DRAFT

Aquatic Research, Monitoring and Evaluation Plan

Compiled by: Washington Department of Fish and Wildlife
April 2004

Note: This RM&E plan has not been reviewed nor approved by any other agencies or entities other than Washington Department of Fish and Wildlife.

Local and regional efforts have begun to achieve a coordinated approach in the Columbia River subbasins to recover ESA listed salmon and steelhead. A part of those efforts is the development of Research, monitoring and Evaluation (RME) plans that will help direct limited funds to accomplishing the most critical work.

Within the Walla Walla subbasin, a coordinated multi-agency effort has recently begun to develop just such a comprehensive RM&E plan. The plan will pull from regional RME efforts such as the FCRPS Biop plan being developed under the direction of NOAA, the Washington Comprehensive Monitoring Strategy for Watershed Health and Salmon Recovery (CMS), and other similar strategies and plans currently under development.

The RME plan that follows is an attempt to identify priorities in concepts for implementation in the next three to six years. While it would be desirable to have a completed comprehensive RME plan now, the time allowed for its development under the subbasin planning effort is inadequate. This plan will therefore, serve as an interim set of guidelines that will assure a systematic approach to directing and funding RME will occur. Further, this interim plan will serve to facilitate coordination of RME in the Walla Walla among management entities, and to help dovetail Walla Walla basin actions within the broader Columbia Basin RME effort.

Guiding Principles and Priorities

- Fill EDT data gaps and establish baseline habitat conditions
  - Verify attribute values to validate EDT modeling runs
  - Establish firm baseline of habitat conditions to track change over time or response to habitat improvement actions undertaken in the basin (effectiveness monitoring)
  - Use systematic habitat characterization provided by EDT as basis for future validation monitoring.
- Focus RME efforts on critical data needs for VSP attributes.
- Implementation and effectiveness monitoring to document actions should be funded/undertaken within the basin (Implementation - how much, how many sites, how often, where: Effectiveness – habitat and localized fish response)
- Critical uncertainties? (Causal relationships among actions and population response, and confounding factors that may affect our understanding of those relationships).
- Coordinate with regional efforts (Tier 3 studies)

- Data management and coordination are crucial to meet regional data accessibility needs.

- Methodologies should provide data of known quality (accuracy and precision)
- Validate EDT model as a reliable measure of habitat and population response to recovery actions taken in the Walla Walla subbasin.
- A systematic approach to project selection and funding will be used that is consistent with and complementary to other RME efforts within the Columbia Basin

Fill EDT data gaps and establish baseline habitat conditions

The EDT model was populated without extensive empirical data for the Walla Walla subbasin. In all cases empirical data were used if available. However many habitat attributes were rated based on local knowledge and best scientific judgment. It is clear that such data may inadequately represent habitat and fish assemblage conditions. The predictive capacity of EDT to help direct recovery actions and assess their potential beneficial effect could be substantially limited by the data quality. Improving data quality by collecting empirical data should be a priority if the following conditions are met:

- Those attributes with the greatest leverage on EDT model outputs (e.g. max width, gradient, habitat type inventories, large wood, bed scour) (From: *Mobrand Biometrics Quick Guide to Developing the Stream Reach Editor*, 2003)
- Those that are within priority protection or restoration stream reaches
- Data is limited for attributes that have a broad (subbasin wide) effect on population or habitat status (passage at obstructions, water quality, others?)
- Identified in the Hypotheses and Objectives within the subbasin plan

Focus RM&E efforts on critical data needs for VSP attributes.

Four critical areas were identified under NOAA's Viable Salmonid Population (VSP) treatise. Presently an evaluation and rating system for populations within ESUs is being developed by the Interior Columbia TRT. Once the methodology is complete, completing a rating exercise for the basin will be necessary. Beyond that action, specific needs have been identified for each of the four areas of VSP:

Abundance

Adult: Run size to the basin (This can be greatly impacted by out-of-subbasin effects but is critical to monitoring population status). Estimates or enumeration of escapement to the spawning grounds, including hatchery interactions in natural spawning areas, is crucial. Harvest within the subbasin including hatchery harvest and incidental hooking mortality of wild fish. Out-of-basin harvest and mortality (up-river subbasins may

be prevented from recovering if out-of-basin effects limit adult escapement.

