**Fish Tagging Forum**

**Meeting Notes**

**Tuesday February 19, 2013**

Northwest Power and Conservation Council

**Introductions/Meeting Objectives/Recap of Last Meeting**

Therese Hampton and Tony Grover provided an overview of the update the Fish Tagging Forum (FTF) representatives provided to both the Council’s Fish and Wildlife Committee and the full Council during its February 2013 meeting. The FTF representatives provided an overview of the FTF process, the methodology used, and the depth of the work being done by the FTF. The presentation was well received by members of the Committee and of the Full Council. The members reacted well to the scope and depth of information that has been gathered by the FTF to date and how that information is being used and displayed, such as with the spider chart tools. The PowerPoint slides and memos presented during the February 2013 Council meeting are appended to the agenda items “Update on Fish Tagging Forum” and “Briefing on Fish Tagging Forum” and are available ([here](http://www.nwcouncil.org/news/meetings/2013/02/))

Kevin Kytola went over the [agenda](http://www.nwcouncil.org/media/134312/agenda.pdf) items to be covered today. No changes were made.

**Bonneville (Rick Golden) & USACE (Mike Langeslay) Tagging Cost Information**

Rick Golden (Bonneville) presented updated information on the cost per tagging technology funded by Bonneville Power Administration (Bonneville). The spreadsheet provides updated information on the cost associated with genetic tagging as well as inclusion of some projects previous omitted for other tagging technology types (see [BPA Tagging Cost Summary](http://www.nwcouncil.org/media/4897041/BPATaggingCost.xlsx)). In this updated sheet, the cost is augmented by about 2 million dollars; the increase is mainly related to the addition of the genetic projects. In the spreadsheet, the $500 associated with project number 2010-028-00 is used to cover the additional incremental cost associated with taking the fish samples for genetic analysis. This spreadsheet should now contain all the vast majority of the Bonneville tag related spending. Amounts that may not be captured in this spreadsheet would consist of overhead that is not always represented within the contract’s work elements.

Mike Langeslay (ACOE) stated that the cost information presented in a previous spreadsheet provided by Jim Ruff in February 2012 [AFEP Tagging Project Estimates](http://www.nwcouncil.org/media/23291/afep_tagging.xlsx) is close to being correct and should contain an adequate level of detail to meet the discussion needs of the FTF.

***Group Discussion***

How precise do we need to be with the ‘indirect’ or ‘overhead’ et cetera aspect of the Bonneville tagging related cost? We have currently chosen to roundup estimates of cost, will the FTF need more accurate estimates?

* The current level of accuracy should suffice. We should, however, inform people that the cost numbers provided in the spreadsheet still have some margin of error, such as some of the information contains overhead costs whereas others don’t.
* The current approach to rounding to the nearest hundred thousand is fine.

Is it worthwhile to separate out what is Bonneville’s direct spending versus reimbursable tagging cost when this cost information is eventually presented to the Council?

* Yes, the funding from Bonneville should be depicted to show what amount is directly funded by Bonneville versus what is indirectly funded as a reimbursable cost from other programs (e.g., Willamette BiOp, ACOE AFEP, etc). This should also indicate specific obligations that are subsumed in the Fish and Wildlife Program such as the LSRCP.

Do we want to obtain the Coded Wire Tag, PIT Tag, Genetic marking regional cost versus Bonneville direct cost? What is needed to get this information?

* Yes, we should have an understanding of how others are using the various tagging technologies so that we can have an appreciation of how a decision to alter Bonneville funding to a given tag type (CWT, Genetic, Otolith) may impact others. It is important to have an understanding of the context within which the Bonneville funded tags reside.
* Information about use of CWT by Bonneville and others was presented by George Nandor (PSMFC) during the May 2012 FTF meeting (see [CWT costs and map](http://www.nwcouncil.org/media/23344/CWTinfo.pdf)), so it will be easy to extract that information.
* PIT-Tag is a very Columbia River Basin centric tag technology, so what is done in the Basin likely represents the vast majority of activities using PIT tags.
* We know that others fund genetic tagging, such as the state of Washington and Alaska but likely this doesn’t represent a large amount. It should be fairly easy to capture the non-Bonneville funded genetic tagging work in the Snake River Basin. Perhaps we can access more information by contacting those that maintain genetic databases such as NOAA-Fisheries (Seattle) for the GSI-database database.

