number of shared sites. This overlap in sample led to some modification of the protocols of both programs to enable better integration of data.	4	
77	ODFW	Link to Fish Monitoring			CHaMP states that "stream habitat data generated by CHaMP will be used in conjunction with salmonid growth, survival, abundance and productivity to estimate fish-habitat relationships across the Columbia River Basin." Good idea but exactly how will this be done?	4	

78	ODFW	Logistics, training		2.3	The mesh of remote sense (LIDAR, photogrammetry, etc) and GIS data with the field program are computer and technician intensive, and some may not be realistic. Additional consideration needs to be given to the logistical and economic constraints involved	4	
79	ODFW	Study Design		2.3	CHaMP needs to conduct an analysis of the adequacy of sampling 20 active channel units. Our research suggests that for most wadeable streams, between 500m – 1,000m are more appropriate for channel unit based surveys	4	
80	ODFW	Content accuracy		2.15	ODFW began habitat surveys in 1990, not in 1998 as indicated in the CHaMP document	4	
81	ODFW	Content accuracy		2.15	The statement on page 28 that ODFW "relies on visual estimates of individual channel unit characteristics at a site" is not correct in terms of many channel unit attributes. Attributes that we measure include unit length, width, maximum depth, and large wood length and diameter.	4	
82	ODFW	General		2.15	An intermediate step between "Metrics" and "Indicator Generation Process" should be inserted. For example, it is unclear how you get from "site measurement of riparian structure" to "estimated annually for post hoc stratified domains of historical riparian vegetation types in the survey frame with sampling design based algorithm for each riparian structure".	4	
83	ODFW	Channel Unit Classification		2.11	More definition of how different channel dimensions will be used to classify channels according to M & B system. The classification system is irrelevant. What does the program want to know about the channel morphology – gradient, sinuosity, valley form, bankfull/active channel width, etc.	5	

SECTION 2: COMMENTS AND RESPONSES BY TOPIC/INDICATOR

2.1 Northwest Power and Conservation Council Comments

Comment Topic 1: Revise and develop CHaMP to address Scientific Review in collaboration with ISRP, Council and other participants in habitat monitor/evaluation.

- *Response:* Immediate Change for 2011. The way CHaMP was implemented in 2011 was modified based on input from ISRP, Council, and others. Additional changes are expected in 2012 based on "lessons learned."

Comment Topic 2: Overarching program goal of cost-effectiveness.

- *Response:* Immediate Change for 2011. BPA responded to this overarching goal by implementing a pilot version of CHaMP in 2011 and holding project costs to a minimum.

Comment Topic 3: Implement in an incremental approach in selected basins undergoing active restoration and fish and habitat monitoring.

- *Response:* Immediate Change for 2011. BPA responded to this overarching goal by implementing a pilot version of CHaMP in 2011.

Comment Topic 4: Field test protocols and habitat parameters in selected basins to test for appropriateness or value.

- *Response:* Immediate Change for 2011. BPA responded to this overarching goal by implementing a pilot version of CHaMP in 2011.

Comment Topic 5: Evaluate the value of "non-standard" metrics and methods at special sites.

- *Response:* Change for 2012. The field season was already underway when this recommendation was provided by the Council. Other "non-standard" metrics will be considered for 2012.

Comment Topic 6: Resolve differences in habitat monitoring approaches among other groups by coordinating and comparison testing protocols on site.

- *Response:* Change for 2012. The field season was already underway when this recommendation was provided by the Council and there was insufficient time to coordinate with other groups. However, a crew variability protocol test was incorporated into 2011 pilot year implementation. Results from this will be comparable to other monitoring groups.

Comment Topic 7: Develop/Assess in-basin relationship(s) between habitat monitoring to fish status and trend monitoring.

- *Response:* Immediate Change for 2011. We appreciate the Council's recognition that "it is not necessarily the responsibility of, or in the control of, the CHaMP project itself to develop the linkages to the VSP monitoring and the overarching analytical methods for evaluating habitat effectiveness, the ISRP recommended a comprehensive review of the entire framework or architecture after it is more fully developed (NPCC 2011; p 15)." However, we intend to illustrate relationships between habitat and fish data where available, are working to develop results output to meet the needs of "end users" like the Expert Panels, and are willing to work with the responsible parties to further develop fish/habitat relationships.

Comment Topic 8: Develop/Test methods to scale up selected habitat conditions from stream to watershed to sub-basin indicator of habitat quality.

- *Response:* Immediate Change for 2011. Scaling up observations to metrics to indicators at the subbasin scale has always been an objective of CHaMP. Doing so in 2011 as part of the pilot approach will facilitate this objective.

Comment Topic 9: Explore effectiveness of fewer sites at higher intensity.

- *Response:* Immediate Change for 2011. We will make these explorations in places like Bridge Creek, Tucannon, and Entiat where we have collected habitat data at different spatial scales.

Comment Topic 10: Develop information and technology transfer among CHaMP cooperators.

- *Response:* Immediate Change for 2011. Information and technology transfer among CHaMP cooperators has always been an objective of CHaMP.

Comment Topic 11: Complete "Lesson Learned Report" including revisions, linkages /integration with fish monitoring and proposed expansions.

- *Response:* Immediate Change for 2011. The CHaMP annual report will focus on "lessons learned" as described.

Comment Topic 12: Bonneville, the Council, and NOAA will prepare a transition plan describing implementation and/or phasing out of other habitat monitoring projects.

- *Response:* Immediate Change for 2011. Bonneville, in coordination with NOAA and the Council, will continue its review of habitat projects that involve monitoring and evaluation during the winter of 2011, and, while taking into account the results of the ISEMP and CHaMP lessons-learned, will determine the appropriate levels of effort within those projects. These recommendations will be completed by spring of 2012.

Comment Topic 13: Bonneville and NOAA to meet quarterly with Council's Fish and Wildlife Committee to report progress regarding pilot phase testing.

- *Response:* Immediate Change for 2011. Quarterly progress meetings are underway.

Comment Topic 14: Within one year agencies should develop the analytical, evaluation and reporting elements of habitat effectiveness monitoring to accompany CHaMP monitoring consistent with ISRP's review. Statement should include 5 elements focused on integrating VSP parameters and comparing different model outputs used.

- *Response:* Immediate Change for 2011. Progress on this comment is underway.

2.2 Other Programmatic

Comment Topic 1: The utilization of CHaMP in other (non-IMW) watersheds were fish populations are being monitored was not thoroughly explained, including whether the sampling protocols would facilitate an evaluation of restoration effectiveness on fish populations [ISRP 1].

- *Response:*

Comment Topic 2: We are still not sure how habitat status and trend monitoring data will be related to (integrated with) status and trends of fish population data within CHaMP watersheds to evaluate the effectiveness of specific restoration strategies or general restoration effectiveness in a geographic area [ISRP 7].

- *Response:*

Comment Topic 3: It was unclear which entity or entities will be responsible for conducting fish status and trends monitoring at CHaMP sites, what kinds of fish data would be collected (e.g., site/reach-specific abundance sampling or fish in- fish out), and what kinds of analytical methods will be used to relate fish status and trends to habitat status and trends [ISRP 8].

- *Response:*

Comment Topic 4: It is not clear at this point in time how the data will be analyzed for long-term habitat status and trends, and whether CHaMP personnel or collaborators will perform the analyses [ISRP 13].

- *Response:*

Comment Topic 5: It is unclear how the results obtained from monitoring individual sites within a watershed can be "rolled up" to the entire watershed to advance generalizations about status and trends in habitat condition for the watershed as a whole [ISRP 10].

- *Response:*

Comment Topic 6: It remains to be demonstrated how well the results obtained through the CHaMP project can be extrapolated to unmonitored watersheds within the interior Columbia River Basin [ISRP 2].

- *Response:*

Comment Topic 7: CHaMP states that "stream habitat data generated by CHaMP will be used in conjunction with salmonid growth, survival, abundance and productivity to estimate fish-habitat relationships across the Columbia River Basin." Good idea but exactly how will this be done? [ODFW 77].

- *Response:*

Comment Topic 8: Implementing the survey design as stated in CHaMP will make it almost be impossible to detect a trend in any stream habitat in a reasonable time frame. With about 25 samples per year (a total of 50-75 with a three year sample frame), it is unlikely that a 10 to 20% response in stream metrics over the timeframe of a decade would be detected (Roper et al. 2002) [USFS/BLM 63].

- *Response:*

2.2 Coordination and Use of Existing Protocols

Comment Topic 1: The rationale for not adopting existing monitoring protocols (e.g., EMAP, PIBO, ODFW's Aquatic Inventories Project) could have been made more apparent by the CHaMP team. [ISRP 5]

- *Response:*

Comment Topic 2: Ability to cross-walk between existing datasets and protocols [YN 48, USFS/BLM 49, 50, 58; ODFW 75], duplication of effort [USFS/BLM 56].

- *Response:*

Comment Topic 3: CHaMP should consider the coordination needed to link with fish monitoring/shared sites [ODFW 76].

- *Response:*

Comment Topic 4: Prior to extensive implementation of CHaMP, a cautionary approach might be to initiate several modestly sized CHaMP protocol tests (focused, for example, on a range of watersheds across the Columbia Basin where both habitat and fish population monitoring efforts are occurring) in which different approaches to design, data collection, data storage, and data analysis, can be compared to provide a test of the efficacy of scaling up from

past efforts while still allowing and encouraging other promising, or well proven, efforts to continue [ISRP 17].

- *Response:*

2.3 Study Design

Comment Topic 1: Questions about logistics/amount of time required to complete 1 site per day [ISRP 4, YN 43, USFS/BLM 65, ODFW 72].

- *Response:*

Comment Topic 2: It was not clear how ISEMP and CHaMP, in evaluating restoration effectiveness, propose to accommodate factors affecting fish populations downstream from CHaMP sampling locations (non-wadeable areas downstream of CHaMP sampling sites, including the mainstem, estuary and ocean) [ISRP 3].

- *Response:*

Comment Topic 3: Unclear how much flexibility would be allowed in implementation of the protocols to deal with possible field constraints such as limited time available for sampling, problems posed by weather conditions, and logistic difficulties in sampling particular sites [ISRP 6].

- *Response:*

Comment Topic 4:

- *Response:*

Comment Topic 5: Technological and economic requirements for collaborators and potential constraints [ISRP 16, ODFW 78].

- *Response:*

Comment Topic 6: Necessity of sampling 20 active channel units [ODFW 79].

- *Response:*

Comment Topic 7: Evident that these results can be confounded by several factors… Despite the progress and promise of simulation modeling, the protocols and application of CHaMP will be very much challenged by these limitations [ISRP 11].

- *Response:*

Comment Topic 8: Revisit the issue of the number of sites, sampling intensity, and influences on site selection [ISRP 12].

- *Response:*

Comment Topic 9: Sufficient number of topographic points scaled to longer site lengths vs. average [YN 46].

- *Response:*

Comment Topic 10: Request to weight number of sample points in Klickitat/White Creek subwatershed [YN 47].

- *Response:*

Comment Topic 11: We recommend less emphasis on sampling small, higher gradient streams since it is unlikely these streams will tell you much about either the status or trend of stream habitat (Montgomery and MacDonald 2002) [USFS/BLM 64]. There are many attributes that PIBO and AREMP evaluate which CHaMP chooses not to measure, including those that lead to an evaluation of the presence of invasive aquatic species that could affect fish survival [USFS/BLM 66].

- *Response:*

Comment Topic 12: The CHaMP survey protocol is currently restricted to summer surveys (with the exception of water temperature monitoring). Can less precise site survey design result in the ability to conduct surveys in the summer and winter? [ODFW 73].

- *Response:*

Comment Topic 13: Description of life stages influenced by various habitat measurements could be more refined….Where possible, seasonal or age class effects could be noted, and this would help illuminate how some restoration actions are influencing VSP parameters [ISRP 9].

- *Response:*

2.4 Nutrients-Chemsistry, Dissolved Oxygen, Pesticides

Comment Topic 1: Two water quality issues, in particular, should receive additional consideration by CHaMP: Agricultural pesticides and Pharmaceuticals, personal care products, and flame retardants [ISRP 20].

- *Response:*

2.5 Embeddedness of Fast Water Cobble

Comment Topic 1: Recommendation for dropping embeddedness from CHaMP Protocol [CRITFC 27].

- *Response:*

2.6 Subsurface Fines

Comment Topic 1: Sampling 210 pebbles vs. clast of 100 (Wolman) [USFS/BLM 69], Subsurface fines sampling locations in riffles and use of shovel method [CRITFC 25, 26].

- *Response:*

2.7 Solar Input

Comment Topic 1: Recommendation for use of Solometric Suneye 200 [CRITFC 41].

- *Response:*

2.8 Total Drift Biomass

Comment Topic 1: Comments about mesh size [CRITFC 33], Placement of nets [CRITFC 34], Method for calculating drift biomass [CRITFC 35], Utility of drift data [YN 45], Adequacy of deployment duration and number of nets [USFS/BLM 61].

- *Response:*

2.9 Benthic Macroinvertebrate Metrics

Comment Topic 1: Concerns about lack of Benthic Macroinvertebrate sampling [CRITFC 30, USFS/BLM 59, 60, 62; ODFW 74].

- *Response:*

2.10 Riffle Particle Size

Comment Topic 1: Concern about clarity of protocol and visual estimates [USFS/BLM 68, 70], Recommendation for use of gravelometer and two transects (vs. zigzag) [CRITFC 31, 32].

- *Response:*

2.11 Channel Complexity, Score; Channel Unit Volume, Complexity

Comment Topic 1: More information about how M&B valley types will be determined [CRITFC 22; ODFW 83].

- *Response*

Comment Topic 2: Concern about sampling in disproportionate lengths in areas where bankfull width modified by land use [CRITFC 23].

- *Response*

Comment Topic 3: Request for clarification re: where to establish boundaries vs. natural channel boundaries [CRITFC 24].

- *Response*

Comment Topic 4: Clarify terms monuments, benchmarks, control points [CRITFC 36].

- *Response*

Comment Topic 5: Comment that definitions of cascade and rapid seem to be reversed [CRITFC 38].

- *Response*

Comment Topic 6: Recommendation to include dry channel and puddle units [CRITFC 39].

- *Response*

Comment Topic 7: Total Survey comments and questions about benchmarks [CRITFC 37].

- *Response*

Comment Topic 8: Total Station protocol approach and accuracy [USFS/BLM 51, 52, 53, 54, 55; ODFW 71].

- *Response*

Comment Topic 9: Defining bankfull [USFS/BLM 57].

- *Response*

2.12 Fish Cover

Comment Topic 1: Dropping some cover elements will make it impossible to crosswalk between CHaMP and previous, e.g. EMAP, datasets [CRITFC 28].

- *Response*

Comment Topic 2: Question/suggestions re: definition of artificial structures [CRITFC 29].

- *Response*

Comment Topic 3: Concern about inadequate protocol definition and proposed visual estimates of fish cover [USFS/BLM 68, 70].

- *Response*

2.13 Riparian Structure

Comment Topic 1: Approach does not directly survey riparian vegetation even though it has been shown that land management, including restoration efforts to improve riparian areas, provide survival benefits to fish [USFS/BLM 67].

- *Response*

2.14 LWD Volume

Comment Topic 1: Methods for measuring or estimating the width and length of LWD is not clearly defined, recommendations [CRITFC 40], Concern about visual estimates {USFS/BLM 70].

- *Response*

2.15 General Content/Accuracy

Comment Topic 1: ODFW began habitat surveys in 1990, not in 1998 [ODFW 80].

- *Response*

Comment Topic 2: The statement on page 28 that ODFW "relies on visual estimates of individual channel unit characteristics at a site" is not correct in terms of many channel unit attributes. Attributes that we measure include unit length, width, maximum depth, and large wood length and diameter [ODFW 81].

- *Response*

Comment Topic 3: An intermediate step between "Metrics" and "Indicator Generation Process" should be inserted [ODFW 82]. CHaMP states that site evaluation will be completed using a to be developed manual (p. 45). What will site evaluation consist of? [CRITFC 42].

- *Response*

Comment Topic 4: Unclear what the current status of the CHaMP Program is or the likelihood of funding subbasins such as the Klickitat [YN 44].

- *Response*

2.16 Reporting/Future Review

Comment Topic 1: Although the ISEMP team has an excellent record of issuing timely progress reports, we feel that more information should be published in peer-reviewed journals [ISRP 14].

- *Response*

Comment Topic 2: ISRP encourages the periodic exchange of habitat status and trend data and analyses through annual meetings of those organizations engaged in collecting both habitat and fish population information. Periodic (annual or 2-year) habitat workshops would be a useful forum for information exchange between monitoring organizations, particularly with respect to questions about which protocols are and are not working effectively [ISRP 15].

- *Response*

Comment Topic 3: ISRP recommends that a comprehensive review of this suite of projects (ISEMP, IMWs, CHaMP) be undertaken to determine if indeed they, as a whole, are sufficient to provide status and trends monitoring of habitat and fish and are capable of answering the central question of whether habitat restoration actions are achieving desired objectives [ISRP 18].

- *Response*

Comment Topic 4: ISRP would be interested in learning more about the efficacy of different approaches to establishing the relationships between fish performance and habitat condition and would like to review CHaMP, ISEMP, PNAMP and other effectiveness monitoring efforts in one to two years [ISRP 19].

- *Response*

SECTION 3: APPENDICES

Appendix A: NPCC (context pages and CHaMP-specific excerpts, only)

Northwest Power and Conservation Council

May 26, 2011

DECISION MEMORANDUM

TO: Council Members

FROM: Fish and Wildlife Staff

SUBJECT: Partial Decision Memorandum: Remaining projects and associated programmatic issues from the review of Research, Monitoring and Evaluation and Artificial Production Projects

The Fish and Wildlife Committee (Committee) asks the Council to approve the recommendations for the remaining 43 projects and the resolutions of associated programmatic issues under the Research, Monitoring and Evaluation and Artificial Production Projects (RME/AP) category review. The components of the decision represent a subset of projects and issues from the entire review.

The Council, at its April meeting, made final recommendations to Bonneville on 100 projects and resolution of two programmatic issues. What remains for Council recommendation are the resolution of the remaining programmatic issues that include habitat action effectiveness, ocean research, estuary habitat monitoring and evaluation, sturgeon and lamprey projects, and coded wire tags, and the 43 projects (lines 101-143 of the spreadsheet), most of which are associated with the programmatic issues. The estimated FY 2012 funding for these projects is approximately $34.4 million. Also included in this decision are recommendations dealing with reporting, research projects and regional coordination; all of which are more global in nature.

The attached table summarizes the decision before the Council at its June meeting. Part 3 of the decision document, and its associated spreadsheet, comprise the Fish and Wildlife Committee's recommendation to the Council. The decision document also describes the detailed review process and provides the context for this subset of decisions. The staff will write a more formal explanation required by Section 4(h)(10)(D) of the Northwest Power Act as part of the completion of the review in Part 4 of the decision document.

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851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

Research, Monitoring and Evaluation and Artificial Production Project Review
Decision document June 2011

Review of Research, Monitoring and Evaluation and Artificial Production Projects

Fish and Wildlife Committee recommendations to the Council

Introduction

Pursuant to Section 4(h)(10)(D) of the Northwest Power Act, the Northwest Power and Conservation Council has been engaged in a review of research, monitoring and evaluation and artificial production projects that implement the Council's *Columbia River Basin Fish and Wildlife Program*. This is a draft of the document that, when final, will contain and explain the Council's recommendations to the Bonneville Power Administration for the funding and implementing of these projects for Fiscal Years 2012 through 2016.

Part 1 below provides the background on the review, including the description of these two categories, the projects reviewed, and the review process.

Part 2 covers programmatic issues. As has been true in the past, the review of the individual projects illuminates a set of broader policy or programmatic issues that affect the Council's review and recommendations for a collective set of the projects. Part 2 describes these programmatic issues and Committee-recommended resolutions, for Council consideration.

Part 2 includes two issues resolved by the Council in April, as part of the decision on the "A list" subset of projects (*see* below). This includes the programmatic issues concerning the monitoring and evaluation of hatchery effectiveness and effects (issue no. 4), and PIT tags and related tags (issue no. 10).

Part 3 of this document contains and explains the Council's recommendations for the funding and implementation of the individual projects, along with a description of the form and duration of our recommendations. Associated with this part of the draft decision document are a set of spreadsheets that list the projects reviewed in this category, with Bonneville's FY 2012 planning budgets and other information, and with comments about each project as developed during this review. The tables include a Council recommendation for each project, as well as conditions or comments to be considered a part of the recommendation, more fully explained in Part 3.

Finally, Part 4 will contain the formal explanations by the Council responsive to the specific requirements of Section 4(h)(10)(D) of the Northwest Power Act. This includes the written explanations required of the Council in those few instances in which the Council's project funding recommendations do not follow the recommendations of the Independent Scientific Review Panel.

The Council will also explain how it complied with the requirements in Section 4(h)(10)(D) to "consider the impact of ocean conditions on fish and wildlife populations" and "determine whether the projects employ cost-effective measures to achieve program objectives" when making project funding recommendations.

Status of the Review as of May 24

At its regular monthly meeting, in Wenatchee, Washington, on April 13, the Council decided on a set of implementation recommendations for a subset of the projects under review -- the so-called "A list" of projects -- and for two programmatic issues associated with those projects.

The Council staff transmitted these recommendations to Bonneville as final recommendations of the Council for these projects and issues. The Council's decision, and the transmittal to Bonneville, included the spreadsheet identifying the 100 projects that constituted the "A list" decision of the Council, with the Council's recommendation for each project specified in the right-hand column of the spreadsheet along with any conditions or guidance associated with that recommendation. It also included the Council's recommendations to resolve two programmatic or overarching issues associated with projects on the "A list," one involving the monitoring and evaluation of artificial production activities, and the other concerning the use of PIT and associated tags. And finally, the "A list" decision and transmittal letter included a set of general expectations regarding the duration and implementation of specific project recommendations.

The "A list" decision was but a step in the completion of the entire RME/AP category project review. The Council is now continuing with its review of the remaining projects (the so-called "B list") and programmatic issues in the category review. This decision document now contains committee recommendations on the remaining programmatic issues, including a recommendation for resolving each one. The spreadsheet identifying individual projects, recommendations for each, and associated programmatic issue, is attached and complete for all the projects reviewed in this category. The package represents final Committee recommendations to the Council for resolution of all programmatic issues and associated projects in this review at the June 2011 Council meeting.

Upon final Council decision, the final decision document will also describe the review process and provide additional context for the Council's decisions, and will contain formal explanations by the Council responsive to the specific requirements of Section 4(h)(10)(D) of the Northwest Power Act.

Part 2: Programmatic Issues

Part 2 identifies a set of 11 broader policy and programmatic issues that have arisen out of the review of the projects in the two categories. The ISRP provided a set of programmatic comments, which have been one important source for the identification of these issues. The issues are summarized briefly here, with additional explanation developed in attachments when necessary.