Juvenile - smolt production at the subpopulation level to reflect freshwater survival and production within the basin. It will be critical in modeling population response to habitat restoration actions.

Diversity: Genetic characterization, life history pathways (juvenile and adult), artificial propagation effects (hatcheries)

Spatial Structure Distribution of juveniles and adults within the subbasin, habitat limiting factors.

Productivity Population Growth rate or potential – juvenile and natural return ratio (NRR) for adults (should be above replacement or 1.0). Hatchery effects should not reduce NRR below 1.0

Implementation and Effectiveness monitoring

Documenting the why, where, how much and whether of habitat recovery actions completed in the basin. (Adopt the SRFB Effectiveness Monitoring Statistical Design criteria (see *SRFB Monitoring and Evaluation Strategy for Habitat Restoration and Acquisition Projects*.) Basic M&E actions for accountability can also capture habitat modifications/changes/improvements for future EDT modeling efforts.

Critical uncertainties

Numerous efforts are presently ongoing within the Columbia Basin to recover ESA listed salmonid. Research is underway to document population response to habitat, hatchery, harvest and hydro modifications. During these actions the general understanding of the biology and ecology of salmon and steelhead populations is increasing. There remain significant data gaps and critical uncertainties regarding recovery actions. Limited funds must be used wisely to help ensure ESA populations receive maximum benefit from actions. Many critical uncertainties remain throughout the region, and within the subbasin. These uncertainties must be answered if populations are to be rebuilt and delisted. Such uncertainties may include habitat/life history stage relationships, causal relationships for degraded habitat and depressed or extirpated populations, and understanding the relationship between resident and anadromous O. mykiss subpopulations. These critical uncertainties will be identified in forums such as: Regional salmon recovery planning; Region wide (Columbia Basin) critical needs lists developed by management agencies; NOAA's Comprehensive FCRPS BiOp RME plan; and Washington State's Comprehensive Monitoring Strategy; and the Walla Walla Subbasin Comprehensive RME Plan.

Population management goals

There have been inconsistent and uncoordinated efforts to establish population abundance goals in many subbasins. Washington, the Columbia River Treaty Tribes, and most recently the TRT have suggested management goals. Each of these efforts is based on different assumptions and were accomplished for different purposes. We believe that at least two management goals will ultimately be adopted: a population abundance level sufficient to delist from the ESA, and a more robust level (beyond VSP) defined by the states and tribes that will assure preservation of populations, but also provide for harvest opportunity. It is likely that the latter goals will be established under the auspices of the Court as part of the US v OR management plan development process. We believe that RME will be instrumental in answering the uncertainties with establishing these goals, and essential to monitoring the attainment of population management goals.

Conclusions and Recommendations

The Walla Walla subbasin managers and stakeholders have implemented efforts to coordinate recovery and RME actions within the subbasin. Included in these efforts was an extensive assessment of ongoing and needed RME actions (Table 1). The managers attempted to identify the current level of effort, and a subjective assessment that effort's progress toward meeting data needs within the subbasin. A complete prioritization of actions within the table has not been accomplished. However, all involved parties committed to completing an RME plan that would, eventually address priority actions. Following are broad conclusions and recommendations based on guiding principles and priorities, and the items listed in Table 1. These will serve as generalized high priority (in principle) actions that should be pursued while the more comprehensive RME plan is completed.

1. *Conclusion:* The quality of data used within the EDT attributes and modeling exercise is inadequate. Empirical data of know accuracy and precision is needed for priority areas (habitat inventory using standardized protocols from region that will fit EDT) of the subbasin (see section ???). These data will be used to evaluate the efficacy of EDT in modeling habitat and population response to actions taken within the subbasin, and to evaluate the hypotheses and objectives presented in the subbasin plan.
Recommendation: Fund habitat inventories to collect data necessary to fill data gaps for attributes with high EDT model leverage and evaluation of progress toward subbasin plan objectives.

2. *Conclusion:* Population status monitoring must occur in a systematic manner that will allow managers to evaluate their progress toward delisting from ESA. Criteria established by NOAA and the TRTs under VSP will be used within the subbasin. These metrics will be useful within EDT, and provide a direct relationship between the habitat and population monitoring efforts, through model outputs.
Recommendation: Continue to fund existing monitoring and evaluation actions within the subbasin that fulfill critical VSP data needs.

