

High-Level Indicators and Descriptions

Comments provided by Bruce Schmidt and the StreamNet Steering Committee Three new columns were added to the right of the original table to provide additional information and comments. New text is in red font.

A primary comment is that this appears to be a very useful attempt to identify core or primary indicators at a 'high level'. One key aspect of that, however, is to make sure that there is a clear and consistent definition of what 'high level' means. We take this to mean a highly summarized overview. It will also be important to define the scale to which each HLI applies. We assume that in most cases this will be for a wide area, such as an ESU/DPS, a subbasin, or the entire basin. It is possible, however, to define some HLIs which might apply at a population or individual watershed level. These will need to be clearly described.

We also believe it is critical to clearly describe the exact mathematical construct of each indicator. That will significantly aid in determining the data that will be needed to create the indicator and any gaps or missing information. It will also help to show the intended scope. Alternative examples of this for salmon population trend might be: "Within an ESU, the number (or percentage?) of populations that are stable or increasing in abundance." Or, "Within an ESU, the average slope of the 10 year (or longer?) regression line of abundance of all populations." Or, "Within an ESU, an index of population trends expressed as "red, yellow, green", with green defined as >60% of all streams classified as stable or increasing, yellow as 40% to 60% of all populations stable or increasing, and red as <40% of populations stable or increasing". Note that these are only general examples of the forms an indicator could take, not recommendations. Indicators could take many forms, and some might require different input data than others, for example, if abundance is compared to a set target, the target number would be needed, but if the indicator is simply a total number or a % change, then the target number would not be needed.

March 2009: Updated list to add Data Source column

July 2008: Council endorsed this list for further development

We recommend adding these columns to the HLI table and providing this kind of information for each indicator. The content below is provided as first stab or best guess examples for what might be included. These need to be determined by the biologists working in these areas. This column provides our comments and suggestions relative to each specific High Level Indicator.

Indicator	Description	Data Source	Form of the Indicator or Metric	Data needed to calculate	Comments
BIOLOGICAL INDICATORS					
Abundance					
Total adult salmon and steelhead returns to the Columbia	Adults & jacks passing Bonneville Dam (1938-present): Excel (30k) or PDF (20k)	Fish Passage Center	Estimated total number passing Bonneville Dam	Direct counts, expanded for time periods not counted.	

	Smolt counts, Lower Granite and McNary to Bonneville: Excel (60k) or PDF (10k) Will include returns to mouth of the river and lamprey if available. Lamprey are out of place in a salmon and steelhead HLI		Unclear. And, why are smolt counts included under an adult return Indicator? Derived estimate of total return to mouth: dam count adjusted for harvest, other factors	Are there counts of smolt outmigration that consistently represent the whole river at a given point? Direct count @ Bonneville Dam Est. harvest prior to dam Other factors in calculation	Not familiar with availability of smolt outmigration data from the basin. The exact form of the indicator needs to be defined so that we know what data are used to calculate it. This should be under a juvenile abundance or productivity Indicator, not adult returns Indicator Not directly familiar with the calculation of estimated return to the mouth, but the specific factors that go into the calculation need to be identified, and the data sources (field measurement or calculated) need to be identified
2. Abundance of adult fish in the Council's program Wild fish, or all including hatchery?	Number of salmon, steelhead, lamprey, resident fish, ...	Status of the Resources, CBFWA	Clarify the actual form of the indicator: population estimate or index? Just which fish are included?	?	Not familiar with the jargon "fish in the Council's program". Is this fish in the wild or hatchery produced fish? Are there fish in the Columbia Basin that are not in the Council's program? Is this a calculated total population estimate, or some form of index?
3. Fish population status for each ESU, especially listed ESUs	Based on NOAA definitions and USFWS (Bull trout and sturgeon)	NOAA, although data is not yet available	1. For each ESU/DPS, list federal ESA status. 2. Percentage of populations within an ESU/DPS that are stable or increasing		We removed the phrase "and trends", since status and trend are two different things. An HLI for 'Trend' added below as new row 3.a We suggest two metrics: one the legal status, and second an overall ESU/DPS status measure, such as % of populations in the ESU/DPS increasing/stable, or some similar aggregate growth statistic for all populations.
3.a Fish population trend for each ESU, esp. listed ESUs		Some of the raw data (e.g. redd counts, dam counts, spawner counts, etc.) are in StreamNet. Other data may be needed to estimate population sizes rather than trends.	For each ESU/DPS, time series of estimated adult population size	Population size can be estimated various ways, may differ by ESU/DPS. Raw input data may include dam counts, redd counts, spawner counts, mark/recapture estimates, etc.	Is the intent to have an index of trend (trend = abundance over time), or to calculate population size and follow over time? Or, use a derived indicator such as '10 year rate of increase/decrease', or 'slope of X year abundance regression line', or some other general description of 'population increasing, stable or decreasing'? The exact form of the indicator is important to know so that we know what specific data are needed to calculate it.
Habitat Productivity					