What about the amount of funds invested by the PUDs on PIT-Tags and Acoustic Tags?

* Leah Sullivan from Grant PUD provided a spreadsheet and a summary describing the cost and use of PIT and Acoustic (see [Grant PUD Survival Studies](http://www.nwcouncil.org/media/4897023/GrantPUD.docx) and [Excel](http://www.nwcouncil.org/media/4897026/GrantPUD.xlsx) ).
* Tom Kahler also summarized the Chelan PUD’s and Douglas PUD’s tag related cost in an attachment (see [DC PUD](http://www.nwcouncil.org/media/4897044/DCPUD_PITAcoustic.docx)).

***Action Items***

Rick Golden (Bonneville) will modify for the March 19th Fish Tagging Forum meeting the information of the Bonneville Direct and reimbursable tagging related costs by:

* 1. Rounding all costs to the nearest $100,000.
	2. Integrate BPA/Corps cost information and present in the following categories:
		1. F&W Program
		2. USACE Reimbursable
		3. Other funding commitments (e.g., Lower Snake River Compensation Plan)

ID (Pete Hassemer), WA (Dan Rawding), OR (Tom Rien) and PSMFC (George Nandor) will meet to discuss the development of cost estimates for regional investments in tagging technologies beyond the Bonneville-funded efforts.

**IEAB Cost Effectiveness Evaluation Update (Bill Jaeger)**

Bill Jaeger provided an update on the IEAB effort since the last meeting, including what has been put together so far and the status of the IEAB cost effectiveness model**.** This includes what needs to be done and what else could be done to answer some of the FTF questions. Bill provided two handouts which describe the model and its assumptions (see IEAB [model](http://www.nwcouncil.org/media/4897029/IEABModelAppendixA.pdf) and [description](http://www.nwcouncil.org/media/4897032/IEAB_LPModelDesc.docx) ). To develop the model to its current version, Bill has been interacting with tagging experts in the basin to gain a better understanding of the topic and to access data to populate the IEAB model.

This IEAB fish tagging model is a linear programming/integer programming model of the Columbia River system, fish populations, and fish tagging objectives. The model represents the full fish life cycle, normalized to a one-year scale for number of smolts, detections, harvests, etc. The model simulates juvenile and adult migrations, ocean survival and fishery harvests. Tagging options include PIT, CWT, PBT and GSI. Other tagging technologies are not included at this time. The model uses a 10-year average of Columbia River Basin hatchery tagging information for spring Chinook, steelhead and fall Chinook. Using wild fish data for the model is proving to be a challenge.

Bill provided an overview of how the model functions and assumptions used. In general, the model relates the number of desired detections at specific locations to the number of fish that must be marked and released upstream. The model can then solve for the least cost technology to attain the desired number of detections. In instances where there are multiple detection locations supported by upstream releases, the model will ensure that the minimum number of detections is achieved at each location. This results in some locations having more detections than their minimum requirement. The model can also be used to understand the number of detections and releases under a constrained funding scenario. This could be used to evaluate any gaps in coverage due to a limited funding scenario. There are some discrepancies in the model that need to be worked out. For instance, there appears to be errors in the steelhead portion of the model. The IEAB modeling team is still not satisfied with the cost aspects of the model that aims to reflect the cost of the various tagging technology (CWT, PIT, PBT, GSI) so they will continue to work on improving this aspect. Once the various components are improved the IEAB modeling team will have better results that will be more interesting to the FTF.

***Group Discussion***

The IEAB is still working out some errors that are appearing in the model such as those related to CWT tagged Steelhead.

* CWT errors in the model may be due to having releases of steelhead that are not marked with CWT.
* Perhaps the 400 CWT steelhead detected from the Klickitat River at BON dam are not actually from Klickitat. Perhaps Klickitat in the model refers to both the Wind and Klickitat rivers, and if so, then that might be why the data shows 400 steelhead detected at BON.

The IEAB would like to receive input from the FTF members about where the model’s assumptions may be too simplified to reflect reality, as well as any other reactions and input from the FTF members as to how to improve the model.

