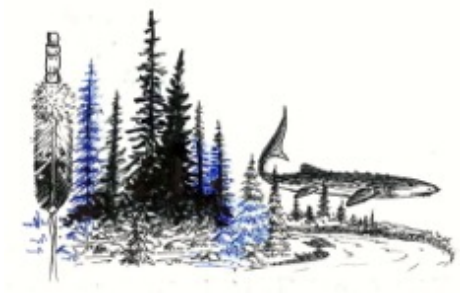

MEETING SUMMARY

Kootenai River Habitat Restoration Program
Meeting to Coordinate Hydraulic Modeling and Biological Monitoring and Evaluation

Thursday May 19, 2016
Spokane, WA

Attendance

The following individuals attended all or some of the meeting: Matt Daniels (RDG), Ryan Fosness (USGS), Ryan Hardy (IDFG), Greg Hoffman (USACE), Charlie Holderman (KTOI), Sue Ireland (KTOI), Rich McDonald (USGS), Chris Nelson (RDG), Jon Nelson (USGS), Tom Parker (Geum), Mike Quist (Idaho Coop Unit, USGS/University of Idaho), T.J. Ross (IDFG), Pete Rust (IDFG), Brad Shepard (BB Shepard & Assoc.), Alison Squier (ZCR), and Shawn Young (KTOI).

1. Meeting overview

Sue welcomed everyone to the meeting and thanked them for their ongoing commitment to the Kootenai River Habitat Restoration Program (KRHRP). Alison explained that the meeting was suggested at the May 2015 Peer Reviewer Advisory Team (PRAT) and Co-Manager and Agency Review Team (CMART) meeting. The objectives for the May 19, 2016 meeting are to:

- Identify and discuss specific opportunities to use hydraulic modeling to:
    - Support testing of hypotheses regarding various limiting factors and/or causes of recruitment failure for Kootenai River White Sturgeon (Kootenai sturgeon), Burbot, and/or other KRHRP native focal fish species
    - Support design of habitat restoration projects
    - Inform analysis of and/or efforts to enhance the food web in the Kootenai River
    - Enhance effectiveness of monitoring the biological response to KRHRP projects
- Identify potential collaborative opportunities and next steps

Participants also identified an additional objective, i.e., to build on prior discussions at the May PRAT/CMART meeting about how to better coordinate and integrate various monitoring activities to support Kootenai River focused monitoring program that moves away from individual projects objectives and towards monitoring and evaluating ecosystem and population responses.

2. Review "KRHRP specific" biological monitoring (e.g., habitat use, microhabitat)

1a. Overview USGS monitoring of KRHRP Substrate Enhancement Pilot Project and results to date

Ryan F. gave a summary of the USGS monitoring of the KRHRP Substrate Enhancement Pilot Project (SEPP) Shorty's Island and Myrtle sites. He also summarized the velocity monitoring that is planned for the 2016 spawning season. The velocity mapping will be timed for when eggs are on the substrate and they'll try to get near-bed velocities.

Questions and discussion:

- Brad S. - Do you anticipate that each year there will be some flushing of the substrates during the peaking events?
    - Matt D. – Yes. The modeling work showed that the surface will remain clean, but the interstitial spaces will fill to a certain height with a roughly a D90 interstitial space.
- TJ R.– Is the SEPP performing as expected?
    - Jon N. – So far so good. It definitely cleaned off after the December high flow.
- Brad S. – So that was a pretty high flow event with 40,000 cfs. What does your modeling say will happen if you have a 20, 000 cfs flow?
    - Rich M. – Both of the SEPP sites are erosional at almost all flows. We (the PRAT and CMART and designers) tried to pick a site where for almost all flow conditions the substrate would be cleaned. Higher flows just remove the sediment more quickly.
- Ryan F. – The Shorty's site is considerably lower than the Myrtle site (Myrtle site is higher on a clay shelf) and we've seen dunes pass through the Shorty's area. Next year USGS will try to do the video work during the spawning season to see if we see anything different.
- Matt D. – What do folks think about the available interstitial spaces we're seeing?
    - Pete R. – It's a good question and I don't know the answer.
    - Ryan H. – From the literature I've read, larvae need a lot of depth in the interstitial spaces. It would be very difficult to determine if survival is affected by the depth of interstitial spaces. In some of these other areas I've seen they can go 2-3 feet down.
    - Sue I. – When we were discussing this with the PRAT members, Larry H. and Mike P. said that a lot of interstitial space may not be necessary, just enough to be able to hide. That's where the D90 figure came from.
    - Pete R. – I would be curious to show these pictures to Steve McAdam, Larry Hildebrand, Jason McClellan, James Crossman, etc. to see what they think. Do they think this habitat looks good?
    - Shawn Y. – I think there's enough space there. They are only going to be there sedentary for a short time, about two weeks after that the big issue is that they have to forage out of that isolated rock patch. So that's the next issue – is there food to eat?
- Ryan H. – We could try to test this by releasing some larvae over the substrate and see what happens.
- Pete R. – Given how hard it is to capture larvae, we may not really know if this is working until they recruit to gill nets.