As noted above, two of the issues have been resolved with final recommendations by the Council as part of the "A list" decision in early April (monitoring and evaluation of artificial production activities, #4, and the use of PIT and associated tags, #10). The staff is now recommending resolutions for the remaining issues, set forth at the tail end of each issue.

The final version of this part of the document will contain the Council's decisions on all of these programmatic issues. The Council's recommendations on the programmatic issues are to be accorded the same weight as the project-specific implementation recommendations. In many cases the Council's programmatic recommendations will then become conditions or recommendations that accompany the relevant project recommendations.

1. Reporting and use of project and program results

Issue: One of the salient roles the Council can play in the region is to improve the reporting, explanation, availability, and use of results from all the program's projects, on-the-ground, monitoring and evaluation, and research. "Results" abound in the Fish and Wildlife Program -- whether that term refers to implementation and maintenance reports, monitoring or research data, or analytical or evaluation conclusions. And project and program results of various types are gathered and compiled in many places, including the project proposals and ISRP review reports, the Taurus and Pisces databases for project implementation information, the Status of the Resource website, and various other databases that collect and house monitoring information relevant to the program. Two additional steps we are taking in the review to increase the reporting and analysis of results are (1) placing conditions on individual projects to improve the reporting and evaluation of project results when the ISRP has identified a problem, including limiting the funding recommendation in certain cases until a results report is complete and reviewed by the ISRP; and (2) requiring synthesis reports to be completed and reviewed by the ISRP for a number of the key topic areas in which a number of years of results need to be evaluated, as described in various issues below.

Even so, much more could be done to systematically push for, obtain, organize, synthesize, evaluate, and regularly report on the implementation and biological results relevant to the program. In comparison, the Council developed over the last decade a systematic and organized way of reporting annually on program expenditures. *See Ninth Annual Report to the Northwest Governors On Expenditures of the Bonneville Power Administration to Implement the Columbia River Basin Fish and Wildlife Program of the Northwest Power and Conservation Council, 1978-2009*, Council Document 2010-06 (May 2010), http://www.nwcouncil.org/library/2010/2010-06.htm. Implementation and biological results are far more complicated than expenditures. Even so, with focused effort we can improve what we do to track, report on and evaluate project and program results, both to educate ourselves and the public and to make more informed decisions. The

2. Habitat effectiveness monitoring and evaluation

Issue: The Council's Fish and Wildlife Program is "a habitat-based Program," aiming "to rebuild healthy, naturally producing fish and wildlife populations by protecting, mitigating, and restoring habitats and the biological systems within them." The Fish and Wildlife Program thus depends heavily on actions in the mainstem, tributaries and estuary intended to protect or improve habitat characteristics as the way in which the program will ultimately protect, mitigate and enhance fish and wildlife populations adversely affected by the hydrosystem. The FCRPS Biological Opinion is built on the same conceptual foundation. The analysis supporting the conclusions in the Biological Opinion includes quantitative estimates of the improvements in life-stage survival to be gained from habitat actions in all areas.

For this reason, *the* critical programmatic issue in the RM&E/AP review is whether the collective suite of proposed projects is adequate to monitor and evaluate the effectiveness of our habitat actions in ultimately improving the population characteristics of our key fish species, and to be able to use what we learn to adapt the implementation and management of the program. The existing projects and new proposals in this review include dozens of projects that are intended in some way to help to assess whether the habitat work is having the desired impact on fish populations. These assessments are to occur at the watershed or reach scale depending on the effectiveness they are testing, i.e., cause and effect at the population or watershed level (Intensively Monitored Watersheds or IMWs, part of the Integrated Status and Effectiveness Monitoring Program or ISEMP), habitat status and trends that can be correlated to fish status and trends at the watershed scale (e.g., the new Columbia Habitat Monitoring Program or CHaMP), or project-level impacts (project or action effectiveness -- although most of this particular type of monitoring is not part of this review; *see* below). Combined, these projects call for investments of tens of millions of dollars in "habitat effectiveness" monitoring, evaluation and research.

Yet most of the elements of the habitat effectiveness monitoring and evaluation effort are in flux or under development. This includes the precise contours of the status and trend monitoring of habitat characteristics and the relationship of this monitoring to the fish population status and trend monitoring, the distinct but related role of the cause-and-effect "intensively monitored watershed" research effort, and especially the analytical methods and procedures that will be used to evaluate all of this information and report on what is being learned.

In other words, the Council still needs clarity and further definition on the monitoring, evaluation and reporting elements of the habitat effectiveness monitoring and evaluation. The Council will not conclude this review without being comfortable that the monitoring and evaluation protocols and analytical methods are in place to give us a reasonable chance of knowing -- in 5, 10, 20 years -- whether the region's huge investment in an evolving suite of habitat actions is contributing significantly to the recovery and rebuilding of fish species important to the region.

The review has given the Council reasons to be concerned about, or at least uncertain about, the answers to any of these questions. The ISRP expressed these concerns well in its programmatic report, concerns that others have identified as well:

> "A lot of data will be collected, and currently it is uncertain that the analytical methods will be sufficient to produce meaningful results in terms of understanding the effects of habitat restoration actions."
>
> "Without a more in-depth and thorough review, it is difficult to ascertain whether or not there is redundant or excessive RME effort within these projects."
>
> "The evaluation component of habitat RME should be emphasized in order to ensure that useful management information is being extracted from the data. What management actions and what positive measurable outcomes can be associated with the habitat status and trend data? With the plethora of data that will be collected from newly planned ISEMP projects, methods of data analysis that can be broadly applied are badly needed. ISEMP has indicated that they are developing these methods."
>
> "There is comparatively little evidence that habitat effectiveness monitoring is being coordinated in such a way that monitoring programs can take advantage of multiple restoration actions occurring in the same area, at least at the subbasin scale. Perhaps the emergence of the new regional "umbrella"-type projects can facilitate better coordination and more cost-effective monitoring actions."
>
> ISRP, "Final Review of 2010 Proposals for the Research, Monitoring, and Evaluation and Artificial Production Category, Part 1: Programmatic Comments," ISRP 2010-44A (December 2010), pp. 26-27, http://www.nwcouncil.org/library/isrp/isrp2010-44a.pdf.

At the same time, as the ISRP recognized, the basic concepts underlying this suite of proposals are sound, and at least most of the projects are technically sound as well. The challenge has been to shape these concepts and the raw material in these proposals into a regional habitat monitoring and evaluation effectiveness framework appropriate to the magnitude and importance of the habitat foundation of the Fish and Wildlife Program.

The ISRP's concerns in particular led to a one-day workshop hosted by the Council on February 10, 2011, attended by ISRP members and federal and state agency and tribal representatives involved in the habitat effectiveness monitoring and evaluation work. The main focus of the workshop was on the ambitious proposal to implement in dozens of basins a more systematic and coordinated approach to the monitoring of habitat characteristics -- the CHaMP project. The ISRP produced its follow-up report at the end of March, "Review of the Columbia Habitat Monitoring Program (CHaMP) Protocols," ISRP 2011-10 (March 31, 2011), http://www.nwcouncil.org/library/report.asp?docid=53. The ISRP commented usefully both on the specific issues involved in the proposed CHaMP monitoring protocols and on the broader questions of the link of the CHaMP habitat monitoring to the monitoring of fish population status and trends (the "VSP" monitoring, also known as "fish in/fish out" monitoring) and the analytical methods that will be used to evaluate and report on the results of the monitoring over time. The ISRP's summary conclusions:

> CHaMP is an ambitious monitoring project that attempts to provide long-term habitat status and trend data needed to relate changes in fish populations to tributary habitat restoration actions over a large portion of anadromous salmonid habitat in the Columbia River Basin. It is an important companion to the ISEMP project, even though CHaMP and ISEMP sampling locations are not always the same.

The ISRP was impressed by many aspects of the CHaMP sampling protocols. However, we note that consensus among major habitat monitoring organizations with respect to the most effective protocols for tracking habitat attributes and metrics has not yet occurred. We recommend that the CHaMP team continue its dialog with other monitoring groups to resolve differences in approaches and that consideration be given to designing rigorous field tests of various protocols. We also suggest that CHaMP devote additional attention to case-by-case inclusion of "nonstandard" metrics (e.g., agricultural chemicals) and to developing and testing methods of scaling up site-specific habitat conditions to watershed- and subbasin-scale indicators of habitat quality. The latter could be evaluated in a few pilot subbasins where both habitat and fish populations are well sampled.

Additionally, simulations could be used to examine the properties and sensitivity of large-scale metrics of habitat change, as well as to compare and contrast the conclusions of CHaMP analytical tools (e.g., the SHIRAZ model) with other widely used habitat models such as EDT. The most pressing need, we feel, is to develop robust, accurate relationships between VSP parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in CHaMP watersheds.

We believe that some CHaMP protocols need additional refinement and testing, and therefore recommend that project partners focus initial activities on a subset of CHaMP watersheds at geographically diverse locations in the Columbia Basin where restoration is occurring and where both habitat and fish population monitoring are sufficiently developed so that CHaMP can build on existing strong RM&E efforts, such as in intensively monitored watersheds. The ISRP would like to review CHaMP after one to two years of data collection to see how field and data management protocols have been modified and how monitoring results are being incorporated into establishing restoration priorities. In addition, we would like to review the ISEMP "lessons learned" report when it is released.

The framework or architecture for the effort to monitor and evaluate the effectiveness of habitat actions has several different elements, defined and summarized in a number of places, including the Council's draft MERR plan. This need is to monitor and evaluate the effectiveness of actions in producing change at each step in the program's assumed relationship between discrete habitat actions and the ultimate goal of improvements in the number and productivity of key fish populations:

Habitat actions >

- Impact of habitat actions over time in changing key habitat characteristics >
  - Impact of changed habitat characteristics over time on key life-stage fish population characteristics >
    - Impact of accumulated life-stage improvements on life-cycle population characteristics (greater adult abundance, productivity, diversity, population structure).

The ISRP's review conclusions neatly cover three of those key elements, distilled as follows:

Monitoring of the status and trends in habitat characteristics. The primary focus in the ISRP's review has been on the CHaMP proposal to transform the way habitat characteristics are monitored. Key issues raised include the validity of the proposed monitoring protocols and sampling methods, and the scale of proposed implementation.

With regard to the monitoring protocols and sampling methods themselves, the ISRP usefully concluded that there is great value in development a consistent, standardized set of monitoring protocols and methods, and that the basic set proposed in CHaMP makes sense. At the same time the ISRP raised a set of useful cautions, including that the choices not to monitor certain parameters might in the end mean valuable information is lacking, while some of the parameters chosen may prove to be less useful. The ISRP recommended building flexibility into the protocols by field testing their value while also monitoring a few "non-standard" (in CHaMP terms) habitat parameters at certain places to evaluate their value. The ISRP also recommended that the CHaMP personnel continue the dialogue with the other entities that monitor habitat characteristics -- such as the Forest Service's PIBO effort (the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program) -- and be open to the possibilities of flexibility and adaptive management with regard to methods and chosen characteristics to monitor to synch these different efforts as much as possible.

As for the aggressive scale at which the federal agencies propose to begin implementation of the proposed CHaMP habitat monitoring effort, the ISRP had as many concerns as others have had. The Panel illuminated the potential problems, both at the practical scale (e.g., implementing the sampling effort as described is ambitious, and will likely need time, experience and tweaking to get right) and at the broader scale of whether this is precisely the right approach for monitoring and evaluating changes in habitat characteristics in relation to fish population improvements, given the many uncertainties and sheer novelty of the effort. The ISRP also highlighted the need for "a broadly based buy-in" to the CHaMP effort if it is to be successful, including the development of methods for the effective transfer of information, technology and expertise. And as described in the next section, the ISRP in particular saw a need to improve how the habitat monitoring would line up with salmonid population monitoring in the same basins. And for these reasons the ISRP recommended an incremental or pilot approach, to reiterate:

> We believe that some CHaMP protocols need additional refinement and testing, and therefore recommend that project partners focus initial activities on a subset of CHaMP watersheds at geographically diverse locations in the Columbia Basin where restoration is occurring and where both habitat and fish population monitoring are sufficiently developed so that CHaMP can build on existing strong RM&E efforts, such as in intensively monitored watersheds. The ISRP would like to review CHaMP after one to two years of data collection to see how field and data management protocols have been modified and how monitoring results are being incorporated into establishing restoration priorities.

If an incremental or phased-in approach makes sense, it will be important to pick the right basins in which to initiate the work, and the right period of time to gather and review information before deciding on the next increment. This will also mean developing a transition plan to phase out of separate habitat monitoring projects in certain basins as the coordinated CHaMP effort phases in.

Monitoring of the status and trends of fish populations characteristics. The ISRP emphasized both the need for and uncertainty about how well the habitat monitoring would be related to the monitoring of the status and trends in fish population characteristics. This is needed ultimately to verify the value of using these habitat metrics and to evaluate the effectiveness of efforts to change habitat characteristics to achieve the desired population response. The ISRP review conclusions on the need for further development of this linkage are:

> We are still not sure how habitat status and trend monitoring data will be related to (integrated with) status and trends of fish population data within CHaMP watersheds to evaluate the effectiveness of specific restoration strategies or general restoration effectiveness in a geographic area (e.g., are the co-managers in a given subbasin successful in restoring stream habitat in their area?). It was unclear which entity or entities will be responsible for conducting fish status and trends monitoring at CHaMP sites, what kinds of fish data would be collected (e.g., site/reach-specific abundance sampling or fish in- fish out), and what kinds of analytical methods will be used to relate fish status and trends to habitat status and trends. CHaMP indicated that fish population surveys are not being carried out simultaneously with the habitat measurements, although it was their hope that ISEMP and other cooperators would be able to provide fish demographic data that could be associated with the habitat surveys. The linkage between fish and habitat monitoring in CHaMP watersheds requires development.
>
> The ISRP understands that a primary objective of CHaMP is to track status and trends in stream habitat condition over large areas using a spatially balanced sampling approach and that this objective does not, by itself, require corresponding fish population data. However, the corollary objective of determining habitat restoration effectiveness *does* require fish demographic data in order to establish a causal link between habitat change and fish performance. Establishing this connection, we believe, is the primary purpose of intensively monitored watersheds. However, in those CHaMP watersheds where restoration actions are taking place, but which do not have experimentally controlled restoration treatments as in the IMWs, the ISRP feels that there is still great value in collecting both habitat and fish data at as many sites as possible in order to verify assumptions about relationships between habitat conditions and fish populations.
>
> ISRP, "Review of the Columbia Habitat Monitoring Program (CHaMP) Protocols," ISRP 2011-10, at 11.

The need to further develop the linkage between the habitat and population monitoring was one of the reasons the ISRP recommended initiating the CHaMP effort on an incremental or phased-in basis, to help develop and test those linkages, and then adapt or tweak the monitoring protocols if needed to make the links detectable, before implementing across the basin. These conclusions also formed the core of the ISRP's concern about the lack of development and selection of the analytical techniques to be used to evaluate the information obtained (the next topic). And because it is not necessarily the responsibility of, or in the control of, the CHaMP project itself to develop the linkages to the VSP monitoring and the overarching analytical methods for evaluating habitat effectiveness, the ISRP recommended a comprehensive review of the entire framework or architecture after it is more fully developed.

Analytical techniques/models/methodologies to be used to evaluate the ultimate effectiveness in improving fish populations. Related, the ISRP noted there is no "consensus" among the habitat

monitoring entities as to the correct analytical tools to evaluate the monitoring data and generate conclusions about the effectiveness of our efforts to change key habitat characteristics and obtain resulting improvements in life-cycle and life-stage population characteristics. As the agencies develop and implement the incremental CHaMP effort, they need as well to put much more definition on the analytical or evaluation end of the habitat effectiveness m&e effort, as well as an explicit commitment to reporting results on a regular basis. The ISRP recommended this be part of a subsequent ISRP review of the overarching habitat monitoring and evaluation framework after the further development called for by the ISRP and discussed here.

In the development and use of these analytical techniques, the Panel noted that "simulations could be used to examine the properties and sensitivity of large-scale metrics of habitat change, as well as to compare and contrast the conclusions of CHaMP analytical tools (e.g., the SHIRAZ model) with other widely used habitat models such as EDT. And the Panel emphasized that "[t]he most pressing need, we feel, is to develop robust, accurate relationships between VSP parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in CHaMP watersheds." The ISRP also emphasized that the agencies need to build into these analytical techniques some way to account for a set of possibly confounding factors that are not directly captured in the habitat and fish population monitoring, including food web factors; exposure to toxic compounds (ditto); out-of-basin effects of habitats downstream in the tributaries and then in the mainstem, estuary and ocean; and the presence of hatchery fish and non-native species.

Project- or site-level action effectiveness. Note that one important element in the overall architecture of habitat effectiveness has not been part of this review, except peripherally. The habitat effectiveness monitoring and evaluation projects included in this review are focused on watershed- and population-scale efforts to monitor how habitat characteristics are changing and to relate those changes in some way to changes in life-stage and life-cycle population characteristics. Except for the research-heavy Intensively Monitored Watershed efforts, the projects reviewed here do not focus on monitoring whether particular actions are effective in changing targeted habitat characteristics or achieving a local population response. That kind of work is often called "project-scale or local-scale action effectiveness" or "project effectiveness." That is, did a habitat action (e.g., planting trees) result in the desired change in the local habitat characteristic(s) targeted (e.g., water temperature and sedimentation)?

Most of the "project effectiveness" habitat monitoring in the program, when it happens at all, currently takes place as part of the work elements of individual habitat projects. These projects and work elements are not part of this review, but will be reviewed during the follow-on geographic review of habitat projects. Discussions are also taking place about developing an umbrella approach to this particular type of monitoring, with an independent third party overseeing the monitoring and evaluation of project-scale effectiveness in a coordinated, consistent manner. That umbrella proposal is not ready for review or recommendation in this RME/AP review, but the committee recommendation below will highlight the role of this type of monitoring in the overall habitat effectiveness framework, and our expectations for how this monitoring might take place in the future through such an umbrella.

Fish and Wildlife Committee recommendation: The recommendation is based squarely in the ISRP review conclusions. The Committee recommends the Council support, as did the ISRP,

the concept of a coordinated, standardized approach to monitoring habitat characteristics and evaluating the effects of changes in those characteristics. We know the federal agencies are working, in the aftermath of the ISRP review and other comments and developments, to reshape the implementation plan for the CHaMP project (and possibly the related ISEMP research effort) and to make additional progress on the other elements of the habitat effectiveness monitoring and evaluation framework. In the best example, at the Council's Fish and Wildlife Committee meeting in Hood River, Oregon, on May 10, NOAA Fisheries staff presented at length on the "Implementation of the FCRPS BiOp Tributary Monitoring and Evaluation Framework." With some obvious differences (especially about the pace of the implementation of the CHaMP project), much of what NOAA presented is consistent with the principles recommended below by staff. The Committee expects continued benefits from continued cooperation and communication between NOAA and the Council on this issue.

The Committee recommends that the Council call for the federal agencies to follow or incorporate the following principles in this effort:

- Revise the CHaMP project and implementation plan and further develop the other elements of the habitat monitoring and evaluation effort consistent with the ISRP's review conclusions *and* do so *in collaboration with* the ISRP and the Council and its staff, as well as the basin's other participants in habitat monitoring and evaluation. This cannot be simply a federal agency effort imposed on the Fish and Wildlife Program, even as the Council is also sensitive to the federal agencies' need to meet Biological Opinion requirements. An overarching goal should be that what is developed and implemented is a cost-effective, standardized, independent, statistically valid approach for evaluating habitat effectiveness. Decisions regarding the implementation and sequencing of CHaMP should be driven primarily by how well the scientific review issues have been addressed and not by other considerations.

- Implement the CHaMP project through an incremental approach, consistent with the ISRP's review conclusions. This means:

    - Begin by implementing the CHaMP project *only* in "a subset of CHaMP watersheds at geographically diverse locations in the Columbia Basin where restoration is occurring and where both habitat and fish population monitoring are sufficiently developed so that CHaMP can build on existing strong RM&E efforts, such as in intensively monitored watersheds." The federal agencies should consult with the Council and others before deciding in which basins to initiate the incremental effort. The basins chosen should allow for the best opportunities to relate, align and integrate the habitat status and trend monitoring data with the monitoring of the status and trends of fish population characteristics. If possible, the chosen basins should also provide good opportunities for exploring how to coordinate the CHaMP approach with the existing habitat monitoring efforts of other entities.

    - Implement the monitoring protocols in the subset of the basins in such a way as to:
        - flexibly and rigorously field-test the proposed sampling methods and the appropriateness or value of the habitat characteristics chosen for monitoring;

- include some monitoring of "non-standard" (in CHaMP terms) metrics and methods to evaluate their value;
- continue the dialog with other monitoring groups to resolve as much as possible the differences in approaches to habitat monitoring, including the use of side-by-side field comparisons of various protocols as part of the pilot effort;
- develop and assess the relation of the habitat monitoring to the fish status and trend monitoring in the same basin;
- as part of developing and assessing the pilot basin approach, develop and test methods of scaling up site-specific habitat conditions to watershed- and subbasin-scale indicators of habitat quality;
- explore whether monitoring more sites less intensively may be more valuable than monitoring fewer sites more intensively;
- develop to a satisfactory level the methods for the transfer of information, technology and expertise to the people and entities participating in CHaMP; and
- clearly identify the roles for the various cooperators in the CHaMP effort (e.g., data collection only, responsible for producing analysis of the monitoring effort either separately or as part of a collective effort, etc.)

  - The CHaMP project sponsors, working with their agency partners, should develop a "lessons learned" report based on the experience in the pilot subbasins that includes any proposed revisions to the protocols and methods based on what has been learned; a review of how well the habitat and the population monitoring has been linked or integrated; and any proposals to ramp up the implementation of CHaMP. The ISRP and then the Council should review this report and the proposals for future work favorably *before* the federal agencies ramp up the implementation of CHaMP into other basins. Decisions on whether to continue or ramp up implementation of the CHaMP monitoring effort will also depend on progress made in developing and reviewing the other elements of the habitat effectiveness framework (*see* below).

  - As the federal agencies implement the CHaMP project in an incremental fashion, Bonneville should work with the Council, NOAA and other participants on a transition plan as to how to implement and/or phase out separate projects involved in the monitoring and evaluation of habitat characteristics. Projects involved in the monitoring of fish population status and trends should, as a general matter, be implemented for the time being, with the possibility of reshaping those projects as needed upon further experience with the implementation of CHaMP and its relation to fish population monitoring.

  - During the initial pilot phase, Bonneville and NOAA Fisheries will meet at least quarterly with the Council's Fish and Wildlife Committee to report on progress with field testing monitoring protocols, techniques and methodologies as implementation in the pilot subbasins is carried out.