* It looks like the model assesses the required detection by looking at various data sources, some from dam detection and some from commercial harvest.
* If the model assumes that all stocks of Chinook are randomly harvested that isn’t accurate since the various stocks have different ocean harvest rates.

Can the model capture or depict how the same tagged fish can be used multiple times to inform different questions? For example, a given PIT–tagged fish serves multiple uses, such as obtaining overwintering survival, SAR, harvest, effect of transportation, etc.

* The way PIT tags are modeled the multiple detections and detections at different stages of the life cycle are captured. But the model doesn’t currently identify how a given tagged fish can be used to answer multiple questions.

Can the model tease out the “free rider” aspect of tagging (i.e., indicators/management questions that are assessed using data that was being collected and funded for another purpose). .

* Not really unless the needs for the study are specifically states and can be expressed as a needed detection

If you only have the model consider a simple cost-detection relationship you lose the free rider information.

* Yes that is true, so next step is to have the model tie detection needs to the questions. Then this should allow us to capture those mutual beneficial aspects. But the IEAB is not there yet with the coding of the model. The management question spreadsheet will help inform this aspect of the model.

Is it possible to have a ‘benefit’ calculator within the model?

* This would require this group to input this information, and prioritize the indicators, from low to high level of importance. I think we might be able to use prioritization to inform this aspect but we don’t want to go too far down this path.

Do you think this model will help you identify the threshold where data efficacy drops off?

* To a limited degree, if we reduce the amount of tagging technologies being used, we could start seeing cost changes and things that become infeasible since the remaining tag technology can’t provide the necessary detections. This may require a non-linear model. If we have fixed costs there will be non-linear outcomes depending on the scale of the variable costs (e.g., a fixed cost for a single detection array versus the variable cost of number of fish tagged).

I am interested in how the model could assess the tradeoff between tagging more fish versus increasing detections so that we could assess whether we should invest in tagging more fish or installing more detection infrastructure. Another tradeoff of interest that perhaps the model could inform is whether you should tag more fish and then spend less time sampling or if you should tag fewer fish and increase the sampling rate.

* the model can inform the mix of tagging and sampling that can produce the answers you want but not sure if what is produced by the model will be realistic or not.

Sounds like the model could serve to inform the FTF about the cost-effectiveness of alternatives developed by the FTF and this information could inform policy discussions.

* Yes, that is possible for the four tag technologies in the model. We can report the model results and let the decision makers know the limitation of those results (like the loss of the complementary / free benefit aspect).

It would be useful to know if the model is sensitive to the number inputted for variables, such as the % SAR information.

* Yes. It is good to assess the biology sensitivity aspect of the model. We need to figure out what numbers biologists are comfortable using in the model.

Can the model assess the overall effectiveness of the program and the effectiveness of individual projects? Can you use the model to assess if a project is more effectively done by using PIT or genetic or some other tagging technology? Will you be looking at variation across programs?

* The model doesn’t look at the objectives of individual programs, but looks at the desired indicators for a given subbasin. So the model is forced to tag enough fish to meet those objectives/indicators.

If you have an indicator that is needed for Willamette area of the basin and to meet the information needed by that indicator you need to have at least 200 CWT fish in the Willamette, will the model spread-out the CWT detection requirement for this 200 fish across all detection sites in the basin or only among the Willamette detection sites?

* The model will focus on meeting the detection rates for the Willamette, and will assess the various tag technology to get that info.

Is tag detection probability in the model?

* Yes.

Is the detection entered into the model by reaches?

* The detection is by the subbasins (~60 subbasins).

Will the model be able to determine whether the cost effectiveness of a tagging technology differs whether it is used at a small scale or at a large scale?

* The way the model is built that would not be the case. But it could be built that way if needed. In general, if there is a large fixed cost then spreading it over a larger area would improve the cost effectiveness of a given technology. .

When can we expect to see results of the model?

* We will soon have results, but not sure yet how confident we will be in those initial results because we may need to ground truth more of the model’s input assumptions.

***Action Items***

IEAB should discuss the model with Rich Zabel (NOAA). Rich works on NOAA’s salmon life cycle model, and he may be able to truth the model’s assumptions for the IEAB. IEAB should contact IDFG as well to discuss the assumptions of the model.