Recommendation: Fund additional actions to complete basic population status monitoring needs for the subbasin (e.g. Monitor adult escapement into the three major basins of the Walla Walla (Touchet R, Mill Creek and Walla Walla above Mill Creek), and the smolt emigration from those basins)
To fulfill this example, the specific actions or improvements listed below may be needed.

1. Adult counting or trap at Bennington Dam
2. Improved counting or trap at Dayton
3. Fix trap/ladder/passage at Nursery Bridge
4. Smolt trap in Touchet

Additional VSP related action may be required/recommended as the full RME plan is completed.

3. *Conclusion*: Basic monitoring of restoration actions undertaken within the subbasin needs to occur to ensure that they were completed in accordance with expectations (Implementation monitoring). However, the effects of those actions on the habitat and salmonid populations (Effectiveness monitoring) is costly and should be done on only a portion of completed projects.
Recommendation: Accountability for restoration actions needs to occur for each project. Basic documentation should be completed in a cost efficient manner. A systematic approach to documenting effectiveness is required that provides sufficient accountability without unnecessary redundancy. (e.g. classes of actions my be represented by monitoring a small portion of similar projects)

4. *Conclusion:* Critical uncertainties will be identified in the Comprehensive RME plan and coordinated with other regional forums. Uncertainties must be understood and answered if population recovery is to occur. ESU wide uncertainties may be addressed in the subbain as part of a regional RME effort. Subbasin specific factors may need localized RME efforts to answer.
Recommendation: Fund research on critical uncertainties unique to the Walla Walla as a priority for recovery actions in the subbasin. (direct need)

Recommendation: Fund research on critical uncertainties represented in the Walla Walla for a broader ESU relevance if not being funded or conducted in other subbasins. (opportunity for coordinated regional effort)

Conclusion: The managers have not established comprehensive population abundance goals for the subbasin. Interim escapement and spawning goals are inconsistent in definition and basis. The subbasin plan and its RME section can provide critical data for establishing these goals in a coordinated and scientifically defensible fashion.

Recommendations: Fund and implement RME that shows a clear link to resolving uncertainty regarding population abundance and management goals.

Table 1. Identified RME opportunities in the Walla Walla Subbasin, 2004.

Metric	Life Stage	Performance Measure	Collaboration	Current Effort	Desired Future Effort	Current Funding
Abundance	Adult	Adult returns to Walla Walla River	WDFW, ODFW, CTUIR, USFS, USACOE, TSS	Counts are made at ladders and weirs throughout the subbasin. Some passive detection stations have been established	Direct observations should be replaced with passive detections throughout the subbasin. A passive detection system should be established at the confluence with the Columbia.	BPA, LSC, volunteers & cost-share
		Run to mainstem dams	USACOE and Columbia River compact	Passive detections and radio detections are made at all mainstem dams and the estuary.	The current effort is sufficient.	BPA, LSC
		CHS Broodstock Collection	CTUIR	Collected from Umatilla River Run CHS	Broodstock should come from locally adapted naturally producing CHS run	BPA and US v Oregon
		STS Broodstock Collection	WDFW	Collected from Lyon's Ferry and Dayton ladder	If experimental hatchery program is deemed sustainable, broodstock should be collected from endemic run to Dayton and Nursery Bridge ladders.	LSC

		Spawner Escapement	CTUIR, USFS, USFWS, ODFW, WDFW	Standardized spawner surveys are divided across geographical boundaries, and conducted with low intensity.	Stratified randomized georeferenced surveys.	BPA, USFWS, LSC, ODFW
		Run Prediction	CTUIR	none	Run prediction models should be developed for CHS and STS	none
	Juvenile	Parr and pre-smolt Abundance	USFWS (BT), CTUIR (STS, CHS), WDFW (Touchet STS, CHS)	Electrofishing, seines, snorkel, and baited trap surveys are conducted by multiple agencies with some coordination.	Stratified randomized georeferenced survey design with increased collaboration and coordination.	BPA, USFS, USFWS, LSC, ODFW
		Smolt Abundance	USFWS (BT), CTUIR (STS, CHS)	Screw-trap collections for upper Mill Creek and Walla Walla systems, plus two Walla Walla mainstem traps.	Additional screw-trap or PIT-tagging effort in the Touchet system, plus increased effort in the mainstem to develop total outmigration estimate.	USACOE, USFWS, BPA, LSC
		Residual Abundance	WDFW, CTUIR	Limited coverage using hook and line and electrofishing.	Stratified randomized georeferenced assessment using hook and line and baited traps.	LSC, BPA
Survival and Productivity	Adult	Broodstock Survival	WDFW, CTUIR	Monitored in-hatchery.	The current effort is sufficient.	LSC, BPA
		Smolt-to-Adult Return	USFWS, CTUIR, ODFW, WDFW, TSS, USFS	Metric derived from independent assessments of smolt survival, age at return, adult mortality, and spawner densities.	Increased PIT-tagging effort for hatchery and wild fish to develop SURPH and CRiSP models.	USFWS, BPA, ODFW, WDFW, PSMFC, volunteers