- Within one year, NOAA and Bonneville, working with other relevant participants, should further develop the analytical, evaluation and reporting elements of the habitat effectiveness monitoring and evaluation effort to accompany the CHaMP monitoring, consistent with the

ISRP's review conclusions. The agencies should then produce a clear statement about those elements for the ISRP and Council to review. The statement should include:

- A description of the analytical methods and models to be used to evaluate the monitoring data relevant to habitat effectiveness and how these methods and models will be used so as to incorporate or respond to the ISRP's review conclusions. Include an evaluation of how the different models and methodologies compare, such as SHIRAZ and EDT and the use of expert panels, and how the output of these methods and models will be used in further decisions on the implementation of habitat actions.

- Explain how, within these analytical methods and models, the habitat status and trend monitoring data will be related to and integrated with the status and trends of fish population data in order to evaluate the effectiveness of specific restoration strategies or general restoration effectiveness in a geographic area. Explain how the analysis will develop robust, accurate relationships between the VSP parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in the CHaMP watersheds.

- Explain how the results of the ISEMP Intensively Monitored Watershed research efforts will be integrated into this analysis. Consider whether and to what extent it is important to continue the distinct IMW effort and at what scale.

- Explain how the evaluation results will be regularly and publicly reported and used to guide decisions on the implementation of habitat actions in the future.

- During the development phase, Bonneville and NOAA Fisheries will meet at least quarterly with the Council's Fish and Wildlife Committee to report on progress with developing the analytical, evaluation and reporting elements of the CHaMP monitoring protocols.

- All projects involved in this review that are part of the overall habitat effectiveness monitoring and evaluation effort will receive implementation recommendations consistent with these principles, allowing for significant reshaping of the projects as the elements are better developed and reviewed. The Council expects the main focus of any reshaping to be primarily on CHaMP and other habitat monitoring projects.

- With regard to the monitoring and evaluation of how effective specific habitat projects are at obtaining and sustaining targeted changes in habitat characteristics (project effectiveness): Within the year Bonneville and its partners should develop for ISRP review a proposal to transform that effort away from monitoring work elements on individual projects into a cost-effective, independent third-party, standardized, and statistically valid method for evaluating project-level effectiveness. This transformation should be ready in time for the geographic review of habitat actions. Also, the development and review of analytical methods and models called for above should include consideration of how to use information on project or site-level effectiveness in the overall evaluation of the effectiveness of our collective

habitat work in realizing improvements in habitat and fish characteristics at the population and watershed level.

3. Monitoring and evaluating the effectiveness of habitat actions in the estuary

Issue: The estuary presents a particular version of the habitat effectiveness issue identified just above. The 2009 Fish and Wildlife Program and the 2008 FCRPS Biological Opinion significantly increased attention on the potential for salmon and steelhead survival gains in the lower Columbia River and the estuary. Project implementation and funding levels have correspondingly increased, both for habitat actions and for assessment and monitoring and evaluation elements. But along with the growing attention to the needs in the estuary there appears to be a lack of coordination and communication among different activities, especially a lack of a sufficiently developed framework for linking actions and effectiveness monitoring and evaluation.

The RME review includes two projects devoted to or focused on estuary research, monitoring and evaluation. Meanwhile, the Corps of Engineers is funding and implementing research, monitoring and evaluation activities in the estuary and lower Columbia River as well, and Bonneville staff report that in discussions among the Action Agencies, the Corps of Engineers has been assigned the ultimate responsibility for evaluating action effectiveness in the estuary. In addition, in 2009, Bonneville implemented RPA 37 of the FCRPS BiOp by forming an Expert Regional Technical Group (ERTG) for the estuary. The purpose of the ERTG is to provide technical support to the Action Agencies on *estimated survival benefits* from habitat actions in the estuary, to help inform the selection of habitat restoration activities in the estuary and lower Columbia River. A related initiative is the Integrated Status and Trends Monitoring (ISTM) program. This is a demonstration effort under PNAMP, focusing on developing monitoring processes and tools in the estuary. There are multiple entities involved in this effort including ODFW, WDFW and the US Geological Survey (USGS).

The various activities and participants may each make sense in concept. But better coordination of the work *and* an overarching synthesis of the action effectiveness monitoring and evaluation to the habitat actions are needed if the activities in the estuary are going to be conducted in a scientifically sound, efficient and collaborative manner. One illustration of the problem: Program implementation includes two habitat projects to address the Biological Opinion habitat needs (*CREST Estuary Habitat Restoration* (2010-004-00) and *Columbia Land Trust Estuarine Restoration* (2010-073-00)). Both received unfavorable reviews in 2010 from the ISRP. The Panel recognized the importance of these projects for the BiOp's habitat restoration effort in the estuary. Yet it was completely unclear to the ISRP how these two projects actually fit into an overarching approach to the estuary linking habitat restoration actions to limiting factors and management decisions to monitoring and evaluation activities.

What happened to those two projects is thus symptomatic of the larger issue -- the lack of a clear synthesis or framework in the estuary linking habitat restoration actions to monitoring efforts to action effectiveness evaluations. Part of the issue may lie in the division of responsibility. As noted above, Bonneville informed the Council that the Corps and Bonneville have divided the estuary responsibilities such that Bonneville has assumed responsibility for a significant portion of the habitat restoration actions and status and trend monitoring, while the Corps of Engineers

Appendix B: ISRP

Independent Scientific Review Panel
for the Northwest Power & Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, Oregon 97204
www.nwcouncil.org/fw/isrp

Review of the Columbia Habitat Monitoring Program (CHaMP) Protocols

Part of the Research, Monitoring, and Evaluation and Artificial Production Categorical Review of the Integrated Status and Effectiveness Monitoring Program (ISEMP; Project # 2003-017-00) and Columbia Habitat Monitoring Program (CHaMP; Project #2011-006-00)

ISRP 2011-10
March 30-2011

ISRP Members

J. Richard Alldredge, Ph.D., Professor of Statistics at Washington State University.

Robert Bilby, Ph.D., Ecologist at Weyerhaeuser Company.

Peter A. Bisson, Ph.D., Senior Scientist at the Olympia (Washington) Forestry Sciences Laboratory of the U.S. Forest Service's Pacific Northwest Research Station.

Charles Henny, Ph.D., Emeritus Research Scientist at the U.S. Geological Survey in Corvallis, Oregon, an expert in wildlife and environmental toxicology.

Colin Levings, Ph.D., Emeritus Research Scientist and Past Section Head Marine Environment and Habitat Science Division, Department of Fisheries and Oceans, Canada.

Eric J. Loudenslager, Ph.D., Hatchery Manager and Adjunct Professor of Fisheries Biology, Humboldt State University, California, an expert in genetics and fish culture. (ISRP Chair)

Katherine Myers, Ph.D., Principal Investigator of the High Seas Salmon Research Program at the School of Aquatic and Fishery Sciences, University of Washington.

Thomas P. Poe, M.S., Consulting Fisheries Scientist, an expert in behavioral ecology of fishes, formerly with the U.S. Geological Survey.

Dennis Scarnecchia, Ph. D., Professor of Fish and Wildlife Resources, University of Idaho, an expert in large river fisheries population dynamics, and salmon, trout and char.

Bruce Ward, Fisheries Scientist, formerly with the Ministry of Environment, Aquatic Ecosystem Science Section, University of British Columbia, Vancouver, B.C., Canada.

Scientific Peer Review Group Member

William Liss, Ph.D., Professor Emeritus of Fisheries at Oregon State University.

Staff

Erik Merrill, J.D., ISRP and ISAB Coordinator, Northwest Power and Conservation Council.

ISRP Review of the Columbia Habitat Monitoring Program (CHaMP) Protocols

Contents

ISRP Review of the Columbia Habitat Monitoring Program (CHaMP) Protocols

Summary

CHaMP is an ambitious monitoring project that attempts to provide long-term habitat status and trend data needed to relate changes in fish populations to tributary habitat restoration actions over a large portion of anadromous salmonid habitat in the Columbia River Basin. It is an important companion to the ISEMP project, even though CHaMP and ISEMP sampling locations are not always the same.

The ISRP was impressed by many aspects of the CHaMP sampling protocols. However, we note that consensus among major habitat monitoring organizations with respect to the most effective protocols for tracking habitat attributes and metrics has not yet occurred. We recommend that the CHaMP team continue its dialog with other monitoring groups to resolve differences in approaches and that consideration be given to designing rigorous field tests of various protocols. We also suggest that CHaMP devote additional attention to case-by-case inclusion of "non-standard" metrics (e.g., agricultural chemicals) and to developing and testing methods of scaling up site-specific habitat conditions to watershed- and subbasin-scale indicators of habitat quality. The latter could be evaluated in a few pilot subbasins where both habitat and fish populations are well sampled.

Additionally, simulations could be used to examine the properties and sensitivity of large-scale metrics of habitat change, as well as to compare and contrast the conclusions of CHaMP analytical tools (e.g., the SHIRAZ model) with other widely used habitat models such as EDT. The most pressing need, we feel, is to develop robust, accurate relationships between VSP parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in CHaMP watersheds.

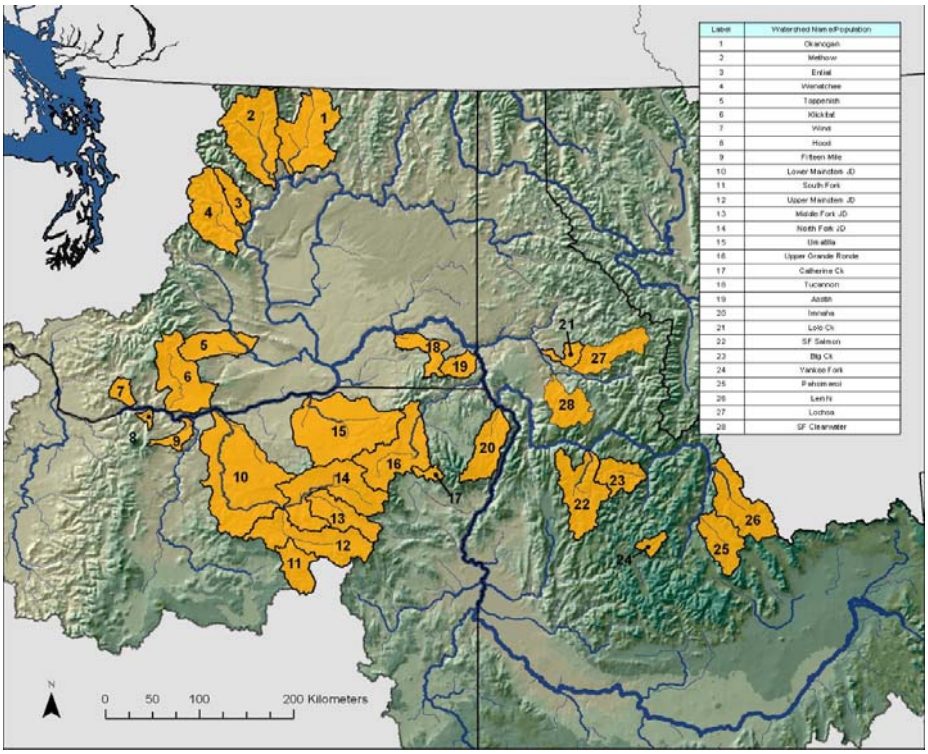
We believe that some CHaMP protocols need additional refinement and testing, and therefore recommend that project partners focus initial activities on a subset of CHaMP watersheds at geographically diverse locations in the Columbia Basin where restoration is occurring and where both habitat and fish population monitoring are sufficiently developed so that CHaMP can build on existing strong RM&E efforts, such as in intensively monitored watersheds. The ISRP would like to review CHaMP after one to two years of data collection to see how field and data management protocols have been modified and how monitoring results are being incorporated into establishing restoration priorities. In addition, we would like to review the ISEMP "lessons learned" report when it is released.

Introduction

The Columbia Habitat Monitoring Program (CHaMP) began as a collaboration of federal, state, tribal, and private sector partners after release of the 2008 Biological Opinion for the Federal Columbia River Power System (BiOp), as modified by the 2009 Adaptive Management Implementation Plan (AMIP).[1] The BiOp calls for habitat restoration in tributaries as a means of mitigating losses of salmon and steelhead through operation of the mainstem Columbia and Snake River hydroelectric system. The purpose of CHaMP is to provide a set of protocols for monitoring fish habitat status and trends throughout the portion of the Columbia and Snake River systems that are accessible to anadromous salmonids, or which affect the quality of habitat in those tributary systems inhabited by salmon and steelhead. CHaMP is closely tied to, but has a different emphasis than, the Integrated Status and Effectiveness Monitoring Program (ISEMP).[2] ISEMP was initiated by NOAA Fisheries in 2003 with the intent of developing a region-wide Research, Monitoring, and Evaluation (RME) program, with particular emphasis on monitoring selected populations of ESA-listed anadromous salmonids using a combination of status and trend analyses and experimentally manipulated, intensively monitored watersheds (IMWs). CHaMP habitat monitoring protocols are being used in some, but not all, of the sites currently being studied by ISEMP. The following map shows the location of the 26 watersheds for which CHaMP protocols are proposed for implementation.

[1] http://www.nwr.noaa.gov/Salmon-Hydropower/Columbia-Snake-Basin/Final-BOs.cfm

[2] http://www.nwfsc.noaa.gov/research/divisions/cbd/mathbio/isemp/index.cfm



The ISRP has reviewed the ISEMP program or components of this program on several occasions. However, 2010 was our first opportunity to examine CHaMP as part of the Categorical RME solicitation. In our review we complimented the CHaMP emphasis on developing standardized data collection methods and spatially balanced and randomized sampling to bring more consistency to monitoring efforts in the Columbia River Basin. However, details on sampling methods, site selection, and data management had not at the time been completely formulated. Therefore, the ISRP recommended the project with the following qualification: "*The ISRP recommends that ISEMP organize a one-day workshop to discuss the CHaMP approach with the ISRP/ISAB and others. A draft of CHaMP should be circulated to the ISRP/ISAB before the workshop. Specific issues at the workshop should include how previously collected data can be or have been incorporated into CHaMP databases. It would also be useful to summarize how ISEMP priorities have evolved over the years, as well as a publication strategy*."

On January 25, 2011, CHaMP partners completed a 2011 Working Version 1.0 Scientific Protocol for Salmonid Habitat Surveys within the Columbia Habitat Monitoring Program.[3] The protocols were sent to a variety of federal, state, and tribal habitat monitoring organizations for comments. On February 10, 2011, the CHaMP workshop took place in Portland with a group of ISRP members interested in habitat restoration, CHaMP partner representatives and interested parties, and two Council members and several Council staff. After the workshop, the ISRP received copies of comments on the CHaMP protocols from several state, federal, and tribal organizations with an interest in basinwide habitat monitoring.

CHaMP is not entirely funded by BPA through the NPCC's Fish and Wildlife Program. Some of the support for CHaMP is provided by the National Oceanic and Atmospheric Administration (NOAA) and Bureau of Reclamation (BOR). Nevertheless, the CHaMP program relies on BPA funding for a substantial portion of its implementation costs and therefore the goals of CHaMP should be aligned with the Council's 2009 Fish and Wildlife Program as well as the reasonable and prudent alternative actions (RPAs) for tributary habitat monitoring in the 2008 BiOp. CHaMP is relevant to the following elements of the Council's Program:

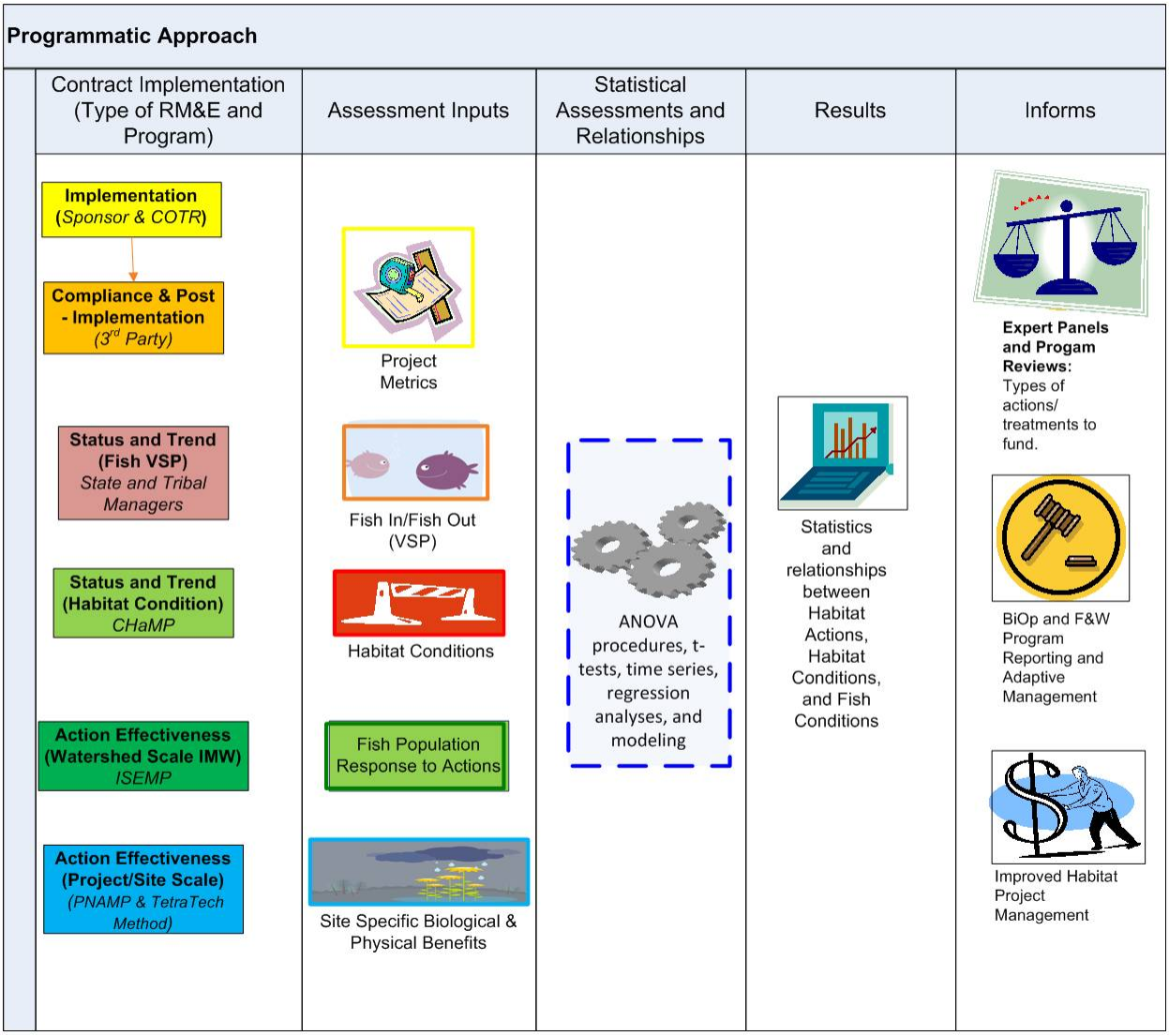
- Emphasizes implementation of fish and wildlife projects based on needs identified in locally developed subbasin management plans (these plans are included in the Fish and

[3] Scientific Protocol for Salmonid Habitat Surveys within the Columbia Habitat Monitoring Program (CHaMP) http://www.pnamp.org/node/3141

Wildlife Program) and also on actions described in federal biological opinions on hydropower operations, hatcheries, and harvest, Endangered Species Act recovery plans, and the 2008 Fish Accords signed by federal agencies, Indian tribes, and the states of Idaho and Montana

- Focuses on protecting and restoring habitat in order to rebuild healthy, naturally producing fish and wildlife populations
- Increases project performance and fiscal accountability by establishing reporting guidelines and using adaptive management to guide decision-making
- Commits to a periodic and systematic exchange of science and policy information
- Emphasizes a focused monitoring and evaluation framework coupled with a commitment to use the information obtained to make better decisions
- Calls for a renewed regional effort to develop quantitative biological objectives for the program

Perhaps the best way to visualize how CHaMP fits into a larger coordinated strategy for tracking and understanding the effectiveness of restoration projects is through the following diagram, which was presented at the February 10 workshop. The diagram displays the various elements of a basinwide effectiveness RME effort that is intended to achieve both the goals of the 2008 BiOp and the Council's Fish and Wildlife Program. The CHaMP program is depicted in the green box under the Contract Implementation heading. What the diagram does not expressly depict, however, is the connection between CHaMP and ISEMP (including its network of intensively monitored watersheds) and the PNAMP effectiveness monitoring effort.



The purpose of this review is to summarize the ISRP's comments on the February 10, 2011, workshop and on the 2011 CHaMP Version 1.0 protocols. It is clear from the comments of other organizations engaged in habitat monitoring that the CHaMP protocols for some field and analytical methods have not reached consensus status, i.e., there is still disagreement about the most effective way to locate, measure, or express certain physical habitat attributes. At this time the ISRP does not take a position on the methods of measuring physical habitat; however, we do comment on other potentially limiting factors that might be overlooked (e.g., food webs, exposure to toxic compounds, and habitats downstream from CHaMP sampling locations, including the mainstem, estuary and ocean). Issues of accuracy, precision, and cost-effectiveness will eventually be resolved by field practitioners with ISRP advice where appropriate, and in any case new methods are constantly being developed and incorporated into monitoring programs. Rather, our objective is to provide assistance to CHaMP and other large-scale tributary habitat monitoring programs with respect to study design, coordination, data sharing and reporting, and use in adaptively managing restoration actions. Additionally, our review is intended to assist the Northwest Power and Conservation Council in evaluating how well the research, monitoring, and evaluation components of the Fish and Wildlife Program are being implemented in the field.

ISRP View:

> The CHaMP project originated in response to the need for a coordinated habitat monitoring program that would permit the assessment of habitat status and trends in subbasins where restoration actions are taking place. CHaMP objectives appear to be consistent with elements of the Council's Fish and Wildlife Program. However, CHaMP enters an arena already crowded with many large-scale habitat monitoring efforts, and full endorsement of CHaMP by other monitoring entities has not yet occurred. It may be unrealistic (or even undesirable) to expect that the CHaMP protocols will become the *de facto* monitoring approach throughout the Columbia River Basin; however, the ISRP applauds the CHaMP effort to bring more consistency to habitat monitoring, and to outline a program where status and trend information can be incorporated into restoration decision-making.