The PIT vs. CWT description shared by Dan Rawding to inform the model will be attached to the Feb 19 meeting notes ([Rawding description of PIT versus CWT](http://www.nwcouncil.org/fw/tag/2013_02/rawding.docx)).

**Scenario Analysis – Coded Wire Tags (Kevin Kytola)**

Kevin provided a recap how what was done with the spider chart to date, such as adding Scales as a tagging technology type. Kevin also went over the color legend used on the chart, such as the ‘blank/white’ slices in the box is where CWT was eliminated. Kevin restated that the main goal is to identify the primary tag for each indicator and the consequences of losing a given tagging technology. This exercise will help the FTF explore the value of CWT by identifying the theoretical consequences of not investing in the application of CWT ([CWT elimination](http://www.nwcouncil.org/media/4897035/KytolaCWT.pdf) ).

Kevin shared a draft document that shows what can be done with the prioritization that has been done thus far. Currently, this prioritization consists only of the NPCC staff’s prioritization. If other entities want to add their priorities we can add it to this document ([Indicator Analysis](http://www.nwcouncil.org/media/4897038/KytolaIndicator.xlsx)) ; the document also summarizes whether more than one technology informs the indicator, and indicates if the various tagging technology is assigned a primary, secondary or not applicable status for the various indicators. This document is a way to depict the ‘spider chart’ information gathered in a format that allows us to more easily sort the information.

Kevin mentioned how the primary and secondary tag technology assignment on the Spider chart right now focuses on the current use and not what might be the best technology in the future or near future.

***Group Discussion***

With regard to determining priority/preference for a given tag technology, we need to understand practical constraints on their applications. For example PIT is used more above BON because we have had a large investment in infrastructure, whereas below BON we don’t use PIT much since we haven’t had the investment in detection infrastructure or the technology to obtain high detection rates.

* One thing to consider is that we don’t need to only invest in detection infrastructure to improve detection, we also need to have good locations to install this detection infrastructure. The investment above BON occurred because the dams are there to install detection infrastructure. The same opportunity does not exist right now below BON Dam in the estuary.
* Perhaps the FTF recommendation is that we do use PIT tags above BON because we can detect them, but since we can’t detect them as well below BON we don’t rely on PIT as much.

We might also want to consider the cost in the future, for example genetic markers may become a preferred tag once the cost decreases. We may want to assess what is the projected cost over time to help inform this aspect?

Perhaps we should focus on current use of tag technologies in the Spider Chart, and then look it over again and see if there are some technologies we may want to change over time?

* Agree, as this would allow a short term and a long term look at tag technology use.

*See table 1 summarizing the group’s assignment of primary and secondary tag technologies for each of the indicators and discussion of the consequences for losing information gathered by CWT.*

***Action Items***

The FTF participants should look over the various ‘eraser’ scenario analysis and make sure we appropriately captured the consequences of losing the genetic marking technology.

Nancy will send out a doodle poll to set up a conference call to complete the CWT eraser game.

The FTF will come back to the discussion of SARs and the importance of the given tagging technologies at a future meeting.

The FTF will come back to a general discussion of harvest management and the responsibilities under the F&W Program.

PIT Tag eraser game will also be postponed to a future meeting.

**Discuss Preliminary Thoughts on Recommendations (Kevin Kytola)**

Kevin led a group discussion about what the group envisioned as potential recommendations. Note that these discussions were only for brainstorming purposes and are not intended to represent proposed recommendations.

Tony Grover shared with the group some graphical tools he has been developing to help him start thinking about potential draft recommendations (see [Draft Tagging Summary](http://www.nwcouncil.org/media/4897047/TaggingSummary.pptx) )

Should the FTF consider writing up draft recommendations based on what would occur under various scenarios, such as recommending that genetic marking be limited as a pilot in the Snake River Basin, or assessing the impact of removing Bonneville funding for CWTs, or recommending that the ACOE perform their acoustic tag tests less frequently?

Perhaps the FTF should consider providing both short-term and long-term recommendations. This approach would allow for the time needed to close out/ramp up certain tagging technologies at a logical pace. Perhaps this could consist of:

* For the short–term recommendations, evaluate gaps, overlaps, inefficiencies (balance savings with compromises in data quality, building blocks to the long term), and aggregate management question / indicator priorities.
* For long–term recommendations, identify policy choices and technology advancements.