<p>4. Productivity of wild fish in select watersheds targeted by Council program</p> <p>Contradictory. Habitat productivity, but framed in terms of fish survival. Should be a habitat condition metric. Fish survival is not a good indicator of habitat condition-too much variation. This sounds more like population productivity.</p>	<p>Juveniles/spawner for anadromous and resident fish. Will focus on adult fish in and juvenile fish out.</p>	<p>Focus on adult fish "in" and juvenile fish "out". Juvenile fish counts could be added to Streamnet and Status of the Resources/</p>
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I assume that this is a Smolt / Adult Ratio

By ESU/DPS or watershed, adult population estimate (from redd counts, dam counts, etc.), and estimated smolt outmigration (from Smolt Trap data)

Input is needed from local biologists regarding how to calculate the ratio in the various watersheds. It is possible that different methodologies may be used. Different methodologies could mean different raw data are needed.

There may be need for additional sampling due to limited number of watersheds with both types of data (adults in, smolts out) currently available.

Different spatial scale? This is appropriate only for geographically related populations that spawned in similar conditions, not a 'high level' basinwide indicator.

Harvest and Hatcheries

<p>5. Harvest number and rate</p> <p>Is this natural fish or all?</p>	<p>Totals for all spring, summer, fall Chinook, sockeye, steelhead, lower river sturgeon and for each listed ESU and by fishing type as well as hatchery and natural</p>	<p>In-river harvest and rate information from the ODFW and WDFW Joint Staff Report on the stock status and fisheries for fall chinook salmon, coho salmon, chum salmon, summer steelhead,</p>
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- 1. Annual total estimated harvest, by area
- 2. Harvest rate

Different data will go into the estimates, depending on the specific harvest components (sport, commercial, ocean, inriver, etc.) and locations

Harvest and harvest rate are two different metrics

Not familiar with the ways some of the harvest estimates are calculated, so can offer little help in regard to the data needed to calculate the estimates or where to locate those data. This should come from the local biologists. If this is already being calculated, then perhaps the data systems needed are already in place (I don't think so) or could be constructed to provide the data on a more regular basis.

this is not a population harvest rate - often this is of an aggregate.

Harvest as numbers is generally available, but rate varies by population.

		<p>and white sturgeon; ODFW and WDFW Joint Staff Report stock status and fisheries for spring Chinook, summer Chinook, sockeye, steelhead, and other species, and miscellaneous regulations; ODFW and WDFW Joint Staff Report concerning stock status and fisheries for sturgeon and smelt</p> <p>Ocean harvest estimated from PSMFC's coded wire tag database.</p> <p>Source should be PSC TAC. Complicated calculation. Clarify scale. Define spatial and temporal scale. HLI should apply to entire fishery, not populations. Natural, hatchery or all? Harvest in a year, or harvest across a brood?</p>	?	?	
6. Harvest of hatchery fish in the Council's Program	Number by species and by hatchery for all hatcheries receiveing BPA funds	PSMFC's coded wire tag database	Number and/or	percentage of hatchery stock harvested.	?