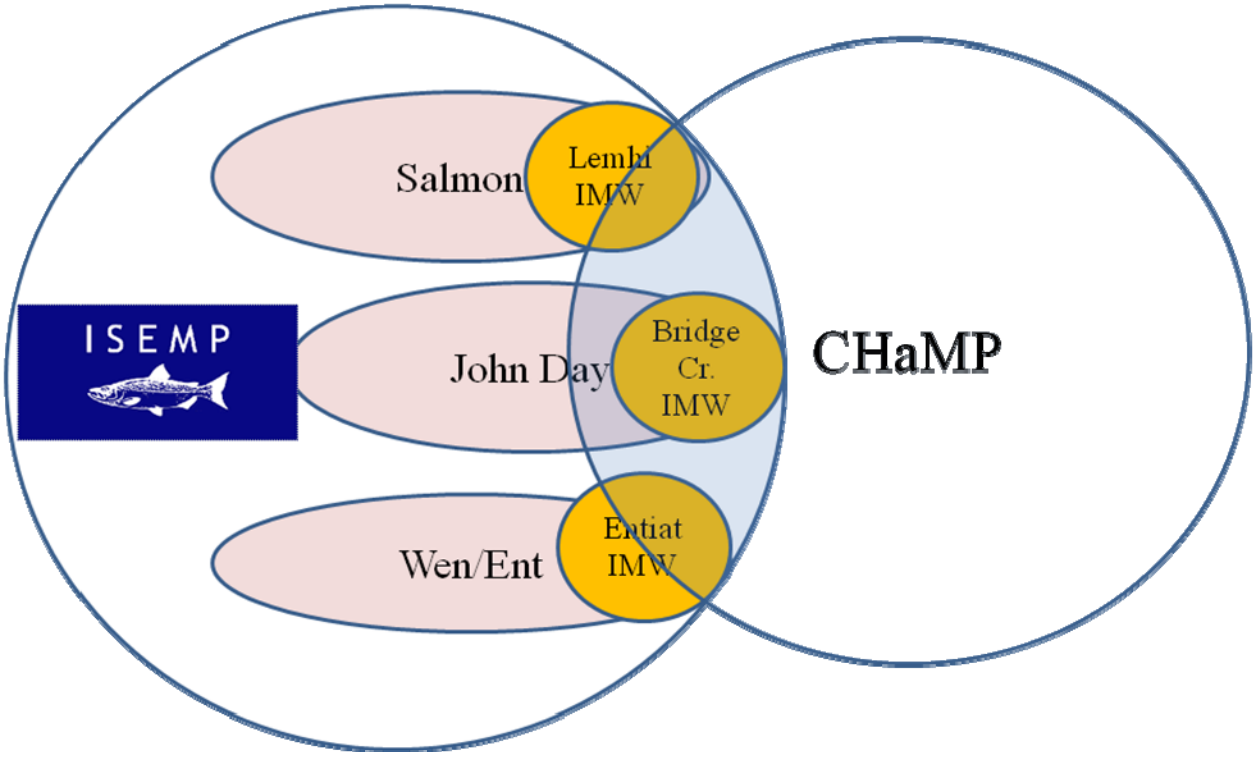
CHaMP protocols

The following quotes were taken from an opening presentation at the February 10 workshop and provide additional background information on the current status of the CHaMP program:

> *Pilot projects started in 2003 as ISEMP Wenatchee, Methow, and Entiat river basins in the Upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin to pilot and test action effectiveness and status monitoring approaches.*
>
> *These pilot projects became the IMW element of the program, which now covers 9 watersheds. A "lessons learned" report for 2003-2010 will be compiled and presented later this year to inform the management questions, demonstrate progress, and guide decision makers implementing offsite mitigation habitat projects.*
>
> *CHaMP projects provide habitat status monitoring for an additional 15 watersheds, as identified in 2009 and 2010 BiOp RM&E Recommendations Reports and Skamania ASMS [Anadromous Salmonid Monitoring Strategy]. CHaMP complements the IMWs and uses the same habitat parameters and protocols, but with less intensity of effort.*
>
> *Together, the IMWs and CHaMP projects will cover at least one population per* [Major Population Group] *MPG.*[4] *Parallel fish population monitoring for CHaMP watersheds is being implemented under other projects.*

The intersection between CHaMP and the ISEMP project is illustrated in the following diagram presented at the February 10 workshop. Note that the CHaMP protocols have been evaluated in a limited number of sites; at the workshop, the Bridge Creek site (John Day subbasin) was highlighted. The designation IMW is for intensively monitored watersheds.

[4] An MPG is a group of independent populations nested within a salmon ESU that serves as a management unit for salmon recovery.



ISRP View:

The conceptual linkage between CHaMP and ISEMP was outlined at the February 10 workshop, but the overlap between fish population status and trend monitoring, led by ISEMP and state and tribal organizations, and habitat status and trend monitoring, led by CHaMP, seems to be restricted to relatively few locations at present. Until there are more streams where population and habitat data are gathered concurrently, some of the assumptions in CHaMP about the relationships between VSP parameters (fish population abundance, productivity, spatial structure, and diversity) and habitat attributes will remain unverified over a range of field conditions. We believe ISEMP intends to use intensively monitored watersheds to provide the basis for relating habitat restoration to changes in population characteristics, but the utilization of CHaMP in other (non-IMW) watersheds where fish populations are being monitored was not thoroughly explained, including whether the sampling protocols would facilitate an evaluation of restoration effectiveness on fish populations.

CHaMP watersheds were selected to represent at least one population within each steelhead and spring Chinook MPG, as opposed to using a stratified random procedure or some other method for selecting watersheds for monitoring. Given CHaMP's approach for selecting watersheds, it remains to be demonstrated how well the results obtained through the CHaMP project can be extrapolated to unmonitored watersheds within the interior Columbia River Basin.

It was not clear to the ISRP how ISEMP and CHaMP, in evaluating restoration effectiveness, propose to accommodate factors affecting fish populations downstream from CHaMP sampling locations (non-wadeable areas downstream of CHaMP sampling sites, including the mainstem, estuary and ocean). Factors such as hydrosystem operation, food web structure, and exposure to agricultural, industrial and urban chemicals could potentially confound determinations of restoration effects on productivity and spatial structure in a drainage system of interest. Each tributary will have a different suite of downstream influences that will add to the difficulty of generalizing effectiveness monitoring results from one area to another.

General observations on habitat survey protocols, and habitat metrics/indicators

The following habitat protocols and metrics will be obtained by 3-person field crews at each location identified in the GRTS (generalized random tessellation stratified) site selection grid discussed below. According to the CHaMP Version 1.0 protocols, all habitat attributes in the table below will be measured at each site in a 1-day period.

Table 1. The metrics and indicators used in the CHaMP protocol and the inference design underlying each indicator.

Indicator	Units	Inference Domain	Inference Design	Inference Method	Metrics	Indicator Generation Process	Software	Fish Response Category	Life Stage
Average Alkalinity	Milli-equivalent per liter	Survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of alkalinity	Estimated annually for entire survey frame with sampling design-based algorithm.	SP Survey	Survival	Parr to smolt
Average Conductivity	Micro-Siemens per meter	Survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of conductivity	Estimated annually for entire survey frame with sampling design-based algorithm.	SP Survey	Survival	Parr to smolt
Average pH	pH	Survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of pH	Estimated annually for entire survey frame with sampling design-based algorithm.	SP Survey	Survival	Parr to smolt
Growth Potential	Degree grams	Survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of drift biomass and temperature	Estimated annually for entire survey frame with sampling design-based algorithm for the product of drift macroinvertebrate biomass and temperature	SP Survey, Thermal Dynamic Model	Growth	Parr to smolt
Percent Below Summer Temperature Threshold	Percent	Survey frame	Total length estimated over survey domain, annually	Model-based	Year-round temperature logger data from sites	Model-based inference for all stream reaches in the watershed based on a continuous stream temperature model calibrated with site specific temperature logger data	Thermal Dynamic Model	Growth	Parr to smolt
Percent Above Winter Temperature Threshold	Percent	Survey frame	Total length estimated over survey domain, annually	Model-based	Year-round temperature logger data from sites	Model-based inference for all stream reaches in the watershed based on a continuous stream temperature model calibrated with site specific temperature logger data	Thermal Dynamic Model	Growth	Parr to smolt
Velocity Heterogeneity	Index	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Modeled velocity heterogeneity at a site	Estimated annually for valley types nested in the survey frame with sampling design-based algorithm for variance Froude number across a site.	SP Survey, Hydrologic model	Growth	Parr to smolt
Embeddedness of Fast water Cobble	Percent	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Average of site embeddedness measurements	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for riffle cobble embeddedness.	SP Survey	Survival	Eggs/Alevin

Indicator	Units	Inference Domain	Inference Design	Inference Method	Metrics	Indicator Generation Process	Software	Fish Response Category	Life Stage
Pool Frequency	Count per meter	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of pool frequency	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for pool frequency.	SP Survey, River Bathymetry Toolkit	Growth	Parr to smolt
Channel Complexity	Index	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurements of depth, width, and thalweg sinuosity	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for variance in depth, variance in width, and variance in thalweg sinuosity.	SP Survey, River Bathymetry Toolkit	Growth	Parr to smolt
Channel Score	Index	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurements of channel unit volume, LWD, and substrate	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm metrics necessary for RP100 calculations as used by PIBO, AREMP, and EMAP.	SP Survey, River Bathymetry Toolkit	Growth	Parr to smolt
Residual Pool Volume	Cubic meter	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of residual pool volume	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for residual depth of all pools as given by the site DEM.	SP Survey, River Bathymetry Toolkit	Growth	Parr to smolt
Subsurface Fines	Percent	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of subsurface fines	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for subsurface fines.	SP Survey	Survival	Eggs/Alevin
Total Drift Biomass	Gram per square meter	Survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of total drift biomass	Estimated annually for valley type nested in the survey frame with sampling design based algorithm for total drift biomass.	SP Survey	Growth	Parr to smolt
Bank Angle	Percent	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of bank angle	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for bank angle from site DEM and channel unit delineation.	SP Survey, River Bathymetry Toolkit	Growth	Parr to smolt
LWD Volume	Cubic meter	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of LWD Volume	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for LWD volume.	SP Survey	Growth	Parr to smolt

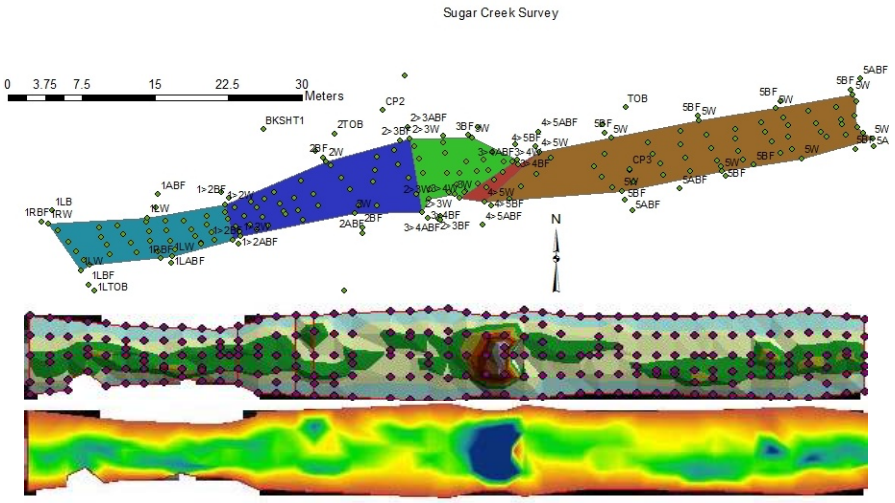
Indicator	Units	Inference Domain	Inference Design	Inference Method	Metrics	Indicator Generation Process	Software	Fish Response Category	Life Stage
Fish Cover	Percent cover	Survey frame	Mean, variance over inference domain, annually	Design based	Site measurement of fish cover	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for channel unit type and whole reach total fish cover.	SP Survey	Survival	Parr to smolt
Channel Unit Volume	Cubic meter	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of volume (DEM, photos, site map) and channel unit type	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for channel unit volume from site DEM and channel unit delineation.	SP Survey, River Bathymetry Toolkit	Growth	Parr to smolt
Channel Unit Complexity	Index	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurements of channel unit volume, LWD, and substrate	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for residual pool depth, subsurface fines and wood volume. A multivariate measure of channel unit complexity, similar to DSM approach applied by AREMP and PIBO to habitat metrics to capture complexity.	SP Survey, River Bathymetry Toolkit	Growth	Parr to smolt
Riffle Particle Size (D_{16}, D_{50}, D_{84})	Millimeter	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of D_{50}, D_{16}, D_{84}	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for D_{16}, D_{50}, and D_{84} from riffles.	SP Survey	Survival	Eggs/Alevin
Riparian Structure	Kilometer by type	Vegetation community types nested in survey frame	Total length estimated over survey domain, annually	Design-based	Site measurement of riparian structure	Estimated annually for post hoc stratified domains of historical riparian vegetation types in the survey frame with sampling design based algorithm for each riparian structure.	SP Survey	Growth	Parr to smolt
Solar Input	Degree day	Valley type nested in survey frame	Mean, variance over inference domain, annually	Design-based	Site measurement of solar input	Estimated annually for valley type nested in the survey frame with sampling design-based algorithm for solar input.	SP Survey, Solar Pathfinder	Growth	Parr to smolt

The last two columns of the table are important as they point to the type of biological response a habitat attribute ("indicator") is likely to influence, and the fish life history stage most affected.

Some of the habitat features in the table involve one or several easily-obtained measurements averaged at a site (e.g., alkalinity, pH), but other attributes related to physical habitat structure require detailed survey techniques. The CHaMP protocols include channel unit and topographic surveys that are carried out with sensitive surveying equipment (total stations[5]) which enable bathymetric mapping of the channel surface, as well as large logs or other

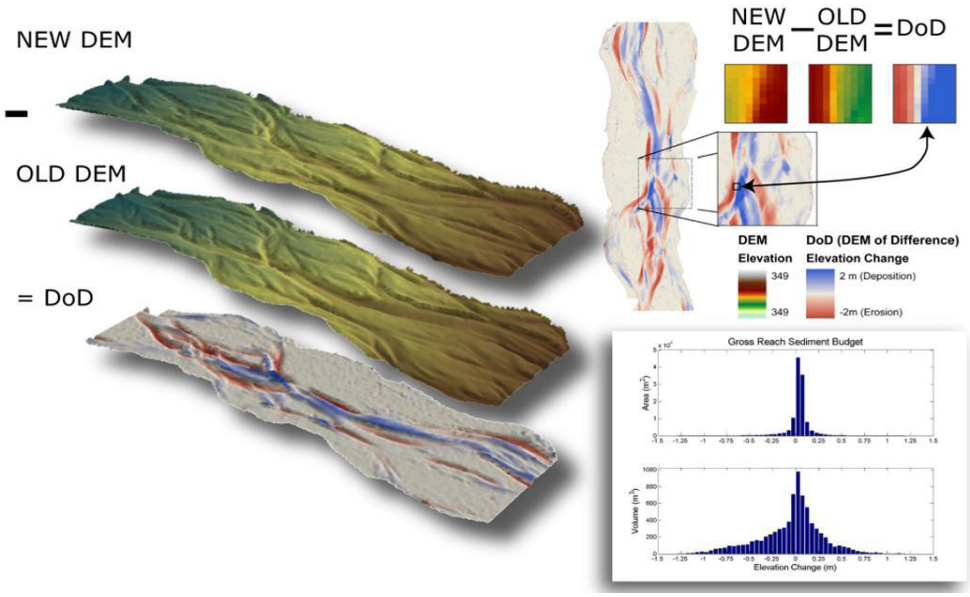
[5] A total station is an electronic/optical instrument used in modern surveying. The total station is an electronic transit integrated with an electronic distance meter to read slope distances from the instrument to a particular point.

habitat structures associated with the stream. The following graphic illustrates the sampling points and resultant digital elevation map (DEM) that was constructed from a site survey.



Color representation of a digital elevation map developed from a total station survey of a stream reach.

The digital elevation maps (DEMs) created by the surveys can be used to track habitat changes and sediment movements over time at a very fine scale, and they can be linked sequentially together to generate a topographic map of an entire stream system. CHaMP and ISEMP are partially supporting refinement and application of a "River Bathymetry Toolkit" that can be used to summarize changes in channel morphology over large areas. The toolkit can use remotely sensed high resolution data (e.g., green LiDAR) that can substitute for ground surveys, thus saving time and expense. The following graphic illustrates how sequential DEMs can be compared to display changes over time (DOD stands for DEM of Difference in channel form over two surveys).



ISRP View:

The CHaMP habitat protocols and metrics represent a very ambitious set of measurements that will require careful training of field crews and implementation of quality control measures to ensure data accuracy and precision. At the workshop, CHaMP personnel stated that a 3-person crew could sample a site per day on

average. We think this may be optimistic for sites that are located in roadless areas or sites that are otherwise difficult to access, given the large number of habitat attributes and the time required for digitizing channel morphology. The ISRP notes that all surveys will be conducted during the period of summer low flows. This will provide a detailed picture of summer habitat conditions but may be inadequate for characterizing habitat during other seasons. When questioned about the possibility of dropping indicators that might not yield useful information, thus saving time and expense, the CHaMP staff indicated they would be willing to do so.

The rationale for not adopting existing monitoring protocols (e.g., EMAP, PIBO, ODFW's Aquatic Inventories Project) could have been made more apparent by the CHaMP team. Presenters at the workshop indicated that existing habitat assessment protocols have different objectives than CHaMP and so would not be applicable, but they did not explain clearly why other protocols were insufficient to meet CHaMP objectives. It seems likely, given the scope and objectives of large habitat monitoring efforts, that CHaMP surveys and surveys by other monitoring organizations may take place in the same watershed. If this occurs, we encourage CHaMP and those organizations to share data for the purpose of comparing results, increasing replicate samples, and establishing a basis for habitat variability during the period of summer low flow.

It was also unclear how much flexibility would be allowed in implementation of the protocols to deal with possible field constraints such as limited time available for sampling, problems posed by weather conditions, and logistic difficulties in sampling particular sites. Will all the measurements proposed by CHaMP be expected to be made at all sites in CHaMP watersheds, or will surveyors have some discretion based on local conditions? Are all the measurements and commensurate metrics equally important, or are some more important than others? What procedure will be given to prioritizing measurements and metrics, identifying those that are most essential and should be collected at all sites? Although briefly mentioned, it would have been useful to have had additional discussion of methods that will be used to compare data collected under CHaMP with legacy (historical) data collected following different protocols than CHaMP.

We are still not sure how habitat status and trend monitoring data will be related to (integrated with) status and trends of fish population data within CHaMP watersheds to evaluate the effectiveness of specific restoration strategies or general restoration effectiveness in a geographic area (e.g., are the co-managers in a given subbasin successful in restoring stream habitat in their area?). It was unclear which entity or entities will be responsible for conducting fish status and trends monitoring at CHaMP sites, what kinds of fish data would be collected (e.g., site/reach-specific abundance sampling or fish in- fish out), and what kinds of analytical methods will be used to relate fish status and trends to habitat status and trends. CHaMP indicated that fish population surveys are not being carried out simultaneously with the habitat measurements, although it was their hope that ISEMP and other cooperators would be able to provide fish demographic data that could be associated with the habitat surveys. The linkage between fish and habitat monitoring in CHaMP watersheds requires development.

The ISRP understands that a primary objective of CHaMP is to track status and trends in stream habitat condition over large areas using a spatially balanced sampling approach and that this objective does not, by itself, require corresponding fish population data. However, the corollary objective of determining habitat restoration effectiveness *does* require fish demographic data in order to establish a causal link between habitat change and fish performance. Establishing this connection, we believe, is the primary purpose of intensively monitored watersheds. However, in those CHaMP watersheds where restoration actions are taking place, but which do not have experimentally controlled restoration treatments as in the IMWs, the ISRP feels that there is still great value in collecting both habitat and fish data at as many sites as possible in order to verify assumptions about relationships between habitat conditions and fish populations.

The ISRP believes that the description of life stages influenced by various habitat measurements could be more refined. In many cases, the life stage affected by a given habitat attribute was identified as "parr to smolt." However, we believe this may be too coarse. Where possible, seasonal or age class effects could be noted, and this would help illuminate how some restoration actions are influencing VSP parameters.

It is unclear how the results obtained from monitoring individual sites within a watershed can be "rolled up" to the entire watershed to advance generalizations about status and trends in habitat condition for the watershed as a whole. In addition to its role in restoration effectiveness monitoring, CHaMP provides an opportunity to assess future habitat degradation, which is largely ignored at this time. Evaluation of how other results obtained from monitoring individual sites within a watershed can be "rolled up" to a landscape scale should be considered (see O'Neill et al. 1997[6]; Ruiz-Jaen and Aide 2005[7]; Urban 2005[8]).

The habitat and fish modeling workshop (February 8 and 9, 2011) which preceded the CHaMP workshop at the Council offices in Portland, served to display the capabilities of current practitioners and the potential of simulation modeling as a planning, predictive, and analytical tool for evaluating restoration effectiveness, as CHaMP portends. Practitioners agreed there is room for improvement in development and parameterization of habitat and fish population models. Habitat-based prediction of fish population capacity and productivity, as well as the potential responses to restoration treatments, was demonstrated in several presentations.

However, it was also evident that these results can be confounded by several factors, including, for example:

- the presence of hatchery fish (which affect wild fish productivity and capacity and display different VSP values than wild fish)
- variable composition of the fish community
- non-native fishes (introductions and invasions)
- factors outside of the watershed (e.g., ocean survival and growth, in-river passage), and
- climate change.

All of these factors require further exploration in theory and in the field, and affect the number of years and watersheds that shall be required in an experimental treatment-control setting to establish proof of concept. Despite the progress and promise of simulation modeling, the protocols and application of CHaMP will be very much challenged by these limitations.