We need to clearly define what we mean by short-term and what we mean by long–term recommendations.

* Perhaps short-term recommendations focus on today’s reality (efficiencies);
* Whereas the long-term recommendations can aim at getting us to a future desired state by providing short-term answers to continue meeting information needs on an annual basis and the longer term answers using advances in tagging technologies to become more efficient, such as with genetic technology.

Perhaps we can spend one of the FTF meetings trying to reach consensus on the prioritization of management questions and indicators. This could inform the IEAB model and help develop recommendations that can improve the current mix of tags used and tagging infrastructure.

In our recommendations we need to acknowledge that a tag technology could change over time.

When developing our recommendations we should consider building off of existing tagging infrastructure. That infrastructure, combined with geographic location and species of interest, can really influences the tag types chosen in the past and what technology could be used in the future. For example, PIT tag detection in spillways is being tested at Lower Granite Dam in 2014.

What about considering within our recommendation other species that may be of interest in the future? For instance, lamprey is gaining attention and efforts to improve tagging technology for this species are increasing. What if we have to answer impacts of FCRPS on new species of interest, such as smelt?

Perhaps we should consider the constraints that may impact our recommendations? For example, will the management questions change or are these pretty much going to stay the same? Perhaps the questions will not change much but their prioritization will? We know that the management questions have changed significantly over the last 14 years due to new legal obligations such as treaties and biological opinions. Some of these are still in a state of flux so it is hard to predict what will occur with the management questions in the future. So we probably need to recognize that there could be some changes in management questions in the long-term. For example, if lamprey were to be ESA-listed, this probably could have some impact on the questions.

***Action Items***

Council staff had assigned NPCC high, moderate, neutral, and no interest to each of the indicators. This prioritization information can be used to sort by priority the tagging technology and the indicator information. This assessment would benefit from having other entities providing their prioritization to the indicators. Having this additional information will inform our understanding of the alignment of priorities among entities and the consequences of FTF recommendations and future policy decisions. Kevin encouraged those interested to provide their prioritization of the indicators directly to him.

**Recap and Plan Next Meeting**

Conference call to finish up the CWT Eraser Exercise will be scheduled prior to the March 19th FTF meeting. See the FTF website for details.

March 19th FTF meeting, agenda topics will include completing the PIT-tag eraser game; an update on the cost aspect of the IEAB model; a discussion on the tagging technologies needed for the different SAR indicators; development of draft recommendations. See the FTF website for details.

March 28th FTF meeting, consult the FTF website for details.

April 25th FTF meeting, consult the FTF website for details.

May 7-8 Council meeting, the FTF will present their draft recommendations to the Fish and Wildlife Committee.