ACTIONS:

- KRHRP team to send images of SEPP substrate monitoring results to additional sturgeon experts (e.g., Larry H., Mike P., Steve M., Jason M., James C.) to get their input on the quality of the rocky substrate surfaces and remaining interstitial spaces for sturgeon egg attachment and larval hiding.
- At next Kootenai sturgeon APR, discuss possibility of testing substrate use by releasing larvae over substrate.

1b. Overview IDFG monitoring of KRHRP Substrate Enhancement Pilot Project and results to date

Pete R. reviewed the objectives of IDFG's KRHRP Substrate Enhancement Pilot Project (SEPP) monitoring:

- Objective 1 – Determine if habitat use of two SEPP locations has changed pre- versus post-treatment.
- Objective 2 – Determine if spawning distribution and magnitude on SEPP locations has changed pre-versus post-treatment.
- Objective 3 – Determine of larval recruitment has changed on SEPP locations pre-versus post-treatment.

For Objective 1, IDFG deployed a Vemco VPS telemetry system during May through July in 2015 and 2015 at both SEPP sites to evaluate adult Kootenai sturgeon movements within the VPS array area and on the specific SEPP areas. This will be continued for one more year at the SEPP locations. In the spring of 2017 IDFG would like to move the VPS sites upstream near Bonners Ferry to evaluate similar aspects of other KRHRP projects (e.g., Straight Reach project). Preliminary results suggest habitat use has not changed significantly as a result of the SEPPs at either site.

For Objective 2, starting in 2014, the IDFG deployed substrate egg mats to collect spatial and temporal spawning distribution pretreatment data from each site. They will continue this sampling in 2016 to see if distribution, timing and use/or use has changed as a result of the SEPPs. The sampling design includes three strata, one on the SEPP project, one above the SEPP project on similar habitat, and one above the SEPP project on the inside river bend in an area where eggs are rarely found. The mat sampling begins around May 11 and continues through July. More eggs were collected in pretreatment (2014) than 2015 at both sites. It is too early to conclude anything, but more eggs were collected off the SEPPs in 2015 than on at both sites.

For Objective 3, starting in 2014 the IDFG deployed paired larval nets below each SEPP to test new gear and document pretreatment larval abundance. In 2015, beginning 10 days after initial egg collection (early June through August), IDFG sampled two paired nets above and below each SEPP to evaluate any potential larval recruitment and subsequent drift. This effort will continue in 2016. Pete noted that they captured three larvae in 2014 (two at Myrtle, and one at Shorty's) but none in 2015. Sampling at night when larvae drift is difficult due to Kootenai River conditions.

Figure 1 shows the location of the SEPP monitoring sites and VR2W receivers, and egg mats in relation to one of the SEPP sites.

Pete reviewed data gaps and unknowns associated with the SEPP monitoring from IDFGs perspective:

- How many years of monitoring are needed to determine: if use is changed as a result of the SEPP pilot sites, if the SEPP pilot sites have changed other aspects of river morphology, and if the SEPP pilot sites have increased larval hatching success?
- What is the current measured physical status of the SEPP sites (embeddedness, subsidence, siltation), has it changed and is it still suitable habitat (note: embeddedness and subsidence questions are being answered by physical monitoring)?
- How or if the SEPP pilot project sites have changed other aspects of river morphology (note: this is being addressed by physical monitoring)?
- Not sure if mat sampling is a reliable indicator of spawning quantity.
- Is it necessary to quantify larval net sampling efficiency?
- Can modeling be used to help increase larval sampling efficiency?
- Possible use of genetic markers (parental based tagging, etc.)
- Understanding of Kootenai sturgeon early life history needs is also a major gap.