Sampling design and site selection

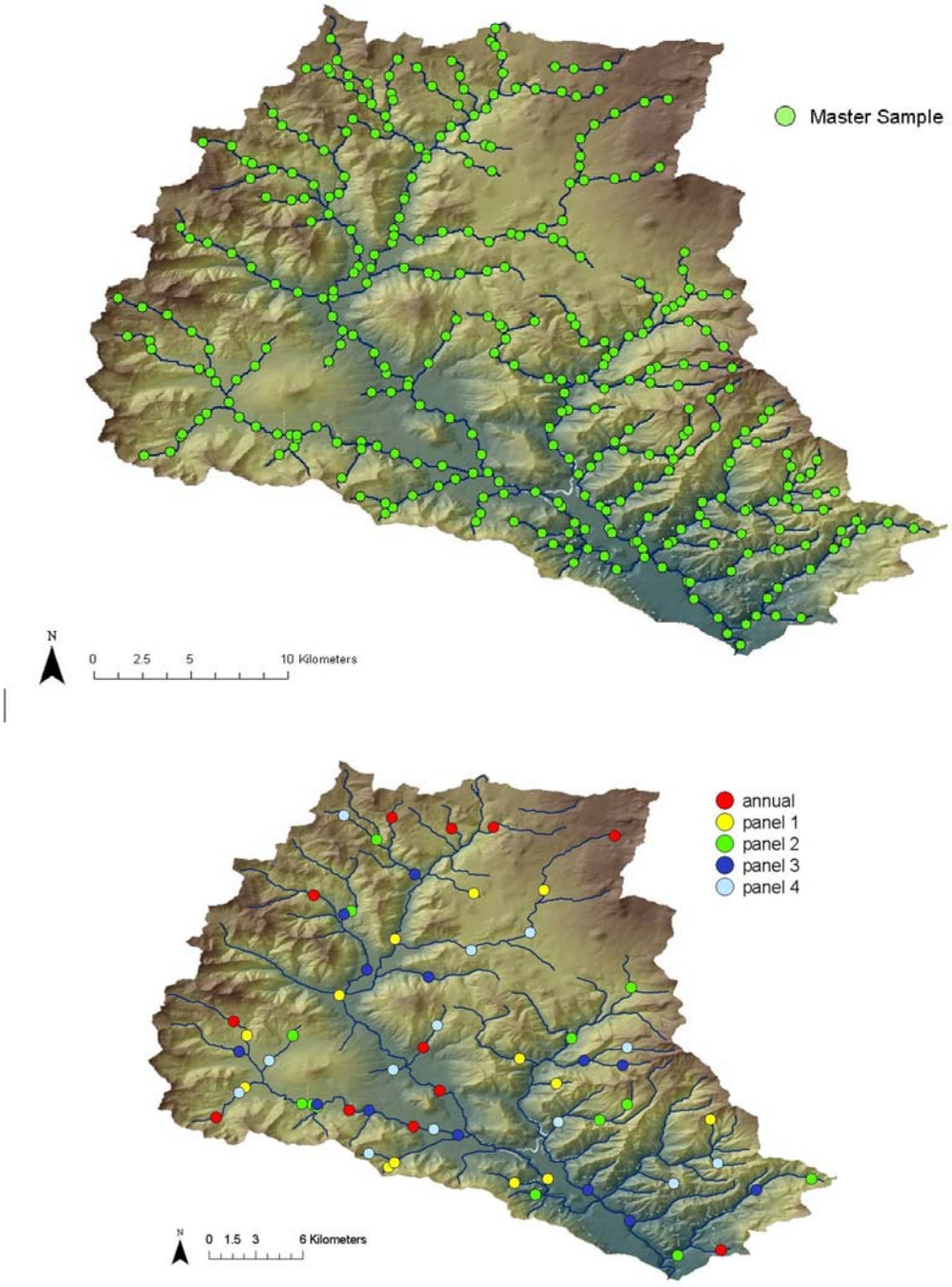
CHaMP employs a spatially balanced, probabilistic design – GRTS, the method used in EPA's EMAP and ODFW's habitat programs – which allocates sampling sites in watersheds possessing at least one population within a MPG of spring Chinook or steelhead. Potential sampling locations include all stream segments in wadeable, perennial channels below natural impassable barriers to migration. CHaMP will sample 25 sites, selected from a larger number of candidate locations, annually in each watershed. In some watersheds the same 25 sites will be sampled each year; in others, some of the sites will be sampled annually and the balance will be sampled every few years on a rotating basis. The following maps of the Wind River watershed depict hypothetical candidate sites in the drainage

[6] Explores landscape approaches to environmental monitoring with a focus on biotic diversity, watershed integrity, and landscape stability. Combines remote imagery, GIS, and landscape ecology principles to monitor landscapes. "Monitoring environmental quality at the landscape scale." O'Neill, R.V. et al. 1997, BioScience.

[7] Reviews how restoration success has been evaluated in restoration projects and compare these results with attributes identified by the Society of Ecological Restoration International that should be considered when evaluating restoration success. Three ecosystem attributes identified: diversity, vegetative structure, and ecological processes. "Restoration success: How is it being measured?" Ruiz-Jaen, M.C. and Aide, T.M., 2005, Restoration Ecology.

[8] Uses simulation modeling to relate fine scale ecological processes to large-scale management and environmental policy. Intent of modeling is to simplify the model while retaining details essential for larger-scale applications. Uses graph theory, hierarchical perspective, and meta-models. "Modeling ecological processes across scales." Dean Urban, 2005, Ecology.

system (top) followed by color coded locations of selected sampling locations using a GRTS rotating panel design (bottom). The four color-coded panel sites will be sampled in sequential years.



ISEMP is currently developing a field manual giving protocols for site evaluation and is planning to finish the work in spring 2011, and then site selection in all 26 watersheds will be completed.

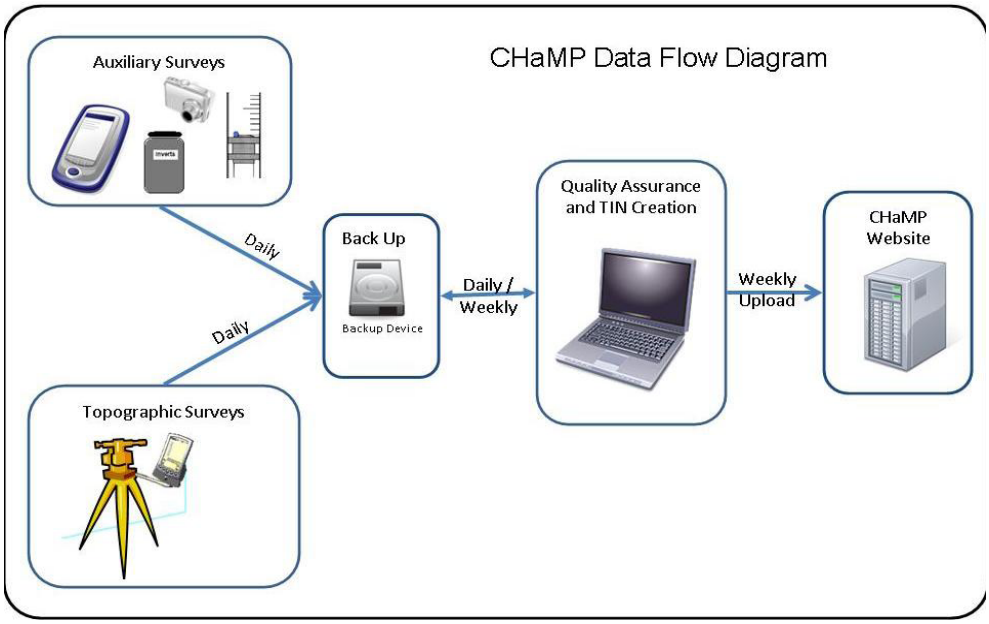
ISRP view:

We think the GRTS spatially balanced probabilistic approach to site selection and the use of the latest technology in digital terrain mapping uses methods accepted in large-scale data collections. There was

some debate at the February 10 workshop over whether improved information on habitat status and trends could be derived from sampling more than 25 sites per watershed at a lower intensity per site, relative to the 25 proposed sites at which all of the attributes and indicators in Table 1 are measured. At present the ISRP is not aware of any reports or publications that can answer this question with certainty. However, we acknowledge that the question of whether more, but less intensively sampled, sites may be more informative than fewer, more intensively sampled sites is legitimate. We therefore suggest that CHaMP re-visit the issue of number of sites, perhaps by designing a study that compares long-term monitoring results from paired CHaMP watersheds with more, less intensively sampled sites versus fewer, more-intensively sampled sites. We also suggest that CHaMP provide a clearer description of how site selection is influenced, if at all, by proximity to ongoing instream or riparian restoration actions.

Data management and quality assurance

The data management plan for CHaMP relies on a variety of field data collection methods – most recorded digitally – that are fed daily into backup drives to prevent data loss, followed by weekly quality assurance checks and uploading to the CHaMP website. The following diagram from the Working Version 1.0 protocol shows the steps in the process.



Data management activities are scheduled according to pre-season (statistical design, site evaluation), field season (data capture, quality assurance, data archival), and post-season (completeness of data, derivation of metrics) reviews.

ISRP view:

CHaMP monitoring will produce large and complex data sets. It is not clear at this point in time how the data will be analyzed for long-term habitat status and trends, and whether CHaMP personnel or collaborators will perform the analyses. Apparently personnel involved with CHaMP are developing analytical procedures, but the details of these procedures and the entities that will develop them (CHaMP personnel or collaborators) remain unclear. Nevertheless, CHaMP has a well thought-out plan for data management. Although the ISEMP team has an excellent record of issuing timely progress reports, we feel that more information should be published in peer-reviewed journals. CHaMP is a young program, but the results will be of interest to restoration practitioners throughout the region and in other major river basins.

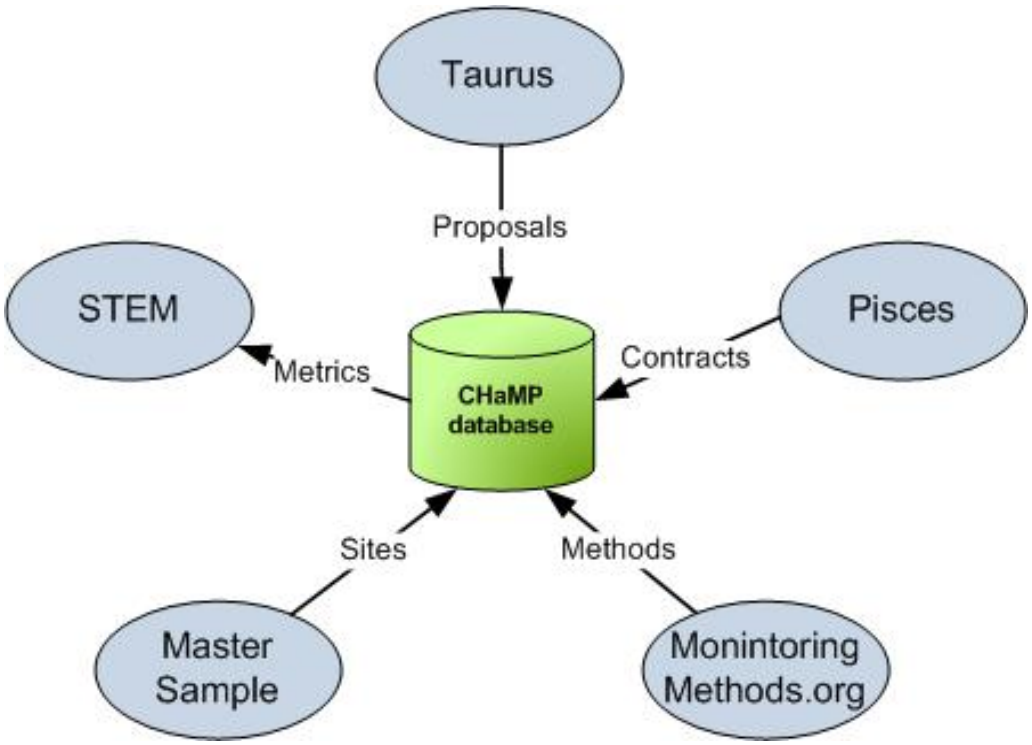
We hope that publication of annual progress reports and peer-reviewed papers will be included in data management goals.

Data sharing with other large habitat monitoring efforts (AREMP/PIBO, PNAMP, EMAP, CRITFC, other)

CHaMP is quick to point out that its objectives differ slightly from those of other large monitoring programs:

> *"The stream habitat data generated by CHaMP will be used in conjunction with salmonid growth, survival, abundance and productivity to estimate fish-habitat relationships across the Columbia River Basin. The CHaMP protocol is fish-centric, i.e., measuring habitat relevant to salmonids of interest under the BiOp. As such, it differs from other programs like the Aquatic and Riparian Effectiveness Monitoring Program (AREMP), which was designed to assess the condition of aquatic, riparian, and upslope ecosystems under the jurisdiction of the Northwest Forest Plan (Gallo 2001), or the PACFISH/INFISH Biological Opinion (PIBO) protocol, which was designed to determine whether a suite of biological and physical attributes, processes, and functions of upland, riparian, and aquatic systems are being degraded, maintained, or restored, particularly in reference to livestock grazing and other federal land management practices (http://www.fs.fed.us/biology/fishecology/emp/), or the Environmental Monitoring and Assessment Program (EMAP) protocol, which was designed by the Environmental Protection Agency (EPA) to produce unbiased estimates of the ecological condition of surface waters across a large geographic area (or areas) of the West (Peck et al. 2001)."*

However, data collected by CHaMP will be made available to interested collaborators through the CHaMP database. The following diagram shows the input and output pathways for the database:



Although habitat information in the CHaMP database will be made available to others, there appear to be no formal data sharing agreements with other large monitoring programs. Nevertheless, the single-source website will include standard query and data sorting tools for interested users. In addition, many attendees of the February 10 workshop agreed that periodic (perhaps annual) data sharing workshops involving CHaMP, AREMP, PIBO, EMAP, and large state and tribal habitat programs would be beneficial.

ISRP View:

For a young program, CHaMP has developed the web tools and taken reasonable steps to make data available to others in a timely manner. Data archiving appears to be one of CHaMP's strong suits. The ISRP encourages the periodic exchange of habitat status and trend data and analyses through annual meetings of those organizations engaged in collecting both habitat and fish population information. Periodic (annual or 2-year) habitat workshops would be a useful forum for information exchange between monitoring organizations, particularly with respect to questions about which protocols are and are not working effectively.

Critique of CHaMP protocols by other monitoring entities

The ISRP received comments from many other monitoring entities regarding the CHaMP protocols. In general, those organizations commended the intent of CHaMP and its goal of linking tributary habitat status and trends to changes in fish population demographics. Overall we were impressed with the detail with which these organizations examined the CHaMP version 1.0 document, and perhaps not surprisingly there were detailed comments on the suitability of the protocols. As previously stated, the ISRP does not address in this review whether one habitat monitoring approach is better than another (e.g., is benthic macroinvertebrate sampling more informative than drift sampling?), but we did note several themes that were common to the critiques:

- CHaMP methods and analytical tools remain somewhat untested, in the view of some monitoring organizations.

- The CHaMP protocols seem more appropriate for intensively monitored watersheds than to a large-scale approach to monitoring watershed health (the ISRP notes, however, that CHaMP is admittedly fish-centric and not focused on tracking watershed functions).

- The links between survey protocols and factors that are causing habitat degradation could be clearer.

- Land ownership (public and private) may cause an imbalance in site selection, especially where focal species tend to inhabit private lands and access to those lands is restricted.

- There was moderate to strong disagreement over which habitat attributes would be most informative and useful for tracking habitat status and trends, not only between other organizations and CHaMP but also among the other programs themselves. The condition of food webs supporting fish production, for example, is not adequately addressed by CHaMP.

ISRP View:

While CHaMP metrics are, in general, similar to those in other habitat monitoring approaches, the integrative methodologies using those data (modeling) are in many cases very sophisticated and in various stage of development, and we do not yet see consensus among the large habitat monitoring organizations with respect to analytical tools (e.g., use of the SHIRAZ vs. EDT models). A broadly based buy-in to the CHaMP program seems critical if CHaMP is to fulfill its BiOp objectives. One factor affecting regional acceptance is "enfranchisement." In this regard, there is a sharp contrast between the high level of technical proficiency of some of the people speaking to us at the February 10 workshop and the frequent shortage of such expertise among some on-the-ground collaborators, as pointed out in some of our RME project reviews.

It seems important to the ISRP that if CHaMP is to be used effectively and widely accepted for monitoring, it should include effective *information transfer, technology transfer and perhaps expertise transfer*. Basic training in habitat measurement is one thing; transferring the ability to understand and apply the entire suite of protocols and tools to cooperators is another. It will be difficult to achieve a broad level of enfranchisement until major points of disagreement regarding the protocols have been resolved. It was not completely clear if the potential cooperators with CHaMP (agencies, tribes, regional NGOs, etc.) are to be mainly data collectors or if it is anticipated that the cooperators themselves will eventually have the staff expertise not only to collect the data using established protocols but to effectively understand and use the modeling programs and other analytical tools to support and document the benefits of their habitat restoration programs. If CHaMP included a long-term plan for enfranchising other habitat monitoring efforts, differences over the protocols and their analyses and interpretation might be more easily resolved.

Other Conclusions

ISRP recommendations for evolution of the CHaMP effort

We are impressed with the quality and amount of material that the CHaMP team has created in a short amount of time. They seem to have a clear picture of the overall goals and have devised an approach that is supported by

statistical design and analysis considerations, while implementing promising newer technologies. The issue of how much standardization of field protocols is possible and/or desirable is complex and contentious. On the one hand, standardization contributes to data sharing and opens possibilities for answering questions about habitat status and trends at a larger scale, while on the other hand too much standardization limits creativity and a diversity of approaches that might be beneficial. Of course, the underlying issue of turf comes into play during these considerations, as we saw at the February 10 workshop. Prior to extensive implementation of CHaMP, a cautionary approach might be to initiate several modestly sized CHaMP protocol tests (focused, for example, on a range of watersheds across the Columbia Basin where both habitat and fish population monitoring efforts are occurring) in which different approaches to design, data collection, data storage, and data analysis, can be compared to provide a test of the efficacy of scaling up from past efforts while still allowing and encouraging other promising, or well proven, efforts to continue.

Suggested role for the ISRP in future reviews of the program

Although the purpose of the workshop and ISRP review was to evaluate CHaMP protocols, the larger question, of importance to both the BiOp and the Council's Fish and Wildlife Program, is whether habitat restoration actions in a watershed improve fish performance and survival as well as VSP criteria. The following were listed as Tributary Habitat Questions at the workshop:

- Are tributary habitat actions on track to achieve expected performance standards and targets?
- What are the relationships between tributary habitat actions, habitat changes, and fish survival and productivity changes?
- What actions are most effective?
- What are the limiting factors or threats preventing the achievement of desired habitat or fish performance objectives?

CHaMP alone does not address all of these questions. In theory the questions surrounding the effectiveness of restoration actions are being addressed by a combination of ISEMP studies, the Intensively Monitored Watershed projects proposed for implementation or currently being implemented in numerous basins, and information from CHaMP on habitat status and trends. The ISRP believes CHaMP's role in addressing the questions above is not yet completely clear. In an important sense, CHaMP cannot be reviewed comprehensively independent of ISEMP and the existing and newly proposed IMW's as they pertain to the central question of habitat restoration effectiveness. The intersection of these three efforts needs further examination and refinement to ensure that, collectively, these projects can provide answers to the tributary habitat questions.

The ISRP recommends that a comprehensive review of this suite of projects (ISEMP, IMWs, CHaMP) be undertaken to determine if indeed they, as a whole, are sufficient to provide status and trends monitoring of habitat and fish and are capable of answering the central question of whether habitat restoration actions are achieving desired objectives. We suggest this, in part, because several new IMW projects were proposed in the recent RME/AP project solicitation. The ISRP had concerns about the design and conduct of some of these new projects, especially concerning comparisons of treated and untreated (reference) watersheds. Furthermore, the ISRP has reviewed ISEMP favorably in the past but never in the context of an integrated RME program. Even after the February 10 workshop the ISRP was uncertain how CHaMP intersected with ISEMP's activities, including those areas designated (or proposed) as IMWs. As well, we are interested in comparing how habitat modeling efforts are informing restoration decisions. For example, EDT was used extensively during the subbasin planning process, but the preferred model in CHaMP is SHIRAZ. How do model outputs from these two tools compare, and how will they be used in restoration planning?

The ISRP would be interested in learning more about the efficacy of different approaches to establishing the relationships between fish performance and habitat condition and would like to review CHaMP, ISEMP, PNAMP and other effectiveness monitoring efforts in one to two years. Future reviews of CHaMP can help reveal approaches

that produce the most generally useful information. For example, at the February 10 workshop three approaches currently being employed in the Columbia Basin were mentioned but not discussed in detail:

- Formal, experimental manipulation of stream habitat with fish responses monitored at the population level (this is primarily used in IMWs).

- Model projections of population benefits of restoration actions based on per project change in habitat quality/quantity, habitat status, and fish response to habitat condition.

- Correlation analysis of habitat quality/quantity and fish abundance across a gradient of actions and potentially confounding covariates.

The GRTS design may not address the habitat restoration effectiveness question because the site selection process is random and does not target specific areas where restoration actions are ongoing or planned. However, it will give an indication of large-scale trends in habitat condition, tracking habitat degradation as well as improvement. As the project progresses, we will be interested in seeing how well CHaMP achieves the dual objectives of tracking overall changes in habitat condition and helping to establish restoration effectiveness.

Water quality

The habitat quality and quantity indicators in the CHaMP protocol have been designed specifically to evaluate the features of stream habitat critical to juvenile salmonid survival from egg to smolt life stages (2011 Working Version 1.0, page 8). Table 2 in the Working Version provides the reason why toxic compounds (low feasibility) and benthic macroinvertebrates (low information content) were not included in the CHaMP protocols. Yet, there are numerous literature references in the ISAB Food Web Report[9] about concerns for an adequate food supply and exposure to toxics (and not just in the natal stream). Lack of information about food availability and toxics exposure can cause great confusion when attempting to interpret fish population responses based on physical habitat data alone.

Two water quality issues, in particular, should receive additional consideration by CHaMP.

1. Agricultural pesticides. Potential exposure information is available, even on a pesticide-by-pesticide basis, for the various locations in the Columbia Basin (from USGS National Water-Quality Assessment Program, National Synthesis Project, see Food Web Report Fig. C.7.3). This information may provide a good indication of the exposure patterns to these toxic chemicals in some of the watersheds included in the CHaMP program.

2. Pharmaceuticals, personal care products, and flame retardants. An important source for these chemicals is wastewater treatment plants. Nearly all of the treatment plants in the Columbia Basin are shown in the ISAB Food Web Report, including average discharge (millions gallons/day) and the river flow at each site. A recent paper[10] shows a strong correlation between a simple dilution index (Wastewater Treatment Plant discharge/ River Flow) and PBDE egg concentrations for fish-eating osprey. A similar type of calculation could provide a rough indication of fish exposure to these chemicals in CHaMP watersheds (including exposure downstream from CHaMP sampling sites, which could be very important to survival). Furthermore, the Washington State Department of Ecology has reported PBDE flame retardant concentrations in fish and water from throughout Washington.[11] General patterns of exposure to toxic

[9] http://www.nwcouncil.org/library/isab/2011-1/

[10] Henny CJ, Grove RA, Kaiser JL, Johnson BL, Furl CV, Letcher RJ. 2011. Wastewater dilution index partially explains observed polybrominated diphenyl ether flame retardant concentrations in osprey eggs from Columbia River Basin, 2008-2009. Ecotoxicology DOI 10.1007/s10646-011-0608-2 (On Line February 2011).

[11] Johnson A., Seiders K., Deligeannis C., Kinney K, Sandvik P, Era-Miller B, Alkire D. 2006. PBDE flame retardants in Washington rivers and lakes: concentrations in fish and water, 2005-06. Washington State Dept. Ecology, Publ. No. 06-03-027, Olympia, 102 pp.

compounds (as listed above) may be very important in further interpreting ISEMP/CHaMP results and could possibly be used in an exposure risk stratification scheme that could help identify sites where potentially toxic chemicals could be included in habitat surveys. To address this issue, macroinvertebrate drift samples could be stored for toxic compound analysis, should the situation warrant it.