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| Table 1: Assignment of primary and secondary tagging technologies for each indicator and discussion of the consequences of losing CWT information. |
|  | **Hatchery** |  |  |  |  |  |
| **Hatchery** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1B (adult harvest / return/ escapement) | CWT primary.Genetic is a strong secondaryException is with SR Chinook and SR steelhead use genetic as primary. Genetic is a strong second but currently it weakens as the fish is sampled further down river and into the ocean; also more application of genetic to steelhead than for fall Chinook for example. Would need some ramp up for genetics to be a good backup, would need to expand baseline.Otolith: would need everyone to mark in order to effectively support this indicator (N/A)Scales N/A | The closer to the ocean, less reliance on geneticsPIT not a good back up but could be used in some cases, such as above BON Genetics and PIT tags in lower Columbia where all ESUs are present🡪 different applicability | Fall Chinook,Snake River Chinook,Snake River Steelhead | Significant consequence w/out CWT in areas other than the SRB. However, there is hesitation to rely on PIT tag data for hatchery recoveriesIn the future (Pete, IDFG), they are cutting CWT from steelhead programs so must rely on genetics. | What is needed to support this indicator is a baseline of stock. Ramp-up of genetics to fill the CWT gaps, PIT is not a complete secondary back-up (except for in-river harvest) |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Hatchery** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1C (adult to survival rates) | CWT is primary. For run reconstruction, CWT gives more info than PIT since PIT may be lost when fish gutted in ocean harvest.Replacement technology is genetics (soft secondary from last time) but now a stronger secondary and address future long-term needs. (Genetics is primary in some instances)PIT are more a weak secondary. | from BON or Lower granite to Priest 🡪 PIT tags would be primary for run-reconstruction. - If this indicator means tracking fish all the way back to hatchery (single-origin) then no mark required (just count the returning fish)– no way to get ocean data with PIT tags, genetics makes sense then for ocean fish (strong second). In-river tag applicability depends on locations (genetics vs. PIT for secondary). |  | Site-component is important. Without CWT, genetics is about the only other thing to rebuild history of stock (PIT tags are often lost when fish is gutted)Otolith: very specialized use (s) - -if all-else fails. Priest Rapids Hatchery is learning about the results discrepancy between CWT and otolith. Otolith are time-consuming and ‘art’ to read. Costs are recovery and analysis/processing. Theoretically a valuable low-cost backup (marked efficiently) | Do you need any tags to support this indicator? Depends on species and location. Counting should be sufficient. Tags are needed to understand harvest mitigation decisions as part of requirements. |  |
| **Hatchery** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 2A, 3D (Proportion and origin of hatchery fish within natural spawning populations) | CWT primaryGenetics strong secondary. Genetics can give you proportion and origin, as long as have PBT. GSI might not be enough to get origin since wild may looks like a hatchery and vice versa.Without CWT, the backup is PBT tagging (GSI is N/A)Adipose is primary for proportion part of indicator. Origin is a different question.Scales – more value for this indicator than otolith. Scales can be separated based on origin, but more mature fish have no scales. Location / population specific can apply to scales 🡪 this is a functional technology but has been buried by more ‘modern’ technologies (i.e. hidden in the closet, outdated)Otolith: matter of implementation. If everyone’s using it, it can be secondary/primary need to have this future discussion |  |  |  |  |  |
| **Hatchery** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 3A (Adult abundance) | Adipose is primary, Genetics is weak secondary. CWT is limited to cases where it’s used in wild stock. Typically wild or listed stocks are not tagged, but a few instances where they are. Typical tag application:-wild fish = no mark or tag-hatchery fish, intact adipose but CWT tagged -supplementation fish = adipose clip Wild/listed fish have limited use with otolith, scales, or CWT. Captive brood stock or supplementation fish are primarily CWT tagged. W/out CWT, we would back it up with PIT 🡪 but PIT is only effective in some instances.Supplementation and conservation hatchery program, CWT must be primary because it’s equivalent to adipose = (Pete says CWT is one of the most efficient marks with limited handling, cheap and easy to apply). Price difference between blank and CWT is insignificant, so often CWT is used to have benefit of more data. | SRB |  |  |  | What is this indicator exactly? Does it tie back to hatchery? Where are we counting fish? Clarification: Fish tracking should be back to the watershed where it is from. If the goal is brood stock management, you want to be sure that every fish of a certain origin is identifiable (i.e. visible mark or genetics) Is the SRB using CWT or genetics? 🡪 if fish is spawned in the hatchery, the fish is genetically marked. At an individual hatchery, the conservation program fish must be passed up above the weir w/out handling. If the fish has CWT it doesn’t require handling to pass through. CWT is used for instantaneous detection and decisions to separate hatchery from wild.  |
| **Hatchery** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 3B (juvenile productivity -natural origin fish for supplementation) | PIT is primaryGenetic is weak secondPIT tags or genetics is common (application is to run a screw trap, PIT tag, and recapture for data).PIT tags or genetics are the only applicable tags. CWT = N/AOtolith and Scales = N/A  |  |  |  |  | Would need to do a mark/recapture to know productivity. Definition: Natural origin fish from supplementation Discussion of definition:1) If the question is ‘Are your fish producing offspring?’ then use Genetics2) If the question is ‘Did all of the fish – including natural and hatchery – produce?’ Then the fish need to be recaptured (i.e. live tag) |
| **Hatchery** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| SARNote: FTF differed discussion about all SARs to later | CWT is primaryGenetic secondary. Without CWT, rely on PIT or genetics.PIT secondaryScale soft secondarysame assumptions apply as for 1COtolith and scales = special purpose, otolith marks are used for Chum SARs |  | Chum |  |  |  |
|  | **Habitat** |  |  |  |  |  |
| **Habitat** Indicator: CWT | Primary/Secondary | Geographic Coverage |  | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1C (spawning distribution) | Visual observation is adequate method if there was not pit or other tag available. If can’t count directly then PIT is primary and genetic is weak secondary Primary vs. ‘best’PIT – as long as fish are tagged downstream (and genetics with the right baseline), we can figure out where the fish are going. Otolith are a weak supporting / Otolith, not applicable (verify)CWT not needed to get this infoRadio , specialized useAdipose not applicableScale not applicableFallbacks for information that are not tagging-related-CWT data is almost N/A for spawning distribution (for Idaho), but as addressed in Hatchery 2A/3D, the stock of origin is addressed. This is specific to tributary improvements and habitat contribution |  |  |  |  | Main question: Is the improved habitat affecting production? -Don’t necessarily need PIT tags and arrays to understand where fish are going (i.e. we can just count them going upstream) |
| **Habitat** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1D (fish in) | PIT primaryRadio primaryGenetic weak secondaryCWT specialized use (areas without pit tag arrays we would lose t info on the distribution in these geographic areas) Stock composition associated w/ fish in = this is more applicable to CWT than spawning distribution (1C Habitat)Otolith not applicable |  |  |  |  |  |
| **Habitat** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1E (Fish out) | PIT primaryGenetic weak secondaryCWT not applicableAcoustic not applicableRadio not applicable |  |  |  |  |  |
| **Habitat** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 3f (maturation) | Genetics weak secondaryCWT primary, can determine maturation rate in the oceanPIT not applicable |  |  |  |  |  |
| **Habitat** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 3b(growth rate) | No CWT usedPrimary otolithCwt weak secondary (verify) |  |  |  |  |  |
| **Habitat** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| SAR Note: FTF differed discussion about all SARs to later |   |  |  |  |  |  |
|  | **Hydro** |  |  |  |  |  |
| **Hydro** Indicator: CWT | Primary/Secondary | Geographic Coverage |  | Net Cost Consequences | Measurement Confidence Impact | Other |
| SAR Note: FTF differed discussion about all SARs to later | PIT primary for figuring out conversion rateCWT secondary since can inform harvest aspect of the SAROtolith weak secondaryGenetics weak secondaryTo be completed later |  |  |  |  |  |
| **Hydro** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 4D(i) ( tributary survival straying rates) | PIT primaryCWT not applicableRadio weak secondGenetics not aplicable |  |  |  |  |  |
| **Hydro** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 4D(ii) ( spawning success) | No applicable tagging technology because it can’t be assessed since we don’t know if the parents of the juveniles were transported or not. |  |  |  |  | Definition: did the adult spawn or not? The only way to measure this is to ID if the fish made it back to its native stream (where it was transported from)Indicator N/A to the question 🡪 should be under population status and recovery \*Remerge with (i)\*  |
| **Hydro** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 4F (Predation rate) | CWT not applicablePIT is primaryAcoustic not applicable |  |  |  |  |  |
|  | **Harvest** |  |  |  |  |  |
| **Harvest**Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1A, 2C, 3D (run size forecast) | CWT = primary. Strength of CWT, lots of populations taggedPIT/Genetic = strong secondary. PIT tagging across populations has been lower in breadthGenetics is moving into a strong secondary (better steelhead and wild stock forecasting due to genetics)ID , in SR basin, uses multiple tags for reconstruction, CWT are additive to PIT and geneticCSS has done forecasting work with PIT Replacement for Spring Chinook? This data is hard to replace | SRBWithout CWT, the lower river loses the most (sibling forecast or wild forecast) | Spring Chinook |   |  | Council interest addresses adequate harvest opportunities as part of mitigation? 🡪 from Tony1. Harvest opportunity
2. Conservation responsibility of harvest accountability (and the connection to BiOp)