Ocean commercial harvest is available from PSMFC's PACFIN database, not RMIS (coded wire tags). CWT data is useful for some differentiation of source stocks within the overall harvest reported for a landing area, but much work is needed. A primary source for this data is the harvest managers in the management agencies. There currently aren't any data systems set up to specifically deliver this kind of information at an individual population or hatchery stock level. This is a bigger job than indicated here.

Not sure what the phrase "in the Council's Program" means. This should be more clearly articulated for those not in the know. For hatchery fish, population exploitation rate of each hatchery could be used

7. Relative fitness of supplemented stocks from hatcheries in the Council's Program	Possible measures may include relative reproductive success (RSS), percent natural influence (PNI), or the number of natural origin spawners compared to control streams.	Being developed by the Ad Hoc Supplementation Workgroup and ISRP. May include number of natural origin spawners. Completion goal: 2009.
Hydro survival		
8. Survival rates through the hydrosystem for adult and juvenile fish passing in-river and barged	From LGR to Bonneville and McNary to Bonneville, total system survival and individual hydroelectric facility	NOAA
Life-cycle mortality		
9. Life stage survival estimates for representative populations of Chinook and steelhead	Mortality rates at each life stage: egg to smolt, freshwater passage (reservoirs, dams), estuary, ocean, harvest, freshwater return. Include SARs.	To be determined. It will incorporate data from other HLIs.
Wildlife		
10. Wildlife habitat units by dam: lost and acquired	Measured in habitat units.	Bonneville Power Administration's PISCES database.
IMPLEMENTATION INDICATORS		
Passage Barriers		

Need to define a specific measurement or descriptor

Raw data needed likely will vary depending on how this is specifically defined.

Define. Percentage survival?

What specific field measurements will be needed?

Need to define

Need to define the specific indicator and identify what specific field data are needed to calculate it. Need to define scale. This appears to be below the Basin scale

Habitat units acquired (total and trend over time?), or, # HUs added each year?

<p>1. Instream passage improvement. Additional habitat made accessible</p> <p>Net, include new barriers and habitat lost</p>	<p># of miles of habitat accessed, number of barriers removed</p>	<p>Bonneville Power Administration's PISCES database. Specifically combining work elements #84, 85, 184</p> <p>Should include other efforts that remove barriers.</p>	<p>1. Total miles of habitat available, w/ trend over time to show increases, or # miles opened each year? (i.e., annual numbers or cumulative?)</p> <p>2. # of barriers removed during year.</p>	<p># barriers removed each year.</p> <p># miles of habitat opened each year.</p> <p>Total occupied miles</p> <p># barriers removed</p> <p>Number of miles of habitat opened and number of barriers removed are two different metrics.</p> <p>Should decide whether this is total miles accessible and how that changes every year, or is this simply habitat opened to access each year?</p> <p>Also, should be net habitat. There could be new barriers installed that block (decrease) habitat.</p> <p>Note that there is no complete inventory of barriers anywhere yet.</p>
<p>Water</p>			<p>1. Acre ft protected during year</p> <p>2. # miles of stream affected by improved flow</p>	<p>The second metric, # of miles of primary stream reach improvement, does not sound like it relates to water conservation. It sounds more like physical habitat improvement. Is the second metric better described as "# miles affected by improved flow"?</p> <p>Would a better (more concise) name for this indicator be "Water flow enhancement"?</p>
<p>Land</p>			<p># of riparian miles protected,</p> <p># of acres protected</p>	<p># of riparian miles protected,</p> <p># of acres protected.</p> <p>Would a better (more concise) name for this indicator be "Land protected"?</p> <p>If this Indicator is for all land protected, might it be a better idea to separate out land purchase/easment/protection into the purpose for protecting, such as Lands protected for wildlife and Lands protected for fish?</p>
<p>Habitat Improvement</p>				