Appendix C: CRITFC

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION
729 NE Oregon, Suite 200, Portland, Oregon 97232 Telephone 503 238 0667 Fax 503 235 4228

February 8, 2010

Review Comments on:

Bouwes, N., J. Moberg, B. Bouwes, S. Bennett, C. Beasley, C.E. Jordan, P. Nelle, M. Polino, S. Rentmeester, B. Semmens, C. Volk, M.B. Ward, and J. White. 2011. Scientific protocol for salmonid habitat surveys within the Columbia Habitat Monitoring Program. Prepared by the Integrated Status and Effectiveness Monitoring Program and published by Terraqua, Inc., Wauconda, WA. 118 pages.

Authors: Casey Justice, Seth White, Dale McCullough

Summary

By and large the Columbia Habitat Monitoring Protocol (CHaMP) closely resembles the monitoring procedures proposed by the Columbia River Inter-Tribal Fish Commission (CRITFC) in 2009 and implemented in 2010 (Justice et al. 2010) (see attached). Both protocols draw from the best available methods from a number of different stream habitat monitoring programs in the Pacific Northwest region including Integrated Status and Effectiveness Monitoring Program (ISEMP), PACFISH/INFISH Biological Opinion (PIBO) Effectiveness Monitoring Program, Environmental Protection Agency's Environmental Monitoring and Assessment Program (EPA-EMAP), Aquatic and Riparian Effectiveness Monitoring Program (AREMP), and the Oregon Department of Fish and Wildlife's Aquatic Inventories Project (ODFW-AIP). We agree with CHaMP's focus on process-based habitat assessment and its emphasis on channel-unit scale measurements that are more relevant to fish biology. While we fully understand the importance of coordinating regional monitoring strategies and appreciate the hard work that has been invested in developing a standardized monitoring protocol, we have some concerns with certain aspects of the protocol that we feel might limit its ability to adequately and efficiently characterize fish habitat. We hope that these issues can be addressed during the developmental phase of the CHaMP protocol.

Comments, Questions, and Concerns:

Comments are grouped into three categories including:

Highest Priority – These comments pertain to issues that we feel should be addressed before implementation of CHaMP in 2011 and relate to broad-scale issues such as survey design and classification and potential problems with some survey methods or proposed habitat metrics.

Moderate Priority – These comments pertain to issues that we feel should be addressed before implementation of CHaMP in 2011, but that are generally small-scale in scope and should be easy to fix.

Lower Priority – This is a list of comments that we also feel are important and should be considered in an effort to improve the utility of CHaMP, but are limited in scope and are less of a priority.

Highest Priority Comments:

1. *Spatial extent of monitoring* – The CHaMP protocol states the spatial extent of sampling will occur within the Technical Recovery Team (TRT) population boundaries (p. 3). Since recovery of fish populations can include improvement to both current and historic (potential) habitat, we hope that potential habitat is included in the CHaMP design. We are aware of existing TRT GIS layers which include potential fish extent based on intrinsic watershed features such as gradient, stream width, temperature, and sediment. However, because it is not explicitly stated in the CHaMP protocol, we would like assurance that potential habitat is in fact included.

2. *Use of stream classification* – The authors recommend balancing sampling efforts across Montgomery and Buffington (M&B) (1997) valley types (source, transport, and response) and two classes of land ownership, resulting in six ―multi-density categories‖ into which sampling is given equal effort (p. 44). Although it is not stated, we assume the land use categories are public and private. We suggest that steelhead and Chinook salmon habitat in source valley types will be extremely rare if not absent; Chinook salmon habitat in transport reaches will be uncommon; and most fish habitat will occur in response reaches, which in most basins is disproportionately represented by private land. Therefore, the sampling matrix will be empty or unbalanced in many cases (e.g., the absence of fish-bearing source reaches in private land). Additionally, we would like more information about how the M&B valley types will be determined prior to sampling so that we can ensure it meets our project needs.

3. *Site length and delineation* – CHaMP uses a GRTS-generated starting point for the reach location, and reach length is determined by scaling reach length to

bankfull width measured on-site. However, bankfull width is a characteristic that can be modified by land use such as cattle grazing, so some heavily impacted streams will be sampled in disproportionate lengths. An alternative method is to use a regional bankfull width-watershed area relationship (which can be modeled in GIS using ODFW Aquatic Inventory data, see Clarke et al. 2008) so that reach lengths are scaled to modeled bankfull widths and reach endpoints are known prior to the first site visit. This method has the added benefit of knowing ahead of time whether features would occur within the reach that would cause field crews to relocate the reach—such as tributary junctions, stream classification breaks, and private property.

Another issue that needs clarification is where to establish the boundaries of a reach with respect to natural channel unit boundaries. For example, if the GPS start point for a reach falls in the middle of a pool, it would make sense to shift the downstream boundary of the reach to the downstream end of the pool. Similarly, the upstream boundary should probably be coincident with the upstream boundary of the upper most channel unit.

4. *Location of subsurface sediment sampling* – The CHaMP protocol recommends evaluating subsurface fine sediment in randomly selected sites within riffle habitats. We agree that subsurface fines are a critical habitat metric that needs to be evaluated. However, we feel that fine sediment quantities in riffles is not necessarily a good indicator of spawning gravel quality and will be difficult to directly relate to a biological response (i.e., growth or survival), which is a primary goal of the CHaMP protocol. Instead, we suggest that subsurface samples should be collected in areas of potential spawning habitat as determined from an evaluation of suitable depth, substrate size, and velocity criteria (Schuett-Hames et al. 1999). Suitability criteria could be sufficiently general as to include potential spawning habitat used by various salmonid species including Chinook salmon and steelhead. While subsurface fines in riffles may be sensitive to habitat disturbance and changes in sediment transfer, it is within potential spawning areas that subsurface fines are most relevant to egg survival and fish production. In addition, other metrics generated from the CHaMP protocol can be used to evaluate substrate conditions in riffles such as surface sediment pebble counts and visual estimates of fine sediment.

Another reason that we disagree with the subsurface fine sediment methods proposed by CHaMP is that collection of substrate samples within highly variable riffle habitats will likely be very difficult from a physical and practical standpoint. Riffle habitats often contain large cobble- and occasionally boulder-sized substrate that would be very difficult to extract with a shovel. Even if these larger particles are removed from the sample, it is not necessarily the case that the underlying substrate will be composed of finer, more easily managed particle sizes. In addition, it becomes questionable whether the sample is truly representative of the habitat condition if larger particles are subjectively removed to make the extraction of a gravel sample easier.

5. *Processing of subsurface sediment samples* – The shovel method for collection of subsurface sediment samples may result in a loss of fine sediment particles as water currents may tend to wash the fine sediment out of the sample as it is retrieved, particularly in swift currents. A McNeil sampler or similar device (e.g., a stilling well) may be advisable to retain fine sediments when collecting the sample. In a comparison of McNeil samples with three different shovel methods, Schuett-Hames et al. (1996) found that only the shovel method with stilling well produced statistically equivalent estimates of percent fines. Additionally, sieving the samples while wet may result in fine particles sticking to large particles, potentially resulting in a bias towards larger particles in the estimate of percent fines. Furthermore, weighing the particles while wet may bias the results, as the ratio of water to sediment is likely inversely related to sediment size. Finally, collecting the entire sediment core allows drying and sorting to give the full particle distribution, which has more information content. At a minimum, we recommend retaining the fine sediment fraction as in Sutherland et al. (2010) and drying and weighing the various fine sediment fractions in the lab. Alternatively, a volumetric approach could be used in the field to estimate fine sediment composition, although this approach would be more time intensive.

6. *Embeddedness metric* – We recommend dropping embeddedness from the CHaMP protocol in order to save time, reduce redundancy, and eliminate collection of data that are prone to measurement error and subjectivity. The CHaMP authors state on page 39 ―Measurement of embeddedness was reviewed extensively by Sylte and Fischenich (2002) and it appears that this attribute has no common definition and is too subjective to be used for monitoring.‖ On page 107, the CHaMP authors state ―Embeddedness – critical flaw in measurement technique (increased fines can = decreased % embeddedness); also no agreed upon definition,‖ and ―Too subjective and not able to assess water flow, DO levels, and other critical elements of interstitial space; poorly defined and typically not measured in all habitat types.‖ Based on this assessment, embeddedness fails to meet both the first and second criteria for inclusion in the protocol as defined by CHaMP authors on page 8 including: 1) information content, and 2) data form. We would argue that estimation of embeddedness for all cobble-sized particles encountered during a 200+ particle count would also fail to meet the feasibility criteria defined by CHaMP for inclusion in the protocol.

7. *Fish cover metrics* – The CHaMP protocol uses a modified version of the EMAP protocol to evaluate fish cover in each channel unit. However, CHaMP has dropped some of the cover elements from the original EMAP protocol including brush and small woody debris, boulders, aquatic macrophytes, and filamentous algae. Given the relatively small time investment required to estimated percent cover for each of these elements, we think it is a mistake to exclude them from the protocol. Having a significant amount of experience conducting snorkel surveys, our team contends that all of these cover elements are commonly used by juvenile salmonids and should not be overlooked. In addition, removal of these categories makes it impossible to cross walk between CHaMP and EMAP datasets, which

could be important for utilizing historic data in future analyses of fish habitat. Also, the category of artificial structures needs to be clarified. Does this include LWD and boulders that were placed in the stream as part of a restoration project? If so, are they counted twice? It doesn't seem to make biological sense to include artificially placed LWD and boulders in the same category as tires, old cars, diversions, and other structures? We suggest counting artificially placed LWD in the ―woody debris‖ category, artificial boulders in the ―boulder‖ category, and not including these elements as artificial structures.

8. *Benthic macroinvertebrates* – The current version of CHaMP does not include benthic macroinvertebrate sampling, relying completely on drift sampling. However, even the current CHaMP protocol states that ISEMP desires more empirical data regarding the relationship between benthic and drift invertebrate samples (p. 36), so why does the protocol exclude benthic sampling? The CRITFC Accords habitat project will include benthic sampling in our surveys because benthic macroinvertebrates are good indicators of overall environmental conditions and can be compared with data collected by other organizations (e.g., PNAMP, ODEQ). In the November 2010 version of CHaMP, benthic macroinvertebrate protocols were compatible with ODEQ/PNAMP's regional water quality monitoring protocols (PNAMP, n.d.), which incorporates the River Invertebrate Prediction and Classification System (RIVPACS) (Wright 1994). In the interest of coordinating statewide monitoring efforts, we recommend adopting PNAMP's laboratory protocols as well (e.g., invertebrate sub-sampling and minimum taxonomic resolution). Furthermore, PNAMP protocol suggests completing a rapid, one-page land use survey form as additional information that can be related to RIVPACS; we recommend including the land use form in the CHaMP field protocol.

Moderate Priority Comments

9. *Measurement of surface sediment particles* – The CHaMP protocol recommends measuring surface sediment particles using a ruler. We suggest using a gravelometer (i.e., template) instead. This approach is commonly used, fast, affordable, and has been shown to reduce measurement error compared with measuring particles by hand (Bunte and Abt. 2001). Also, rather than zigzagging to collect particles, why not collect on 2 transects spaced at a certain distance apart. Bunte and Abt recommend spacing between particles > the largest particle.

10. *Drift sampling* – Mesh size for drift sampling is 1 mm, which seems quite large. Juvenile Chinook salmon and juvenile steelhead have been known to select small prey sizes (Rondorf et al. 1990; Johnson 2007). We recommend a more standard mesh size of 500 µm. Also, to capture more variability in the invertebrate composition (e.g., terrestrial invertebrates or invertebrates living in shallower water), nets should be placed in (a) the thalweg and (b) stream edge, vs. two replicate nets in the thalweg as currently outlined in CHaMP. Setting the net at a standardized distance downstream of a riffle crest is also advisable (see line-item

comments). Also, why limit invertebrate analysis of drift to g/m2? Important information can be gleaned from identifying individual taxa such as determining the origin of the drift (terrestrial vs. aquatic), which component of the benthos is contributing most, and estimating caloric intake by taxa group for use in growth models. Drift expressed simply as g/m2 does not explain food availability. Availability also involves particle size selection. We recommend estimating biomass of drift by taxa, terrestrial vs. aquatic, and size class.

11. *Total Station Survey* - The terms monuments, benchmarks, and control points need to be more clearly defined (p. 46). Regarding maintaining visibility to 2 other benchmarks during the survey, is it necessary to see other benchmarks from the starting benchmark (p. 56)? Can't intermediate points be used to link all survey points to a single benchmark? In addition, because the GPS coordinates collected at a benchmark are not highly precise, it may introduce unnecessary error to use more than one benchmark in the creation of a DEM for each reach. If all points in a total station survey are relative to a single benchmark, the amount of error in the resulting DEM will be reduced.

12. *Channel unit classification* - p. 54. Definitions of cascade and rapid seem to be reversed. The notion that cascades have a lower gradient than rapids is not supported by the literature. Additionally, unit classification types such as ―dry channel‖ and ―puddled unit‖ are not included in the protocol, but are likely to be frequently encountered in the field. We recommend that CHaMP includes these unit types.

13. *LWD size* - p. 67. Methods for measuring or estimating the width and length of lwd is not clearly defined. Where on each piece of wood is the width assessed? Is it the mid-point, the butt end, or something else? Are lengths and widths measured or visually estimated? We recommend visually estimating width at the midpoint of each piece and visually estimating length, and measuring a systematic subset (e.g., every tenth) of each piece. Also, there are very few size classes for LWD, so the calculation of LWD volume will be very rough. We recommend expanding the width and length size classes to incorporate all potential size classes encountered in the field using width increments of 15cm and length increments of 3m.

Lower Priority Comments

14. *The solar pathfinder* - This requires using a pen to trace by hand the canopy boundary or post processing of digital photographs. This is time consuming and doesn't permit the inclusion of open spaces in canopy areas unless great deal more time is spent. The Solmetric Suneye 200 allows precise measurement to be made and also stored on the computer for further processing digitally if required. This device should be investigated as a more updated and reliable method for solar loading. Also, more than 5 samples can be taken to more fully represent the riparian canopy due to the rapid analysis capabilities.

15. *Site evaluation* – CHaMP states that site evaluation will be completed using a ―to be developed‖ manual (p. 45). What will site evaluation consist of?

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Appendix D: Yakama Nation

Date: Fri, 18 Feb 2011 08:35:41 -0800
From: David Lindley <dlindley@ykfp.org>
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.13) Gecko/20101207 Lightning/1.0b2 Thunderbird/3.1.7 ThunderBrowse/3.3.4
To: "Michael B. Ward" <wardski@wildblue.net>
CC: Nicolas Romero <nromero@ykfp.org>
Subject: CHaMP comments

Hey Mike,

Here are the comments and questions that Nico and I referred to in our phone conversation with you yesterday.

We appreciated the invitation to attend the CHaMP workshop meeting in Portland, OR on February 10, 2011. After listening to the formal presentations by CHaMP Program developers and the ensuing discussion we have some questions and concerns we would like to bring to your attention.

Questions and Concerns

- To reiterate a concern raised by other collaborators, we have reservations about the feasibility of completing one site per day. These concerns are driven by the remoteness of some parts of the Klickitat subbasin, vegetation, topography, site length, and the implementation of a new sampling protocol with various levels of field crew experience. It appeared at the meeting that the field crew in the "pilot study" was a dedicated field crew with multiple seasons of experience. We will be utilizing a crew that consists of members with varying degrees of experience coupled with extended travel time to remote sites.

- After attending the Portland meeting it was unclear what the current status of the CHaMP Program is or the likelihood of funding subbasins such as the Klickitat. Any clarification of CHaMP status would assist our preseason preparation and the formulation of a hiring timeline.

- In regards to the proposed CHaMP protocol, we question the utility of drift collection. It is unclear what interferences will be made from this data. For a drift sample collected on one summer day, the scope of inference is limited to one season (Summer). Based on Yakama Nation (YN) personnel experience, a YN multi-year Food Web Study, and peer reviewed literature it is documented that fish diet is seasonally influenced. Due to limitations imposed by sampling sites at most once a year, we recommend excluding the macroinvertebrate component from the sampling protocol.

- A valid point was raised at the meeting regarding the density of topographic points. It does not appear that the proposed number of topographic points (500-1000) collected is scaled to longer site lengths based on bankfull widths ≥ 20 m. An average point density

may be more appropriate. To scale it proportionally again brings the feasibility of one site per day into question.

Sample Design Comments

- The discussion of the GRTS sampling design was informative and addressed site selection criteria. In the Klickitat subbasin the White Creek subwatershed is the focal point of several habitat enhancement projects and intensive *O. mykiss* monitoring and evaluation efforts. Therefore, we would like to weight the number of CHaMP sampling sites similarly to the example of Trout Creek in the Wind River subbasin.

- The YN has utilized the Timber Fish and Wildlife monitoring protocol (TFW) since 1996 at 82 sites in the Klickitat Subbasin. Has an analysis been done regarding the ability to crosswalk data collected between TFW and CHaMP protocols (ex. LWD)? How compatible certain metrics are will dictate whether or not we need to incorporate a subsample of legacy TFW sites within the CHaMP site selection. We prefer to crosswalk existing TFW data with CHaMP data without the need to revisit past TFW sites to maximize the geographic distribution of CHaMP sites.

Any clarification of the questions and concerns raised above would be appreciated. We look forward to the opportunity to collaborate in the CHaMP Program. Your time and effort in developing the protocol and program are much appreciated.

Thanks,

Nicolas Romero and David Lindley

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David Lindley
Habitat Specialist
Klickitat Field Office
Yakama Nation Fisheries
PO Box 215
1575 Horseshoe Bend Road
Klickitat, WA. 98628
dlindley@ykfp.org
(509) 369-3565

Appendix E: USFS and BLM

Technical Comments: CHaMPs

These comments were submitted by the Forest Service (FS) and Bureau of Land Management (BLM) leads for the agencies' *PACFISH/INFISH Biological Opinion* (PIBO) and Northwest Forest Plan's *Aquatic Riparian Effectiveness Monitoring Program* (AREMP) monitoring programs.

The most substantive issue with the proposed Columbia Habitat Monitoring Program (CHaMPs) is the lack of discussion on how CHaMPs data will be used in conjunction with similar data collected by the federal land management agencies under their long-term aquatic habitat monitoring programs. For over a decade, the PIBO monitoring program has been the collecting data necessary to establish the status and trend of stream habitats within the range of Columbia River Basin Endangered Species Act (ESA) listed salmon and bull trout populations/watersheds. Extensive quality assurance/quality control (QA/QC) assessments (Roper et al. 2002) have been applied to the PIBO monitoring program and across other programs (Roper et al. 2010) to ensure data are repeatably collected. PIBO program leads have modified their existing monitoring protocols to be more consistent with theses other programs, including the Environmental Protection Agency's Environmental Mapping and Assessment Program (EMAP). To date, over 12 million dollars have been expended within the Columbia River basin implementing the PIBO monitoring program. This program collects data on many, if not most, of the attributes estimated within CHaMPs.

For western Oregon and Washington, both the FS and BLM have expended considerable funds, including contributions from EPA, in support of the AREMP monitoring program for collection of data using the same standardized protocols as PIBO. While there are many similarities between the large scale FS and BLM monitoring programs and CHaMPs, there are significant differences that will likely result in data collected via CHaMPs to not be comparable with PIBO and/or AREMP . Given the known quality of the data collected by PIBO, including other existing monitoring programs within the Pacific Northwest (Roper et al. 2010), it is not clear why there is a need to fund and implement another untested monitoring approach (protocols) until it can be demonstrated that data can be correlated with those collected by other programs, or that it is considerably better. Only by testing the data collection methods proposed by CHaMPs in the same manner as the other major programs have been tested (Roper et al. 2010), can we ensure its quality and usability at a population, Major Population Group, or ESU scale for ESA-listed salmon and steelhead within the Columbia River basin and beyond.

While the Forest Service agrees that protocol methods should change as technology improves, we do not agree that the mere presence of more precise instruments and/or technological improvements will result in more accurate or repeatable evaluations. In order to make such conclusions, we believe it is necessary to submit new technologies to rigorous and intensive testing in field conditions and under time constraints as described within protocols.

While the CHaMPs approach appears to have promise, we see no evidence in the draft document that it is as good, let alone better, than the existing federal land management agencies' long-term monitoring programs. Until such evidence is provided, we remain concerned that adoption of CHaMPs (or any other approach that may be in conflict with existing monitoring programs) until it has been thoroughly tested, shown to be an improvement over current approaches, and can be integrated into existing

efforts that have a proven track record will be problematic. The need for a rigorous, independent science review process, under which all proposed monitoring programs are evaluated, is also critical to obtaining high quality data that will result in a regional understanding of aquatic habitat status and trends within the Columbia River basin.

To our knowledge there has been little effort to co-locate data collection using the new CHaMPs protocol and any other monitoring programs protocols within the region. Absent this, it is impossible to determine how good CHaMPs protocols are, or if there is a trade-off between higher precision in collecting data versus collecting it at fewer sites (since it may take longer to apply CHaMPs protocols). Funding to support the final version of any stream habitat protocol in the absence of these data may lead to redundancy or inability to aggregate unrelated data resulting in lower statistical power to detect any trend in habitat conditions. Given past lessons learned in comparing habitat protocols (Whitacre et al. 2007, Roper et al. 2010) and the time it takes to assess status and trend using *any* habitat protocols, a decision to implement CHaMPs prior to a through field evaluation should be re-evaluated.

The basic premise of the CHaMPs approach is that the use of the *total statio*n protocol, versus a measuring tape, will lead to a more accurate and precise description of channel conditions. The use of the *total station* protocol and associated equipment is considered the gold standard in surveying and has been used extensively in many monitoring programs *but it needs to be applied correctly*. For example, PIBO used the *total station* protocol in 2001 to map 30 streams. In this pilot effort, surveys took multiple days and mapped data were no more reliable than the rapid protocols PIBO now uses. Similarly, in the John Day Basin Protocol Test (Roper et al. 2010), the *total station* protocol was used and then compared with rapid protocols. Applying the *total station* protocol, it took 3 to 7 days to complete surveys at each reach. For many attributes, the rapid protocols were highly correlated to metrics derived from the application of the *total station* protocol. Since for many stream habitat metrics variability is primarily due to differences among streams rather than differences among individuals who collect the data (Roper et al. 2002, Larsen et al. 2004), most monitoring programs choose to use rapid protocols to increase the sample size. Based on this, utilization of the *total station* protocol will only be as good as the rapid protocol method used by PIBO if accurate measurements of stream reaches can be achieved in a one day time period.

As stated previously, the *total station* protocol described in CHaMPs has been widely used to survey stream reaches. However, the CHaMPs approach attempts to complete *total station* surveys more quickly than prescribed. In revising the protocol (how data are collected within a *total station*) to achieve this objective, the protocol can no longer be considered the gold standard. The Forest Service's protocol for implementing a *total station* survey can be found in Harrelson et al. (1994). CHaMPs does cite Harrelson et al. (1994) as the approach they will use to determine bankfull and to lay out a site. However, the difference between CHaMPs and Harrelson et al. (2004) is that CHaMPs fails to require the survey to be closed or discuss what an acceptable level of accuracy is. The CHaMPs protocol instead relies on the ability to relocate the top and bottom of reach markers. This will add error (especially between surveys occurring over years) versus requiring the survey to be closed out.