-Forecast incorporates multiple tag types |
| **Harvest**Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1B, 2D,3F (inseason updates) | Important variation by species, so hard to generalize which tag tech is bestVisual stock identification related to spring Chinook in the 1980s; can determine up-river or lower-river fish. Steelhead in-season doesn’t need a tag (watch them go across dam)PIT is primary for some. Fall Chinook – weekly phone call forecast based on PIT tags. Spring Chinook – variable tags in SRB, PIT tags are primary (stock-specific information)CWT primary for some. Sampling fisheries for CWT to update run sizesGenetics weak secondaryAdipose secondary, in general, but adipose is Primary for Spring Chinook (species-specific), steelhead it’s also primary | Snake River BasinUp-riverLower-river | Spring ChinookSteelheadFall Chinook |  | CWTs are used to get an error rate on the visual identification.  |  |
| **Harvest** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1C, 2D, 3F (post season run reconstruction) | CWT primary, Adipose strong secondary\*Adipose mentioned, but not included in the management question spreadsheet\*genetics as weak secondary PIT is a future potential, applied exclusively for some stocks |  | Fall chinook |  | Without CWT, backed up with genetics and Pit, but reduce the resolution of data Rough shape for fall Chinook. Not a gap, but increase uncertainty vastly | All available information contributes to run reconstruction (just because CWT is primary, all tags contribute) |
| **Harvest** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1D, 3G (stock specific harvest by fishery) | CWT primaryW/out CWT, fallback would be genetics because of broader coverageAdipose also included as (2) – primary for some regions/stocks | ocean |  Coho Fall Chinook | Biggest impact are on species harvested in the ocean. This would be especially difficult for Coho and Fall Chinook because they are intercepted in the ocean | If no CWT, lose stock specific information and increase the uncertainty | PIT – some tag groups aren’t large enough to get stock-specific harvest rates. (in this case, you get aggregate harvest rates) (1) |
| **Harvest** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1E ( ESA listed populations impact rate) | Some wild fish represented by CWT but it depends on the wild stock, some are not tagged with anything. Hatchery fish are sometimes used as surrogates for the wild populations = using CWT CWT primaryPIT is a secondary (below BON get no info, above BON some areas would not have info). Aggregate both CWT and PIT tags. PIT tag (1) because of synergy. But not enough PIT tags to replace CWT.Genetics is a strong secondary and good at ESU/MPG scaleAdipose – included in some stocks | PIT tag harvest for sport fishery below BON, zone 6. Genetics could be expanded elsewhere but currently has not. For individual population not enough of PIT, but for ESUs there are enough PIT 🡪depends on tagging location and what % of population is ESU | SteelheadESUs | With ONLY PIT tag, good data above BON and parts of upper COL and SRB. NO story below BON w/out PIT tags . . . Even above BON though it’s species-specific  | PIT tags from screw traps and mark/recapture are too few for wild fish* With fewer tags out there, (lower harvest rates have decreased and thus recover fewer tags)