<p>4. Habitat</p> <p>seems to be program measurement, not biological. Many types of improvements are listed. Perhaps break out by type or purpose of habitat improvement.</p>	<p>Miles, acres.</p> <p>Increase Instream Habitat Complexity, Realign, Connect, and/or Create Channel, Create, Restore, and/or Enhance Wetland, Enhance Floodplain, Install Fence, Plant Vegetation, Practice No-till & Conservation Tillage Systems, Upland Erosion & Sedimentation Control...)</p>	<p>Bonneville Power Administration's PISCES database. Specifically combining work elements #29, 30, 40, 55, 180, 181</p>
Screens		
<p>5. Installed fish screens</p>	<p>Quantity of water protected in acre-feet</p>	<p>Bonneville Power Administration's PISCES database. Specifically, work element #69</p>
Predators		

1. Acres of habitat improved.
2. Miles of stream habitat improved

Stream miles enhanced (physical habitat) or protected.
acres of terrestrial habitat protected / improved
acres of riparian habitat protected / improved

Two basic metrics.
If there is a universal estimator for instream habitat complexity, then that might serve as a third metric, although it would have to be applied to the entire ESU/DPS range to show changes over time, a significant challenge to measure. This would be a better metric to measure improvements on a project by project scale, not as a High Level indicator at the ESU/DPS scale.

This should probably be separated out into a number of categories, based on the intended purpose of the habitat improvement, at a minimum, separate fish from wildlife purposes.

1. Acre ft of flow screened during the year.
2. # of screens installed during year

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2. # of screens installed during year

Two different metrics - volume protected and number of screens.
Do you want the Indicator to be screens installed during the year (and presumably used in subsequent years), or do you want to keep a running tally of all screens installed cumulatively, so that the Indicator shows an increasing trend in installed screens over the years?

6. Number of juvenile salmon saved from all predators	<p>Include pikeminnow, avian predators, sea lions and others as appropriate.</p> <p>Sea lions are more important as predators of adults, not juveniles.</p>	<p>Pikeminnow project: 2007 37% reduction in predation, about 5 million fish. Avian predation is available and sea lions are pending.</p> <p>Note that sea lions are not a primary predator on juveniles. We recommend a separate indicator for adult predation.</p>
Watershed Health Indicator		
7. Number and percentage of targeted watersheds that provide adequate fish habitat	<p>Need to develop watershed health indicator for fish. Should include measures of water quality.</p>	<p>Being developed through Executive Summit, Task 3.</p> <p>AREMP may have indicators</p>

juvenile salmon protected from predators.

(Will this be broken down by type of predator, or simply be a total # saved?)

nesting pairs (decrease) of several avian species.

pikeminnows removed

Consumption rates of each predator species, by species consumed.

This is an ambitious indicator (but important).

This indicator is focused on juveniles, but predation of adult fish returning (arguably the most important individual fish) are also subject to predation losses. We suggest there should be a similar indicator for adult predation, and reference to sea lions moved to that indicator, as sea lions do not fit with this juvenile indicator.

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Interesting indicator. We don't know how to calculate this one.

Are there any potential indicators missing?

what questions are these indicators trying to address? It would help to state the question, and that might help people suggest specific indicators to answer them.

What calculations are they anticipating?

Clarify whether these indicators are intended to be universal for the Columbia Basin, or do they relate only to efforts funded through the Fish and Wildlife Program? The FWP is only a subset of activities in the basin.

It may be helpful to identify the cases where the intended indicator is already calculated or available, as compared to the many cases where a specific indicator will need to be newly created or calculated.

A number of data types are not yet assembled regularly on a comprehensive basis across all entities. These include Barriers, Diversions/Screens, Habitat Restoration Projects, etc. StreamNet could be directed to pull those data together on a regional basis.