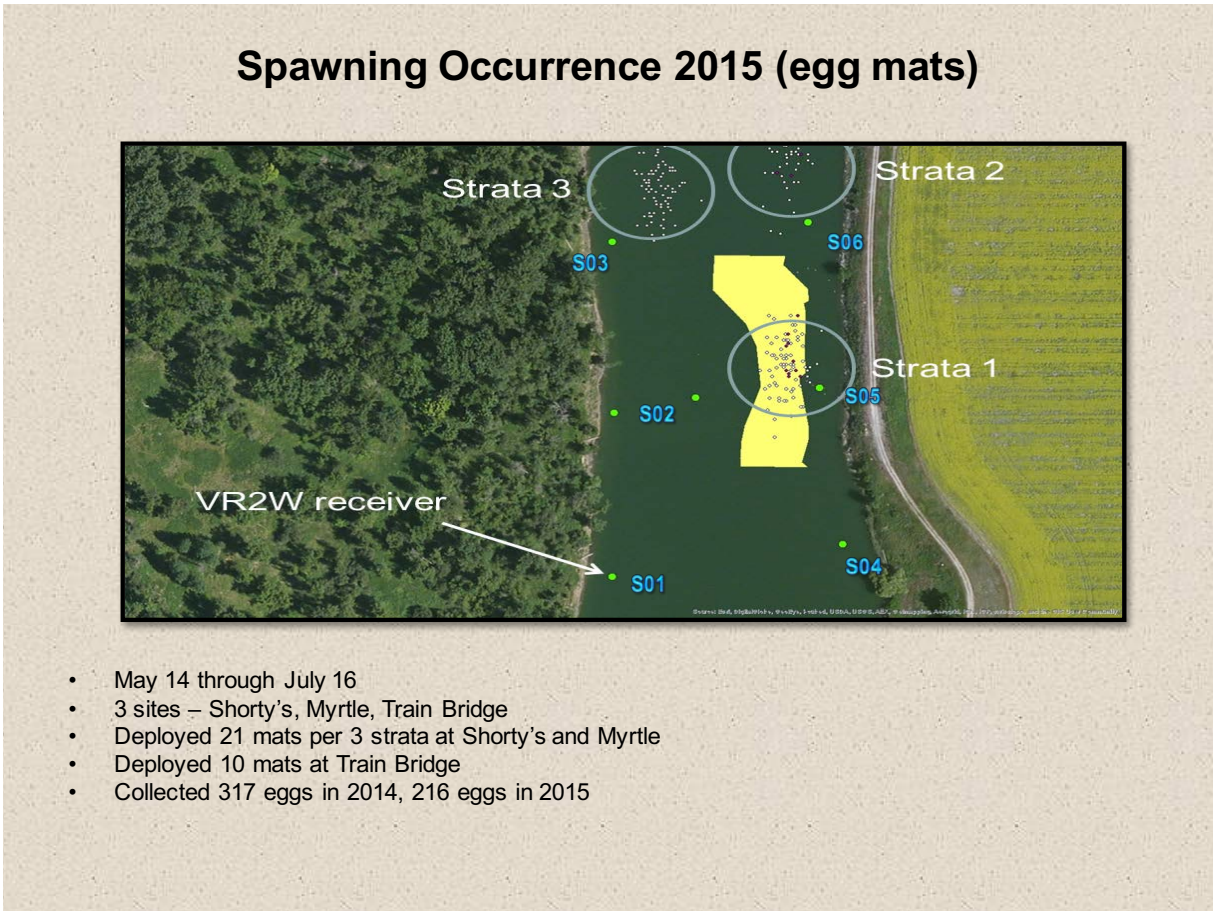

Figure 1. Location of IDFG VR2W receivers, monitoring strata, egg mats, and one of the SEPP locations.

Questions and discussion:

- Rich M. – The 2014 work was prior to placement of substrate?
    - Pete R. – Yes. In 2015 we did paired larval nets above and below the SEPP at Myrtle and Shorty's sites.
- Pete R. – It is important to understand that egg mat sampling is kind of subjective. It's not a great way to evaluate spawning use. One female can spawn in several locations in a given year. The best way it to look at use is to look at the number of spawning events per year. That's probably better than just the number of eggs collected.
    - Brad S. – Do the egg mats give you a reasonable egg density?
    - Pete R. – The problem is you can get 400 eggs in one small area or 2 eggs on a mat. We're also doing larval sampling while we're doing the egg mats. For the analysis we contracted with a consultant who has worked with Larry Hildebrand. The short story is that we haven't increased use, and we also haven't decreased use. We're going to do one more year of monitoring.
- Ryan H. – We didn't expect them to be attracted to the substrate, but we wanted to see if maybe the project somehow changed the cues. The end product is going to be if we have enough power to determine if the larvae are hatching there. Larvae mainly move at night at it is

hard to set nets overnight.