It also appears that the authors of the CHaMPs approach are unconcerned with these types of errors as on page 62 it states "Backsight to a benchmark or control point if visible." However, failure to consistently backsite, as well as having two markers rather than closing out the survey, will result in Digital Elevational Models (DEMs) constructed by different crews that will not overlay with one another. While there are approaches that force DEMs to overlay, the resulting differences can be the result of the algorithm used to construct the overlay rather than true differences within the stream reach. To

maximize precision and accuracy (the reason *total station* approach is used), we recommend that the survey be closed with a predetermined allowable error (see Harrelson et al. 2004, page 24). This will allow for an estimate of the error and closer agreement in the DEM's derived from multiple surveys.

The failure to account for error associated with moving a high precision instrument needed to implement the *total station* protocol can be very problematic. Whitacre et al. (2007) found lower precision in estimating gradient between individuals using a *total station* within the AREMP monitoring program than EMAP crews using clinometers. This was due to EMAP using the average of multiple gradient measurements while AREMP used a single unclosed survey to estimate gradient. Based on this comparison test, AREMP now closes out their surveys. As a result of this change, AREMP had the most precise estimate of gradient in the 2010 side-by-side protocol test (Roper et al. 2010)

In using a revised *total station* protocol, CHaMPs proposed to conduct analyses using Digital Elevation Models (DEM) of Difference (DOD). Again this suggests they can perfectly match multiple surveys at the same exact sites. If this can be done, then the use of DOD is possible. The papers cited on this subject (Brasington et al. 2003; Wheaton et al. 2010) indicate that differences can be detected using this approach, however, all examples in these papers are based on having at least one point for every one to three square meters within the surveyed reach. With the 750-1000 points per site as suggested in the CHaMPs approach, there will be sufficient points to ensure at least point every three meter in streams up to the 12 m bankfull width category. For streams with greater bankfull width, there will be insufficient data to accurately compare DOD (less than one point every three square meters). For example, if the protocol measures a stream that has a 20 meter bankfull then data will only occur one in about 10 square meters. As a result, in larger streams differences observed between surveys will just as likely be due to where different individuals take measurements as true variation in stream habitat. After-the-fact assignment of the reason why differences occurred will then be problematic. At present, there is no science to support that the *total station* approach can be used to detect changes in high gradient channels.

CHaMPs suggests that one improvement in their approach (versus others) is that it allows the taking of "smart" points, meaning sampling crews will have the discretion to take measurements where stream topography changes. This has not been our experience. We have found that when crews are given the option to take measurements or not, they usually choose to make fewer measurements than necessary. Also, most of the "smart" points where crews using CHaMP are supposed to sample (i.e. deepest area in a pool, bankfull width) are located where existing monitoring programs (i.e., PIBO) are already taking measurements. It appears then that there is no value (cost-effectiveness, efficiencies) in implementing CHaMPs for metrics where data is already being collected.

One possible benefit of the *total station* protocol is to use channel form DEM's to determine bankfull (which can be a tough stream attribute for observers to consistently identify). This quality is hindered by the rule within CHaMPs that tells crews to measure, "all features up to and at least 1 m horizontally beyond the first flat floodplain found at or the bankfull elevation" (bottom page 59). Since the highest upslope point established by each observer will be based on what he/she determines to be bankfull, there is no guarantee true bankfull will be correctly identified. In fact there is evidence that observers in most programs substantially underestimate true bankfull (Roper et al. 2010). Therefore, the use of a revised *total station* protocol, which relies on the observer to measure just past what they identify as bankfull, may end up having little value as taking measurements far out into the floodplain was what was needed.

We found no explanation on how data collected using a revised *total station* protocol will be summarized by individual metric, how this information will be used in any broader scale analysis, and how it will be related to data in the same subbasins/watersheds where other monitoring programs are collecting data (e.g. PIBO, AREMP). For example, how will DOD collected with different precisions (points per m^2) and across stream types be combined in a way that explains status and trend of habitat conditions within a Major Population Group? What will the independent or response variables be? If they are to be summarized with a single value (i.e. sediment budget, bankfull width, etc), we question how this will be different than what is currently being done by AREMP and PIBO?

Another substantive issue with the CHaMPs approach is the movement away from collecting benthic macroinvertebrates and instead focusing on macroinvertebrate drift. While drift may provide some advantages when it comes to estimating fish production, there are several disadvantages to the proposed approach. The biggest disadvantage is there is general agreement among all monitoring programs within the region to collect macroinvertebrate data using benthic samples. This allows for sharing of this information between monitoring programs. We also believe that the use of benthic macroinvertebrate data is the only way CHaMPs can tie their habitat metrics to conditions in reference (low to no management)/unmanaged streams (Stoddard et al 2006). The current CHaMP design does not include a reference (low to no management)/managed design component so it will not able to provide data to determine expected taxa. This information, however, can be derived from benthic macroinvertebrate data collected through PIBO since this program specifically collects samples in reference watersheds.

The CHaMPs approach compares their use of macroinvertebrate drift to findings in a paper by Hayes et al. (2007). This is not an appropriate comparison due to the vastly different number of drift samples in Hayes study versus those proposed in CHaMPs. In Hayes et al. (2007) topography measurements were taken with a total station at 755 points within a single pool; this is spacing of about one point every two square meters. Invertebrate drift was then sampled at 1 to 3 positions in the water column, depending on depth, at 17 locations. Samples were collected at 1030 to 1545h and at dusk from 1940 to 2220 h. Water velocities were measured at the mouths of the nets at the beginning and end of sampling with a Marsh McBirney current meter in order to estimate the volume of water sampled." In contrast, CHaMPs uses two nets placed at mid-day for three hours. This is significantly lower resolution than in Hayes et al. (2007) and the use of two nets will unlikely will be sufficient to overcome variability in macroinvertebrate drift in either time or space (Weber 2009).

Instead of eliminating benthic macroinvertebrate samples, we suggest adding one metric to these samples, specifically biomass. Benthic biomass has been shown to be correlated to drift biomass (Koetsier et al. 1996, Weber 2009). By incorporating this change, CHaMPs can still get information on biomass but would also be able to utilize, compare, and aggregate other macroinvertebrate information currently collected by other regional monitoring programs. To date, PIBO has collected and processed well over $600,000 dollars worth of benthic macroinvertebrate samples that can help inform evaluations of watershed condition as these types of aquatic communities often integrate disturbances the occur upstream from the point they are collected.

Implementing the survey design as stated in CHaMPs will make it almost be impossible to detect a trend in any stream habitat in a reasonable time frame. With about 25 samples per year (a total of 50-75 with a three year sample frame), it is unlikely that a 10 to 20% response in stream metrics over the timeframe of a decade would be detected (Roper et al. 2002). CHaMPs may increase the sample size needed to detect a trend by having a more complicated sampling design that utilizes six strata –

especially if some of the strata show a response to management. Although CHaMPs suggests that these strata will simply be used to ensure the entire population is sampled, the general rule in statistics is to "analyze the way you randomize". It is also reasonable to expect mean differences in habitat characteristics based on land ownership or stream power. If there is, and strata are used in the analysis, there could even be less power to detect changes in habitat. We recommend less emphasis on sampling small, higher gradient streams since it is unlikely these streams will tell you much about either the status or trend of stream habitat (Montgomery and MacDonald 2002).

There are several areas not addressed within the CHaMPs approach that are logistical or that could add value to an understanding of ESA-listed fish interactions with watershed conditions:

- The CHaMPs approach proposes to complete one sample per day. In our experience, the time to complete a survey must account for the time it takes to drive and hike to the surveyed site. This is why both PIBO and AREMP only average slightly more than 6 sites in each 8 day period working 10 hours per day. In the first year it will be important that the number of sites surveyed using CHaMPs be tracked and published for comparisons to other programs since we don't think this stated objective is achievable. Additional reasons include; 1) the large number of points to be recorded using a revised *total station* protocol, 2) the amount of time it takes to implement many of the substrate protocols, 3) the large amount and weight of equipment that will need to be transported to a site by a crew, 4) the long drives and hikes required to get randomly identified sites, and 5) the requirement that the data be downloaded and checked in the field. Since CHaMPs suggests this is a rapid protocol it will need to demonstrate that it really is 'rapid' before it is fully implemented;
- There are many attributes that PIBO and AREMP evaluate which CHaMP chooses not to measure, including those that lead to an evaluation of the presence of invasive aquatic species that could affect fish survival;
- The CHaMPs approach does not directly survey riparian vegetation even though it has been shown that land management, including restoration efforts to improve riparian areas, provide survival benefits to fish. PIBO currently spends one-third of its field effort on collecting these data and only requires a two person crew (rather than a three person crew as in CHaMPs) to collect the majority of the data proposed in CHaMPs;
- Some of the protocols suggested by CHaMPs, such as, embeddedness, fish cover, and sediment size are not well described nor have they been shown to be repeatable or responsive to management including restoration. One example is the estimation of substrate size using a pebble count: will pebbles be collected from bankfull to bankfull or only in the active channel? It is important that protocols be clearly described since data will be collected by different crews that may have limited or different training.
- Sediment - The reason Wolman (1954) limited the number of clasts to 100 was not because he found this number was sufficient to precisely describe the substrate size but because samples larger than this led to significant difference between observers. Therefore, the choice to measure 210 pebbles in CHaMPs means that you will have to account for biases among individual crew members (and crews), even as you get more precise estimates of streambed grain size.
- We are concerned that several attributes, such as fish cover, channel unit substrate, and large wood will be visually estimated rather than measured. The use of ocular estimates has been shown to have poor repeatability among different observers.

In summary, while our comments have focused on issues within this protocol, we do not want to suggest that either the CHaMPs metrics or the design is fatally flawed. Many of the protocols within CHaMP are well established and used by other programs. The overall sample design proposed in CHaMPs is also used by other regional monitoring programs to determine where to sample within a basin. This design has undergone rigorous peer review (Urquhart et al. 1998) and is used by both AREMP and PIBO. Other approaches within CHaMPs, such as taking measurements with a solar pathfinder, which is a simple method, could add value to other existing monitoring programs if incorporated. However, our primary concern remains that CHaMPs is proposing a new stream habitat monitoring approach without first considering how, or even if, it can use existing data from other regional monitoring programs. The Forest Service, Bureau of Land Management, Environmental Protection Agency, states, and the tribes have invested millions of dollars in surveying stream habitat within the range of ESA-listed anadromous salmonids species in the Columbia River Basin, yet there continues to be no discussion in the CHaMPs approach on how data from other monitoring programs can be built on or integrated.

The CHaMPs objective is, "to assess the quantity and quality of stream habitat for salmonids in wadeable, perennial streams below natural impassible barriers within Technical Recovery Team (TRT) population boundaries. The intention of the program is to generate standardized status and trend data for salmonid habitat in watersheds of the Columbia River Basin. (CHaMP protocol page 3)". The rationale used to support starting a new monitoring program is that the other regional monitoring programs are not fish centric. Other regional monitoring programs, including PIBO and AREMP, already collect the habitat data necessary to inform models used to predict changes in listed fish populations (see Scheuerell et al. 2006 for such a model developed by NOAA Fisheries authors). If this is all the data that is needed and it is already collected by other monitoring groups, we question why it is not being used. At the very least it would be helpful to explain to other regional entities that currently have monitoring programs what else needs to be collected and why.

Potential Use of PIBO Information

Based on presentations associated with CHaMPs, there are 28 subbasins/watersheds where CHaMPs survey design and protocols would be applied. Currently PIBO is collecting data in a significantly larger number of subbasins/watersheds), including 21 of these 28 watershed identified by CHaMPs (Table 1). In these 21 subbasins/watersheds, PIBO has measurements on a total of 362 reaches; of which 236 are part of a balanced random sampling design (similar to the proposed CHaMPs design) that are revisited every five years. Eleven of these subbasins/watersheds have 10 or more sampled reaches. As PIBO has been collecting data since 2001, these data provide a better basis for estimating trend than does a new, untested monitoring program. To overlay a new sampling program in these same subbasins/watersheds could potentially result in the redundant collection of data and conflicting results.

When trying to evaluate how best to utilize data collected from sampled reaches within the range of ESA-listed salmon and steelhead, it becomes imperative to conduct outreach to ensure all relevant data collected by other monitoring programs are used to inform key decisions. These key decisions include what data still needs to be collected to gain an understanding on the status and trend of stream habitats in watersheds inhabited by ESA-listed salmonids. Having all the data and collecting information where there are gaps will be important for the 2013 FCRPS BiOP accomplishment report.

Table 1. Number of sites sampled by PIBO within subbasins/watersheds proposed for sampling using CHaMPs protocols. The "Random" column heading indicates the sampling site that was selected at random. "Other Sites" include all other PIBO sampled reaches within that subbasin/watershed that were contracted by National Forests to address local issues and/or to evaluate the effects of grazing.

CHaMPs Subbasin/Watershed	Random	Other Sites	Total
Okanogan River	7	4	11
Methow River	8	6	14
John Day River, lower mainstem tributaries	5	18	23
South Fork John Day River	6	5	11
John Day River, upper mainstem	16	3	19
Middle Fork John Day River	10	4	14
North Fork John Day River	28	25	53
Umatilla River	9	1	10
Grande Ronde River, upper mainstem	15	11	26
Catherine Creek	1	1	2
Tucannon River	4	1	5
Asotin Creek	3	2	5
Imnaha River	12	1	13
Lolo Creek	6	1	7
South Fork Salmon River	19	8	27
Big Creek	10	0	10
Yankee Fork	5	3	8
Pahsimeroi River	12	9	21
Lemhi River	19	14	33
Lochsa River	22	1	23
South Fork Clearwater River	19	8	27

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Appendix F: ODFW

ODFW Comments on BPA's
Scientific Protocol for Salmonid Habitat Surveys within the Columbia Habitat Monitoring Program – January 25, 2011 Draft[12]

Since 1990, the Oregon Department of Fish and Wildlife's Aquatic Inventories Project has implemented a habitat survey protocol designed specifically to provide the State of Oregon with information on the status and trend of key features of stream habitat that are important to salmonids[13]. From 1990 to 1998, the program focused on conducting "basin-wide" habitat surveys which are generally intended to provide natural resource managers with information on stream habitat in selected stream reaches or small watersheds. In 1998, as part of the Oregon Plan for Salmon and Watersheds (aka "Oregon Plan"), the project also began conducting random, spatially balanced (i.e. GRTS-based) habitat surveys along the Oregon Coast. In 2007, ODFW expanded the Oregon Plan surveys to include the Oregon portion of the Lower Columbia salmon and steelhead recovery domain. The combined effort of the ongoing basin-wide and Oregon Plan habitat surveys has to date resulted in ODFW gathering fish related stream habitat conditions for over 10,000 km of streams in the State of Oregon.

Because of our extensive experience in conducting fish-based habitat surveys, ODFW has eagerly awaited the opportunity to provide review comments on BPA's Scientific Protocol for Salmonid Habitat Surveys within the Columbia Habitat Monitoring Program. We have organized our review comments into the following categories:

- General Comments
- Effort/Site and Sites/Effort
- Coordination with Existing Programs
- Linkage to fish monitoring
- Additional Specific Comments

<u>General Comments</u>
Overall, we are pleased that the CHaMP program's focus is on using a channel unit based approach to gather site metrics and regional indicators on stream habitat characteristics that significantly affect the capacity and productivity of Columbia Basin streams for salmon and steelhead. We believe that, for many key indicators, the spatial, temporal, and response designs are compatible between our habitat monitoring program and CHaMP. The result will be that the two monitoring programs should be able to incorporate much of the data gathered by either program into their respective inference designs. We also believe that additional and relatively minor coordination between the two programs will lead to an enhanced data sharing capability. At the same time we also agree with ISEMP[14] that more work is needed on:

[12] Bonneville Power Administration's Integrated Status and Effectiveness Monitoring Program
[13] http://oregonstate.edu/dept/ODFW/freshwater/inventory/index.htm
[14] As stated in the CHaMP document

1) "Demonstrating that currently recorded attributes are useful; if not then they should be abandoned in favor of collecting more relevant data."
2) "Developing cross-walking techniques to allow comparisons of the data that has been collected to what might be collected in the future (as to get a return on the large investment already made in these techniques)".
3) "Think about how the attributes could be collected such that they can more meaningfully feed into GIS geodatabases, foraging models, and other quantitative analytical approaches."

Despite the need for more work on these topics, we believe that the time has come to begin implementing the proposed CHaMP protocol, while also understanding that future protocol refinements are needed and inevitable. We have waited too long to begin gathering more comprehensive, fish-based stream habitat information for the Columbia Basin. The CHaMP protocol is a good place to begin.

Effort/Site and Sites/Effort

ODFW has a significant concern over the decision that CHaMP has appeared to make which sacrifices more detailed information on site to site variability in favor of better precision of measurements and metrics at individual sites. We would like to see more analysis of this issue and how it affects the precision of regional indicators. Are we better off collecting less precise data at more sites or more precise data at fewer sites? Do we really need the site precision provided by the total station approach? Can a spatial design be developed that incorporates a combination of less precise measurements at many sites "calibrated" by more precise measurements at a subset of sites? Can the level of precision needed to meet an objective be determined? More precision is not necessarily better if it sacrifices the opportunity to collect other important metrics, or visit more sites

Based on our experience in conducting GRTS-based habitat surveys, we are concerned that estimates of the time it will take field crews to conduct a site survey is underestimated. Very experienced crews (such as those designing the protocols) should be expected to be more efficient than the average survey crew, typically made up of college students on summer break. The difficulty of hauling a significant amount of bulky and heavy survey gear into remote (or semi-remote) sites should not be underestimated. The difference between the amount of time and effort needed to survey relative low gradient and simple stream reaches (such as in Bridge Creek) and that required in high gradient, first order stream reaches (which will compose a high proportion of survey sites) needs to be evaluated. In addition, a GRTS based approach to site selection results in a statistically robust set of sites, but maximizes the drive and hiking time to reach each site.

The issue of effort/site and sites/effort is not trivial. Not only does it impact the precision of the resulting information, but it can result indicator biases if the effort needed for unnecessary high site precision results in reduced inferences that can be made spatially, seasonally, or for some indicators. For example:

- ODFW believes that ESA recovery plans and assessments require full spatial coverage of habitat conditions in an ESU, at least at the MPG scale. In addition, monitoring is needed in

non-wadeable stream reaches. Does gathering more precise data at fewer sites mean that resources are not available to conduct this additional spatial scale of monitoring?

- The CHaMP survey protocol is currently restricted to summer surveys (with the exception of water temperature monitoring). There is considerable evidence in published literature that fish habitat preferences change considerably from summer to winter and that often physical habitat conditions in the winter can significantly influence their productive capacity. Can less precise site survey design result in the ability to conduct surveys in the summer and winter?
- CHaMP has made a decision not to sample benthic macroinvertebrates under the assumption that it has no direct applicability to salmonid productivity. Since we are not expert in the analysis of benthic macroinvertebrate samples, we will leave it to more qualified people to discuss this aspect and request that CHaMP discuss this issue with Shannon Hubler at ODEQ. Regardless of the "direct" ability to incorporate benthic macroinvertebrate data into salmonid productivity models, we think that benthic macroinvertebrate sampling is very important because it should be a crucial consideration in developing a classification scheme which is needed to place the response seen in other indictors into context and allow for the extrapolation of monitoring results to unmonitored (at least with regards to CHaMP) areas. Benthic macroinvertebrates are indicators of overall water quality conditions over the course of a year and are most likely a comprehensive biological indicator of environmental setting in which the fish reside. We would like to see CHaMP investigate the use of benthic macroinvertebrate sampling more, not only in the context of how it is directly related to fish productivity models, but also in relation to habitat classification. Since it appears that another major issue of not sampling benthic macroinvertebrates is cost, we would like to again know what is the trade-off between less precise measurements of some metrics at a site so that other metrics (such as benthic macroinvertebrates) can be monitored?
- As proposed, the 3-person CHaMP survey crew is collecting a very detailed and broad base of information at each site to answer a diverse set of objectives. Consideration to exactly what questions are most important and how to collect that information may lead to an alternative survey design and crew structure.

Coordination with Existing Programs

As previously mentioned, ODFW has an extensive, existing habitat monitoring program that has surveyed over 10,000 km of stream habitat in the State of Oregon (including a significant number of surveys conducted in the Columbia Basin). In addition, extensive habitat monitoring programs are being conducted by the Washington Department of Ecology, EPA, ODEQ, and USFS. It does not make sense to us to begin another habitat monitoring program in the region without serious effort to work with these programs to develop as coordinated, integrated, and efficient protocols as possible. We praise CHaMP for the work that it has done to compare program protocols and in many cases adopt protocols that are used by one or more regional monitoring program. We believe, however, that much more work is needed on indentifying common measurements, metrics, and indicators, and developing data crosswalks that will enable better data sharing among programs. As a result, we strongly encourage CHaMP to actively work with the Pacific Northwest Aquatic Monitoring Partnership's Integrated Status and Trend Monitoring Project to identify commonalities and potential commonalities of spatial, temporal, response, and inference designs employed by CHaMP and other regional habitat monitoring entities.

In addition to coordination with the monitoring conducted by other regional habitat monitoring programs, CHaMP should consider the coordination needed to link with fish monitoring. For example, ODFW's Oregon Plan approach is to conduct habitat monitoring and juvenile fish monitoring at a number of shared sites. This overlap in sample led to some modification of the protocols of both programs to enable better integration of data.

Linkage to Fish Monitoring

CHaMP states that "stream habitat data generated by CHaMP will be used in conjunction with salmonid growth, survival, abundance and productivity to estimate fish-habitat relationships across the Columbia River Basin." Good idea but exactly how will this be done? While many of the indicators that CHaMP proposes to monitoring have conceptually been shown to be "directly" related to salmonid productivity, their specific relationships to Columbia Basin salmon and steelhead populations have not. Unless there is a more specific plan to link fish monitoring information to habitat monitoring information, we doubt that usable fish habitat productivity models will be developed. Further, much more thought should be put into how the impact of variable fish seeding levels (due to the influence of conditions outside of wadeable stream habitat – such as ocean conditions) will influence observed fish/habitat relationships and the variability of responses. Our experience with coho salmon on the Oregon coast suggests that this is a critical consideration in building habitat capacity models and led us to develop a specific study design to gather data, rather than rely on the whims of a random spatial design.