		Smolt-to-Adult Survival	USFWS, CTUIR, ODFW, WDFW, TSS, USFS	Metric derived from independent assessments of smolt survival, age at return, adult mortality, and spawner densities.	Increased PIT-tagging effort for hatchery and wild fish to develop SURPH and CRiSP models.	USFWS, BPA, ODFW, WDFW, PSMFC, volunteers
		Parent Progeny Ratio	USFWS, CTUIR, ODFW, WDFW, TSS, USFS	Metric derived from independent assessments of smolt survival, age at return, adult mortality, and spawner densities.	Increased PIT-tagging effort for hatchery and wild fish to develop SURPH and CRiSP models.	USFWS, BPA, ODFW, WDFW, PSMFC, volunteers
		Pre-spawn Mortality	CTUIR, WDFW, USFWS, TSS, WWBWC	Expanded from carcass surveys and telemetry study.	Stratified, randomized, georeferenced carcass surveys with increased coverage.	BPA, USFWS, OWEB
		Recruit /spawner (adult to adult)	USFWS, CTUIR, ODFW, WDFW, TSS, USFS	Metric derived from independent assessments of smolt survival, age at return, adult mortality, and spawner densities.	Increased PIT-tagging effort for hatchery and wild fish to develop SURPH and CRiSP models.	USFWS, BPA, ODFW, WDFW, PSMFC, OWEB, volunteers

	Juvenile	Egg to Fry Survival	not assessed	not assessed	Should be derived from higher resolution studies of spawners, parr, and smolts.	unfunded
		Fry to parr and parr to smolt survival	not assessed	not assessed	Derived from higher resolution studies of spawners, parr, and smolts.	unfunded
		Smolt Survival to McNary Dam	CTUIR, WDFW, USFWS, USACOE	Derived from PIT-tag detections	Increased PIT-tagging effort to develop SURPH and CRiSP models, plus increased screw-trap effort to estimate total smolt outmigration from WWR.	LSC, BPA
		Smolt Survival through Mainstem Columbia River	CTUIR, WDFW, USFWS, USACOE	Derived from PIT-tag detections	Increased PIT-tagging effort to develop SURPH and CRiSP models, plus increased screw-trap effort to estimate total smolt outmigration from WWR.	LSC, BPA
Distribution and Movement	Adult	Spawner Spatial Distribution	CTUIR, WDFW, ODFW, USFS, USFWS	Standardized spawner surveys are divided across geographical boundaries, and conducted with low intensity.	Stratified randomized georeferenced surveys.	BPA, USFWS, LSC, ODFW, OWEB

		Stray Rate	WDFW, PSMFC, CTUIR, U of I	Passive detections and radio detections are made at all mainstem dams and the estuary, plus CWT recoveries from creel, volunteers, and carcass surveys, and scale analysis.	The current effort is sufficient.	LSC, BPA, OWEB
	Juvenile	Rearing Distribution	USFWS (BT), CTUIR (STS, CHS), WDFW (Touchet STS, CHS)	Electrofishing, seines, snorkel, and baited trap surveys are conducted by multiple agencies with some coordination.	Stratified randomized georeferenced survey design with increased collaboration and coordination.	BPA, USFS, USFWS, LSC, ODFW
		Residual Distribution	WDFW, CTUIR	Limited coverage using hook and line and electrofishing.	Stratified randomized georeferenced assessment using hook and line and baited traps.	LSC, BPA
Life History	Adult	Run Timing	WDFW, CTUIR, ODFW, PSMFC, USACOE	PIT-tag detections, ladder counts, creel surveys, radio telemetry, and spawning surveys.	The current effort is sufficient.	BPA, LSC, OWEB, USACOE
		Passage efficiency	CTUIR, WWBWC, WDFW, ODFW, TSS, USACOE, UI	Telemetry, ladder counts, PIT-tag detections, and spawner surveys.	The current effort is sufficient.	BPA, USACOE, OWEB, ODFW, WDFW