  - Pete R. – To sample overnight we have to wait until it gets to about 12,000 cfs. Last year we got out there and put in a ton of effort because flows were so low, we ran nets all season.

- Matt D. – I wanted to note that the location of Strata 2 was an area that you'd identified as being suitable to put the patch if we could do more than 1-acre when we were looking at the initial project locations.

1c. Overview University of Idaho graduate student investigations looking at fish assemblage structure and habitat characteristics

Mike Q. gave an overview of the University of Idaho research on fish and habitat in the Kootenai River (*see Quist_KRHRP_2016.pdf* for details). Brad S. is also coordinating with Mike Q. on the research projects and provided input on the presentation.

Mike talked about the importance of scale: temporal scale, spatial scale, and "biological scale" (i.e., level of biological organization). He argued that thinking about different scales is important because a lot of times we get stuck at assemblage scale instead of larger scales. Across large landscapes there are larger bio-scale filters that determine where species are located given their basic biology. You can then winnow down and look at abiotic habitat to predict where species will be found. Sometimes there is habitat that's really suitable but there are biotic interactions that influence the occurrence of specific species (e.g.., non-natives). When you're not thinking and acting at the right filter level you're going to go down the wrong pathway. He said we also need to think about biological scale and about the specific taxonomic group as well. The things you might do to monitor or evaluate what's happening at an assemblage level are different than what you would monitor at another level.

The questions are what is the appropriate scale on the Kootenai River and what is the appropriate taxonomic group. Most of Mike's work on the Kootenai is at the segment, reach, macrohabitat and microhabitat scales and most of it is focused on the assemblage level.

Mike described the work and results of three graduate students: Chris Smith (research project in 2012-2013) who was working at the segment and assemblage-population scale, Carson Watkins (research project in 2012-2013) who was working at the reach scale and assemblage-population scale, and Phil Branigan (research project in 2014-2015) who was working at the microhabitat and assemblage-population scale (see presentation for details).

<u>Questions and discussion:</u>

- TJ Ross – For the alcove work, you mentioned there's the discrepancy in treated versus untreated. Is the interpretation that if you removed those alcoves the difference between treated and untreated is pretty similar?
  - Mike Q. – Yes, I think so.
- Shawn Y. – I think the alcoves illustrate the importance of off-channel habitats.
- Ryan H. – Each of those species is associated with microhabitat based on what it needs or wants at that time – food, thermal refuge, etc. You have to look at the reasons they are using the habitat too. Just because they're not there doesn't mean they don't use that habitat. The thermal conditions at a certain time of day might be why they're there.
  - Mike Q. – I agree. One thing you see is they're not just sitting and hanging out at a microhabitat area, they are moving around. You'll see a group of suckers come in and then move out. I think the habitat they're using is not at the microhabitat scale. I think

we needed to look at this, but my sense is this is not the scale where fish are selecting habitat. They are doing that but I think it's at a level higher than what Phil is measuring. It is a good example of why you don't necessarily want to monitor things at this small.