Wild fish are aggregated also with other returns with CWT (same conditions whether wild or hatchery). E.g. 0%-40% for steelhead with PIT tags (small sample size), but pooling of PIT and CWT averages the effects of small sample sizes. |  |
| **Harvest** Indicator: CWT | Primary/Secondary | Geographic Coverage | Species | Net Cost Consequences | Measurement Confidence Impact | Other |
| 1H (release mortality) | Primary = PIT since in-river release mortality is relying more on PIT and some radio tagsPrimary CWT since very important for Coho and (Chinook?) weak secondary acousticweak secondary radio. Radio tag is a great tool, but we’re not really using it. If we didn’t have PIT infrastructure, we would use radio tags. | In-river | Cohochinook |  |  | Release mortality of wild fish = release certain portion of hatchery with adipose intact and CWT in them. Compare return of two groups and ID release mortality |
|  | **Harvest Indicators to be completed by a conference call** |  |  |  |  |  |
|  | **Population Status and Trend** |  |  |  |  |  |
| **Population S&T** Indicator: CWT | Primary/Secondary | Geographic Coverage |  | Net Cost Consequences | Measurement Confidence Impact | Other |
|  | **Indicators to be completed by a conference call** |  |  |  |  |  |
|  | **Predation** |  |  |  |  |  |
| **Predation** Indicator: CWT | Primary/Secondary | Geographic Coverage |  | Net Cost Consequences | Measurement Confidence Impact | Other |
|  | **Indicators to be completed by a conference call** |  |  |  |  |  |