		Age of spawners	ODFW, WDFW,CTUIR, USFWS	PIT-tag detections, CWT recoveries, scale and otolith analysis.	Increased PIT-tagging efforts and scale and otolith analysis with greater coverage and coordination.	BPA, LSC, USFWS
		Size of spawners	WDFW, ODFW, CTUIR, USACOE, USFS, TSS, USFWS	PIT-tag detections, CWT recoveries, ladder counts, creel surveys, and carcass surveys.	The current effort is sufficient.	BPA, LSC, ODFW, WDFW, USFS, volunteers, USFWS
		Sex Ratio of spawners	WDFW, ODFW, CTUIR, USACOE, USFS, TSS, USFWS	PIT-tag detections, CWT recoveries, ladder counts, creel surveys, and carcass surveys.	The current effort is sufficient.	BPA, LSC, ODFW, WDFW, USFS, volunteers, USFWS
		Fecundity	USFS, ODFW, USFWS, WDFW, CTUIR	Fecundity is measured in the hatchery and by ultrasound at the Walla Walla city water intake.	Fecundity estimates should be linked directly with age and growth estimates for all species.	LSC, BPA, USFS
		Spawn-timing	CTUIR, ODFW, WDFW, WWBWC, USFWS, USFS, UI	Telemetry, spawner surveys, and carcass surveys.	The current effort is sufficient.	BPA, LSC, USFS, USACOE, OWEB

	Juvenile	Size at Release	CTUIR, WDFW	Monitored in-hatchery.	The current effort is sufficient.	BPA, LSC
		Release Location	CTUIR, WDFW	Monitored in-hatchery.	The current effort is sufficient.	BPA, LSC
		Emigration Timing	USFWS (BT), CTUIR (STS, CHS)	PIT-tag detections and screw-trap collections for upper Mill Creek and Walla Walla systems, plus two Walla Walla mainstem traps.	Additional screw-trap or PIT-tagging effort in the Touchet system, plus increased effort in the mainstem to develop total outmigration estimate.	USACOE, USFWS, BPA, LSC
		Age at Emigration	CTUIR, USACOE, WDFW, Batelle, USFWS	PIT-tag detections and screw-trap collections for upper Mill Creek and Walla Walla systems, plus two Walla Walla mainstem traps.	Additional screw-trap or PIT-tagging effort in the Touchet system, plus increased effort in the mainstem to develop total outmigration estimate.	BPA, LSC, UACOE, USFWS
		Size at Emigration	CTUIR, USACOE, WDFW, Batelle, USFWS	PIT-tag detections and screw-trap collections for upper Mill Creek and Walla Walla systems, plus two Walla Walla mainstem traps.	Additional screw-trap or PIT-tagging effort in the Touchet system, plus increased effort in the mainstem to develop total outmigration estimate.	BPA, LSC, UACOE, USFWS

		Condition at Emigration	CTUIR, USACOE, WDFW, Batelle, USFWS	PIT-tag detections and screw-trap collections for upper Mill Creek and Walla Walla systems, plus two Walla Walla mainstem traps.	Additional screw-trap or PIT-tagging effort in the Touchet system, plus increased effort in the mainstem to develop total outmigration estimate.	BPA, LSC, UACOE, USFWS
Fish Health	Adult and Juvenile	Disease Incidence	WDFW, ODFW, CTUIR, USFWS	Monthly disease checks in hatchery. No coverage in natural populations and no assessment of hatchery-to-natural transmission.	Coordinated surveys of mortalities and carcasses, plus small sub-sample of "healthy" wild fish.	BPA, LSC, USFWS
		Disease Severity	WDFW, ODFW, CTUIR, USFWS	Monthly disease checks in hatchery. No coverage in natural populations and no assessment of hatchery-to-natural transmission.	Coordinated surveys of mortalities and carcasses, plus small sub-sample of "healthy" wild fish.	BPA, LSC, USFWS
Genetic	Adult and Juvenile	Genetic Diversity and Integrity	CTUIR, ODFW, WDFW, USFWS	not assessed	Coordinated assessment of genetic characteristics for all supplemented, reintroduced, and listed species.	unfunded