Specific Comments

- The mesh of remote sense (LIDAR, photogrammetry, etc) and GIS data with the field program are computer and technician intensive, and some may not be realistic. Additional consideration needs to be given to the logistical and economic constraints involved, and rethink the objectives the program is trying to accomplish with the information. Remember, many of these sites will be small, steep and brushy and remote sense data will be unavailable or not useful.
- CHaMP needs to conduct an analysis of the adequacy of sampling 20 active channel units. Our research suggests that for most wadeable streams, between 500m – 1,000m are more appropriate for channel unit based surveys[15].
- As previously mentioned, ODFW began habitat surveys in 1990, not in 1998 as indicated in the CHaMP document
- The statement on page 28 that ODFW "relies on visual estimates of individual channel unit characteristics at a site" is not correct in terms of many channel unit attributes. Attributes that we measure include unit length, width, maximum depth, and large wood length and diameter.
- An intermediate step between "Metrics" and "Indicator Generation Process" should be inserted. For example, it is unclear how you get from "site measurement of riparian structure" to "estimated annually for post hoc stratified domains of historical riparian vegetation types in the survey frame with sampling design based algorithm for each riparian

[15] see Thom, B. A., K. K. Jones, and R. L. Flitcroft. 1999. Stream Habitat Conditions in Western Oregon, 1998. Monitoring Program Report 1999-1 to the Oregon Plan for Salmon and Watersheds, Governor's Natural Resources Office, Salem, Oregon. http://oregonstate.edu/dept/ODFW/freshwater/inventory/pdffiles/orplanhab98.pdf

structure". Simplification is not only beneficial, but required when designing a field protocol and that specifically meets the program objectives.

- More definition of how different channel dimensions will be used to classify channels according to M & B system. The classification system is irrelevant. What does the program want to know about the channel morphology – gradient, sinuosity, valley form, bankfull/active channel width, etc.

Appendix G: USFS/BLM (spring 2010)

USDA, Forest Service & USDOI, Bureau of Land Management

Comments on the *DRAFT* Stream Habitat Monitoring Protocol proposed by Bouwes et al. July 9, 2010

Context

Over the past six years, there has been substantial momentum within the Columbia River basin to develop a consistent monitoring program to answer questions related to the status and trend of anadromous fish habitat in the Pacific Northwest. These efforts have been coordinated through PNAMP, CBFWA, the Federal Caucus RME team, and the Northwest Power and Conservation Council (Council).
With the issuance of NOAA Fisheries 2008 Biological Opinion on the federal hydropower system, there has been a renewed focus within the basin to increase and standardize fish habitat status and trend monitoring (RPAs, Accords). As described in the Executive Summary (draft Bouwes et al) "BPA is attempting to use standardized protocols for Columbia River Basin monitoring programs implemented under the BiOp requirements." Concurrently, the State of Washington was also contemplating a large scale habitat status and trend monitoring program that would be initiated in Puget Sound and then expand to include more of the state.

In 2009, there was recognition that a real potential existed for multiple habitat status and trend monitoring programs to be implemented in the same basin and perhaps in the same watersheds. To begin to address this issue, CBFWA in coordination with PNAMP, held two meetings with federal, state, and tribal partners to initiate coordination of existing and new programs to ensure that they would be complimentary, be able to utilize/crosswalk other's information, and move towards the ability to aggregate all data to address management questions at various scales (MPGs, ESUs, etc.)

At these meetings, Forest Service leads for the NW Forest Plan (AREMP) and the PACFISH, INFISH Biological Opinion (PIBO) monitoring programs made presentations on their long-standing efforts, including providing considerable detail on lessons learned through over a decade of implementation (protocol adjustments, data analysis, QA/QC, etc.) Meeting participants were encouraged to examine what the two programs had to offer and discuss the addition of metrics that could potentially link to fish status and trend information. Building off these well established monitoring programs would ensure, at minimum, consistent data collection, analysis, and reporting for use of this information at various landscape scales and by all partners within the basin.

General Comments

Bouwes et al seems to recommend an entirely new program within the basin that would require others to change what they are doing with no assessment of how the current programs, including AREMP and PIBO, do or do not meet the needs of the FCRPS Biological Opinion and recovery goals for ESA-listed fish. Also missing is an assessment of potential cross-walks to existing programs and the consequences to existing programs of changing their protocols. A discussion on the accuracy and precision of the proposed protocol and associated costs also appears to be warranted, including an assessment that documents lessons learned from the five+ years ISEMP pilot program within the Wenatchee Subbasin. Although the draft appears to document a relatively thorough effort to improve habitat sampling methods, we have four major concerns and would appreciate your consideration of them, given the potential

ramifications of this proposal to the Forest Service and Bureau of Land Management's (BLM) long-standing monitoring programs.

First, it is uncertain what, or if any, criteria were used in the selection of the attributes to be measured. Given that this has been a topic of much discussion over the five years within the basin, including workshops where the Integrated Status and Effectiveness Monitoring Program (ISEMP) field research has been presented, it seems appropriate that the methods selected be based on field data, or at a minimum, on a systematic review of existing results from current and past field efforts.

Second, there also appears to be no criteria used to select the proposed specific methodologies (i.e., protocol) for measuring these attributes. For example, was an attribute selected due to the ease of measurement, low sampling error, low costs, relationship to fish, etc.?

Third, further explanation of how data will be analyzed needs to be incorporated in this document as this is critical information that is needed for any monitoring program (refer to "specific comments' for further explanation).

Finally an assessment and clarification is needed on the potential influence on the overall assessment of watershed health or trends from the use of these methods/protocols versus the ones currently in use by other established, long-term monitoring programs.

Until these questions are substantively addressed, we believe it is premature for any federal agency to endorse or require that these methods be used within the basin. Other federal and state agencies have invested substantial resources into their current monitoring programs; selecting any one method for measuring habitat without data-driven decisions (indicating clear linkages and superiority of one protocol vs. another) does not seem to be an appropriate method for gaining support across state, tribal, and federal agencies within the basin.

Specific Comments

1. Consistency with existing data and ability to cross-walk with current programs

   It is obvious the majority of the methods described are taken from existing approaches to survey stream habitat (e.g., Oregon Department of Fish and Wildlife, Environmental Monitoring and Assessment Program (EMAP), and PacFish InFish Biological Opinion monitoring program (PIBO)). All of these programs are well established and have extensive quality control measures. The authors of this draft document appear to have identified a set of protocols without first insuring they will allow for data cross-walking with existing datasets from other monitoring programs.

2. Information-based assessments of habitat metrics that should be included

   Although the authors include a review of 'fish habitat requirements' in the document preceding the proposed habitat protocol, it is only a coarse description of the biotic and abiotic requirements of fish, and does not provide the scientific basis for selection of attributes, protocols, etc. Given the numerous studies that have been conducted on habitat needs for salmon, steelhead, and bull trout in the Pacific Northwest, it is unclear how the authors selected attributes to be included in this protocol. While a rationale is given, we question why those attributes were not selected based on existing data (i.e., formal meta-analyses), given the large amount of data that currently

exists. For example, what specific measure of substrate has been found to be the most important to juvenile Chinook salmon (or other species/life stages) in past studies? How does this relate to other species of interest such as steelhead or bull trout?

3. Selection of Methods for Collecting Data

   An additional concern relates to the selection of the most effective means for collecting data? For example, the authors cite a paper by Sutherland et al. (2010) as verification of a shovel method; Sutherland et al. illustrate the use of a shovel method as the most effective means for quantifying the effects of land-use on instream sediment. But with this, there comes a question of how related is this method to the fishes and life stages of interest? Furthermore, Sutherland et al. (2010) found the less labor intensive method of visual fines achieved high correlations with the shovel methods (r = 0.89), but which method is more repeatable and cost effective? For large-scale monitoring projects, additional spatial coverage through more sites is often important and can help overcome issues of precision.

   a. The categorization of multiple sample units (>20) has been proposed (taken from ODFW and similar to Hawkins et al. 1993). Clearly the use of numerous units is an attempt to improve the description of units beyond just pools, riffles, etc. Collecting this additional information comes with sampling costs. Without formal analyses to evaluate how much improvement (i.e., precision) in assessments of habitat status and trends, it is a weak argument to suggest more costly approaches will result in better data. In fact, recent efforts suggest that quantifying multiple channel types does not necessarily improve our understanding of factors associated with fish abundance (e.g., Dambacher et al. 2009; NAJFM). Are there similar types of analyses available for species of interest that suggest more categories of habitat types will improve our understanding of salmon and steelhead?

   b. There have been a substantial number of efforts to quantify observer error for the current monitoring programs, yet it is unclear what levels of observer error exist for the methods currently selected. For example, the authors considered the use of >20 habitat unit types, but how repeatable are these methods (see Roper and Scarnecchia 1995; NAJFM)? Specifically, it seems inappropriate at this time to suggest any particular method without knowledge of the extent of sampling error that may result from errors across individuals, the timing of sampling (i.e., date within a season), and intensity of the sampling (e.g., # of transects) (see Roper et al. 2010; NAJFM).

4. Data use and analyses

   a. The authors have proposed the collection of data for a variety of data types, yet there is no discussion of the analytical approaches that will be used to characterize the quality of habitat at a reach level. For example, with >20 channel unit types how does one summarize the status of the overall reach or link this status to fish habitat use? For many simply-collected attributes (e.g., % fines), summarization is easy but for complex categories require some knowledge of how data will be analyzed in a way that is relevant to fishes is a pertinent question.

b. A recommendation would be for the authors to explicitly describe what type of summaries will be performed for each attribute. For example, how does one summarize 20 channel units collected across main channel, side channels, etc. at the reach level?

c. There is no discussion on how data collected in the ways recommended will be analyzed in conjunction with fish abundance, stream and watershed restoration activities, and the status and trend of watershed conditions. Knowing how monitored attributes and protocols will assist in improving our understanding of key linkages at multiple landscape scales is fundamental to the region moving forward with a program where information from multiple programs can be aggregated across land ownerships.

Conclusion

Federal land managers have broad-scale monitoring programs (PIBO, AREMP) that, collectively, have over 25 years experience collecting and analyzing data on stream attributes. We recommend decisions on whether or not to implement new protocols be data driven, with a strong scientific basis for their selection. While we agree that the methods proposed by Bouwes et al. do relate to fish, stream, and watershed conditions, the many scientific publications from existing programs within the Pacific Northwest suggest existing monitoring programs are already measuring stream attributes in a way that enables these types of assessments to be made.

Given the extensive amount of habitat and fish data collected by ISEMP and IMW projects as well as the states, federal, and tribal agencies, we question why were formal analyses of these approaches not used to guide the selection of attributes. Tinkering with protocols is not new as the following statement suggests; "… whereas each year brings a flurry of allegedly "new" methods which are either pointless modifications of a old idea or are innocent rediscoveries" (Daubenmire 1959).

Federal and state agencies have invested substantial resources into their current monitoring programs. Selecting one approach for measuring habitat without data that indicate clear linkages and superiority of one protocol vs. another will faced difficulty with gaining the support of other agencies as this selection process does not appear to rely on the best available scientific information. In addition, the inability to crosswalk and utilize data from other monitoring programs to provide meaningful and scientifically credible analyses at a population, metapopulation or basin scale should be of paramount importance in moving forward with aquatic habitat status and trend monitoring within the basin.

In conclusion, proposals involving new methods or approaches for evaluating stream characteristics cannot simply be good, they must be demonstrably better than existing programs. It is likely some of the suggested approaches are better but until that is demonstrated the Forest Service and BLM cannot support aligning our programs with this proposal. In the past, it has been the lack of thoroughness in assessing new methods before they were implemented that has resulted in the region having difficulty in sharing data among monitoring programs. The addition of a new set of protocols, as in Bouwes et al., without a full vetting by the region through established forums, including the ISAB, does not appear to be a solution to this problem.

Citations

Dambacher, J.M. Dambacher, K.K. Jones, D.P. Larsen. 2009. Landscape-level sampling for status review of Great Basin redband trout. North American Journal of Fisheries Management 29:1091-1105.

Daubebmire, R. 1959. A canopy coverage method of vegetational analysis. Northwest Science 33: 43-64.

Roper, B.B., and D.L. Scarnecchia. 1995. Observer variability in classifying habitat types in stream surveys. North American Journal of Fisheries Management 15:49-53.

Roper, B.B. and 14 co-authors. 2010. A comparison of the performance and compatibility of protocols used by seven monitoring groups to measure stream habitat in the Pacific Northwest. North American Journal of Fisheries Management 30:565-587.

Appendix H: WDOE

Ecology Comments on Jordan et al., DRAFT. Tributary Habitat Monitoring at the Watershed or Population Scale

July 28, 2010

Overall we are pleased that the authors are attempting to standardize protocols for the Columbia River Basin monitoring programs and that the document includes references to quantitative protocols for measuring some geomorphic processes. However, the protocols presented are unlikely to be supported by a large scale monitoring approach for assessing watershed health. The approach offered seems more appropriate for a smaller scale sampling design like intensively monitored watershed (IMW) but doesn't seem appropriate for the intended multiple watershed or regional assessment design. The document defines a need for monitoring habitat units as they relate to salmon productivity for purposes of making better management decisions. However, we believe the processes by which habitat units are formed are "beyond the scope of this project."

It is unclear how the link will be made between natural and degraded habitat units if there is no direct link to channel forming processes. Making this link will be more difficult without a comprehensive comparison to reference conditions because un-modified river and stream systems habitat units are highly dynamic. A reach-based monitoring program doesn't focus on these dynamic habitat types, but rather describes the system that is present and compares it to what would be expected. The benefit of this approach is that data can be compared consistently between surveys over time and space.

While we support the measurement of metrics which better predict biology health, we are concerned that the proposed methodologies will not maintain the rapid approach of current monitoring protocols or improve the ability to make better management decisions based on the information collected over large geographic scales. Channel habitat units depend on many factors that are not addressed by this protocol. It is unclear if the proposed approach will be better than current stream reach protocols.

Specific Comments:

1) Macroinvertebrate sampling: The document suggests that standard BMI sampling is less accessible and more expensive than drift sampling. While a project to compare drift and kick samples would be interesting, the information obtained from standard kick samples provides more information that is relevant to the health of fish populations and their environment than simple food supply data. While most of the food supply comes from invertebrates drifting in the water column or from "terrestrial insects", which are presumably the winged invertebrates that fly over and may die on the water surface, information about seasonal environmental conditions including temperature and oxygen levels, as well as the general health of the system can be obtained by the data gathered from a kick sample. Also many of the "terrestrial insects" in a riparian zone spend their juvenile/larval stages as aquatic macroinvertebrates. BMI samples provide us with information about these food sources.
For this reason, it might be better to monitor BOTH drift and benthic invertebrates. However, if we had to choose between the two because of time/logistic limits, we believe kick samples provide the most useful information.

2) Page iii. Paragraph 1 - Reach Based sampling still samples characteristics of the stream that are important for salmon survival and reproduction, for example channel morphology, substrate type, instream cover.

3) Why are "recommendations" being made about protocols standardization before the protocols have even been tested? First test season is stated as summer of 2010 on page iii at the end of second paragraph. It would seem more appropriate to hold off on making recommendations for standardization until the methods have been tested and shown to be better than the methods currently used. A study is great, but until that study bears out, a shift in current protocols could reduce productivity.

4) Page 3, Paragraph 1 of Background and Assumptions – The statement regarding the idea that we are dealing with monitoring of listed species because our past monitoring effort and information has not been adequate is not accurate. Generally, healthy populations of any given species are not targeted for monitoring. Therefore, we did not start to monitor the listed species in the current manner until they became threatened or endangered.

5) Dams may be missed in a reach based measurement; however the dam itself would still be recognized by the investigator and acknowledged in any report that it was relevant to. Also, the issue with dams is that they block migration. Habitat measurements would still be measurable within a reach or habitat unit framework on either side of the dam.

If the habitat is in good shape upstream of the lake and downstream of the dam, but we are still seeing negative effects on the population structure, then it would be natural to investigate the possibility of some form of barrier to migration. The point of a monitoring program is to quantify habitat conditions over the long term, which can be reflected more effectively at a reach level. For example, if one is "zoomed in" on each habitat unit, the data may not capture a picture of stream condition as a whole.

6) Habitat units have been shown to be difficult to identify for two main reasons. (1) There is a high degree of individual investigator error, which can be improved with extensive training, but is not 100% resolvable and (2) habitat can change depending on the flow and stage of the river. What one might call a riffle one day may become more of a run/glide after a rain event. Likewise for monitoring programs, the fluctuation of flow can lead to the shifting of habitats across seasons. What might have been a run one year may now include a pool where it scoured out. Reach-wide sampling takes some of these issues out of the equation.

7) Pg ii 4th paragraph line 1: "The review of fish habitat needs highlighted that fish are likely not only responding to watershed and reach conditions, but also the conditions of individual channel units." True, but channel units are responding to larger scale processes. This is important when developing sustainable BMPs.

8) Pg 2, 2nd paragraph, line 2: "The protocol is also designed to maintain the rapid nature of existing stream habitat protocols and is structured in a tiered fashion whereby monitoring groups can collect different levels of spatial resolution depending on the logistical constraints posed by the large variation in physical setting of sample sites." The goal of the protocol precludes the use of rapid assessment protocols.

9) Pg 3, 2nd paragraph line 10: "The mere fact that we are dealing with listed species suggests that we have not been effective at using past monitoring information to make sound management decisions meant to preserve these resources". We would add a caveat to this statement: It is more likely a result of our inability to implement at a geopolitical level, meaningful, large scale changes in land and water use.

10) Pg 4, 3rd paragraph. Physical processes. This section gives an excellent description of the major processes which impact stream habitat. It is important to keep in mind that protocols that do not holistically account for all of these physical processes will not ultimately produce better management strategies.

11) Pg 5, 2rd paragraph, line 5. "The development of sediment budgets, sediment transport, and other channel forming processes are beyond the scope of rapid fish habitat assessments." If the ultimate goal is to improve fish habitat, shouldn't the first priority be to understand and mitigate those processes that degrade habitat? Simply taking inventory of habitat units without monitoring the processes in which those units are formed maybe misleading.

12) Pg 6, 4th paragraph, line 1. "Many variables can be measured to provide information on the various processes described above; however, rapid assessments approaches need to capture gross indicators of change due to land use activities." This is largely the criticism of current watershed health monitoring efforts. I think the paper makes a good argument for not using gross indicators.

13) Pg 7, 4th paragraph, line 5. "Thus, collection of invertebrate drift is perhaps the most direct measurement of food availability (Filbert and Hawkins 1995)." Nice to see the inclusion of primary production measurements. However, we would not agree with this statement. Drift is affected by multiple variables, including season, discharge, water chemistry, light, etc. Too many variables to make meaningful comparisons between sites. Traditional methods for assessing populations are appropriate. (See comment #1)

14) Pg 8, 3rd paragraph, line 3. "If fish succeed in maintaining sufficient growth, to survive, they must also avoid predation and lethal environments caused by high water velocity and water quality issues such as extreme temperatures, low dissolved oxygen (DO), and levels of toxicity (other than temperature and DO, water quality issues are beyond the scope of this document and will not be addressed)." NOAA recently published a paper describing sublethal effects of pesticides on salmonids. They indicate seasonal exposure to pesticides may limit freshwater growth rates. Also, there is extensive literature describing sublethal effects of metals on salmonid behavior. At the very least, a cursory evaluation of the potential for compounds to be present should be performed at each site.

15) Pg 13, 1st paragraph, line 4. "The geomorphic processes shaping fish habitat need to be strongly considered in order to determine the effects of management practices and stream restoration on fish populations. While we often acknowledge these considerations, they are not explicitly considered in most monitoring efforts in the Columbia Basin." Strongly agree. The question is - what is the minimum level of effort required to meet this need.

16) Pg 15, 2nd Paragraph. Synthesis of Sampling Protocols: Again we support the effort of the author to bring consistency to local monitoring efforts and agree with many of the more detailed aspects of the methodologies. However, we question what value the extra effort will provide decision makers given this approach is still missing detail to fully address the desired goal. Also, the protocol is lacking an

assessment of how the metric values relate back to fish habitat requirements. What are the expected tolerance limits for fish? How will metrics be related back to different stream classifications (assuming different stream types will have varying potential for habitat)?

17) Pg 24. Aquatic Invertebrates: Standardized protocols for invertebrate collection have a direct link to the CWA via models (IBI, RIVSPAC). Also, species composition and size may have a direct impact on juvenile salmon growth. The following study suggests growth rates of juvenile Coho salmon varied among season and streams (http://www.humboldt.edu/~cuca/documents/theses/gonzalesthesis.pdf). The study also indicates growth rates were greatest from April to July and that diet changed depending on season.

18) Pg 24, 3rd paragraph, line 1. "Pool habitat is often directly associated with fish abundance and increasing pool habitat is often a primary goal of restoration efforts." If the goal of this protocol is to assess habitat units that are favorable to fish and make recommendations to increase those habitat units in a given system then it would be important to determine all factors involved in channel forming processes. Otherwise we have no way of knowing (1) is restoration activity applicable to the particular stream/segment and (2) is the restoration activity sustainable (i.e., will natural and anthropogenic processes within a given watershed degrade efforts over time.)

19) Pg 40. Conclusions: While we support the measurement of metrics which better predict biology health, we are concerned that the proposed methodologies will not maintain the rapid nature of current monitoring protocols or improve the ability to make better management decisions. Channel habitat units depend on many factors not being addressed by this protocol. It is unclear this approach will be any better than current protocols. We also noticed there was no mention of establishing reference reaches for comparison or monitoring of discharge metrics (one of the largest regulators of channel processes).

20) Bankfull Width: The proposed method may introduce more bias because field crews may "cherry pick" locations to take measurements.

21) Site Characteristics: We agree with the general approach using GIS to provide site characteristic information, but we need better, affordable, and accurate GIS tools before relying too heavily on GIS. GIS coverages are often highly variable in quality and need to be processed correctly, field referenced, correct meta data written, and scales need to be determined and corresponding data sets must be kept at those scales where appropriate, and updated.

22) Substrate: Targeting substrate measures to specific areas will reduce our ability to make comments about the general health of the watershed because of the introduced bias, (i.e., selecting habitats to assess substrate will introduce bias such that we can't assess this important characteristic for overall watershed health). This may help identify relationships between substrate and salmonids, but don't we have a good idea about this already?

23) Channel unit measurements and ID: This is a highly variable measure that in the long run probably will not correlate to production on the proposed scale. However, we will need to find a better way to map, record, or measure side channels and other side channel habitats.

24) Max Depth: Do we need maximum depth for a riffle habitat unit?

25) % Fines: Same comment as substrate.

26) Substrate Composition: If this uses the same methods as we currently use (pebble counts at each transect), then where and how many measurements need to be defined. This approach may answer the problems we have with proposed fines and substrate measures, but it will likely be far too time consuming as proposed. If it is just a visual estimate of the reach then probably not of value.

27) Pools: Measuring pools is always a problem and will likely be a problem because they come in all shapes and sizes and change from week-to-week. If this method requires categorizing secondary pools, it will be even less successful and more time consuming.

Robert F. Cusimano
Environmental Assessment Program
Western Operations Section Manager
Washington Department of Ecology
300 Desmond Drive
PO Box 47710
Olympia, Washington 98504-7710
Telephone 360.407.6596
FAX 360.407.6884