		Reproductive Success	CTUIR, ODFW, WDFW, USFWS	not assessed	Experimental assessment of reproductive success of BT, STS, and CHS at Nursery Bridge Dam.	unfunded
		Effective population size	CTUIR, ODFW, WDFW, USFWS	Assessment of BT connectivity and spatial heterogeneity.	Standardized monitoring of effective population size measured as the rate of decline in genetic heterozygosity	USFWS
Fisheries	Adult	In-basin harvest	WDFW, ODFW	Limited coverage using creel surveys plus catch records from volunteers.	Stratified randomized creel surveys of entire subbasin plus increased volunteer involvement.	WDFW, ODFW
		Out-of-basin harvest	LSC, PSMFC	Randomized creel surveys plus CWT and PIT-tag estimates of harvest.	Increased spatial and temporal coverage and consistency in survey methodologies.	LSC, NOAA
		Hooking rate	WDFW, ODFW	Limited coverage using creel surveys plus catch records from volunteers.	Stratified randomized creel surveys of entire subbasin plus increased volunteer involvement.	WDFW, ODFW
		Handling mortality	CTUIR, WDFW, USACOE, WWBWC	Derived from telemetry mortalities.	The current effort is sufficient.	BPA, LSC, OWEB, USACOE

Habitat	Adult and Juvenile	Instream flow				
		Water temperature				
		Water quality				
		Physical habitat conditions	USFS, WDFW, ODFW, WWBWC, USFWS	Modified Hankin & Reeves or Rosgen surveys.	Addition of EDT-derived metrics such as bed-scour and embeddedness, plus georeferenced survey design.	BPA, LSC, USFS, USFWS, WWBWC
		Biological habitat conditions	USFS, WDFW, ODFW, WWBWC, USFWS, OSU	For riparian conditions, modified Hankin & Reeves or Rosgen surveys.	Addition of regular benthic macroinvertebrate sampling	BPA, LSC, USFS, USFWS
		Habitat Quantity	USFS, WDFW, ODFW, WWBWC, USFWS	Modified Hankin & Reeves or Rosgen surveys.	Addition of EDT-derived habitat types, plus georeferenced survey design.	BPA, LSC, USFS, USFWS, WWBWC
		Passage barriers and diversions	CTUIR, WWBWC, WDFW, ODFW, TSS, USACOE, UI	Telemetry, ladder counts, PIT-tag detections, and spawner surveys.	The current effort is sufficient.	BPA, USACOE, OWEB, ODFW, WDFW

		Habitat utilization	CTUIR, WDFW, ODFW, USFS, USFWS	Derived from juvenile and adult abundance and distribution surveys.	Georefenced survey design for fish population studies	BPA, LSC, USFS, USFWS
		Smolt production of habitat	CTUIR, WDFW, ODFW, USFS, USFWS	Derived from juvenile and adult abundance and distribution surveys.	Georefenced survey design for fish population studies	BPA, LSC, USFS, USFWS
Ecosystem	Juvenile and Adult	Trophic relationships	CTUIR, WDFW, ODFW, USFS, OSU, USFWS	not assessed	Stable isotope assessments plus mass-balance models	unfunded
		Competition	CTUIR, WDFW, ODFW, USFS, OSU, USFWS	not assessed	Stable isotope assessments plus mass-balance models	unfunded
		Natural mortality	CTUIR	not assessed	Stable isotope assessments plus mass-balance models	unfunded
		Marine ecology	CTUIR, CRITFC, OSU	not assessed	Archival tag studies	unfunded
		Redd impacts	CTUIR, WDFW, ODFW, USFS, OSU, USFWS	not assessed	Stable isotope assessments plus mass-balance models	unfunded

		Carcass impacts	CTUIR, WDFW, ODFW, USFS, OSU, USFWS	not assessed	Stable isotope assessments plus mass-balance models	unfunded