- Sue I. – I really appreciate looking at this in terms of the different scales. One of the really big things that came out of Carson's work was an initial thought that, 'oh my gosh, are we creating habitat that will favor non-natives'. I think this work of Phil's will help to take that concern off the table.
- Mike Q. – Phil sampled 300 of those sites and didn't sample a single pumpkin seed or bass.
- Jon N. – This issue about scale and functional versus structural elements of the problem; it seems a little problematic. In some of your earlier slides you talk about elevation. Fish don't sense elevation, but it's a surrogate for temperature. By doing these things at a larger scale, are we losing the possibility of drawing conclusions about what's happening at the smaller scale.
    - Mike Q. – You're right a lot of these things are surrogates for other things. Chris' work shows that there's meaning to these different reaches from geomorphic and biological perspective.
- Jon N. – I'm thinking about the purpose of this meeting. We've got modeling capabilities that we couldn't have imagined 10 years ago. This meeting is about if it is time to revisit that question. Back then, the paradigm or set of rules to judge whether habitat was good or bad were just wrong. Now we're miles beyond that. If we can't relate it to something that is sensed by the organism, how can we ever hope to have small scale predictions in the field regarding the response of the organism? If we start using predictors that capture responses in surrogate ways, we can never develop predictive tools.
    - Mike Q. – There's probably a sweet spot in terms of scale. At the largest scale or the smallest scale, it may not be useful. I'd back up a step and say what is the goal, are you trying to maintain some set of species richness. Then you can get a prediction.
- Jon N. – I think we're also hoping we can use this as an example in terms of relating the physical and biological processes.
- Brad S. – Life stage may be the more important thing to deal with than the actual species. The other thing is sometimes we get hung up on modeling averages. But variation is really important. Maybe we need to provide a bunch of different velocities.
- Rich M. – Mike, you gave the example with the microhabitat of doing fish shocking for a minute and then spending a bunch of time measuring the physical habitat. If you synthesize that data and look at the system as a whole, would that help?

3. Summary highlights of other biological and biomonitoring activities

2a. IDFG Kootenai sturgeon abundance and movement monitoring and evaluation

Pete R. reviewed the IDFG Kootenai sturgeon sampling and movement evaluation objectives, ongoing studies and current data gaps and unknowns by life stage.

- Adult Kootenai sturgeon sampling
    - Objectives: Determine trends in catch statistics and abundance and tag individuals for movement studies
        - Setlines and angling March through May and August through November

- Ongoing studies: continuing sampling in 2016 as planned
- Current data gaps and unknowns: Do we need an updated adult population estimate?

- Kootenai sturgeon movement evaluation (adults and juveniles)
  - Objectives: Determine how Libby Dam operations influence Kootenai sturgeon movements and help guide flow manipulation to benefit Kootenai sturgeon movements into preferable habitats at preferable times
    - Vemco VR2W passive telemetry array
    - Tagging spring and fall annually
  - Ongoing studies:
    - Documenting upstream movement timing for flow planning based on tagged female Kootenai sturgeon.
    - Multistate movement modeling with Steve Dinsmore to determine which physical variables best predict upstream movements.
    - Juvenile Kootenai sturgeon movements on and off Kootenay Lake delta to refine closure assumptions for survival and abundance modeling.
  - Current data gaps and unknowns: determine ways to incorporate backwater effect into movement models.
- Hatchery Kootenai sturgeon evaluation and wild recruitment evaluation
  - Objectives: evaluate stock status (brood year distribution, IGA growth analysis, conditions, survival, polyploidy) of hatchery reared juvenile Kootenai sturgeon and evaluate the wild juvenile Kootenai sturgeon recruitment
    - 2, 4, and 6-inch stretch gill nets (July through September annually) at 25 sites in US and BC combined
  - Ongoing studies: continue sampling in 2016, finalize most recent survival analysis, collect fin rays for IGA studies, polyploidy genetics sampling
  - Current data gaps and unknowns
    - Age at maturity
    - Density dependent growth analysis

<u>Questions and discussion:</u>

- Shawn Y. – Please remove the words “density dependence” from your growth analysis.
  - Ryan H. – Yes. You would expect any population at some level to be effected by the number of fish.
- Shawn Y. – Do they measure the velocity profiles of where they’re setting the nets in the Upper Columbia?
- Mike Q. – These Vemco arrays track fish as they move up the system. Would it be possible to use the flows out of Libby Dam in combination with the models to track the nose or near nose conditions of those fish as they are moving up?
  - Pete R. – The Vemco array doesn’t determine the exact position of the fish. We can’t triangulate in the main array, although we can in the VPS.
- Ryan H. – in Steve Dinsmore’s model we used temperature discharge data. He did find that

temperature consistency was the highest correlate.

- Brad S. – I was also getting at if you could show a track/path of what the fish are moving through. If you could track what are the velocities and depths that the fish is experiencing that could be helpful.

ACTION:

- Alison to follow-up with UCWSRI-TWG to secure description of how they are selecting locations of larval capture nets in the upper Columbia. Report back to IDFG with information.

2b. IDFG Burbot abundance and movement monitoring and evaluation

TJ Ross gave an overview of IDFG's Burbot monitoring program. Objectives are:

- Characterize the status and structure of the population (baited hoop nets)
- Characterize spatial and temporal occurrence of spawning (baited hoop nets)
- Characterize movement patterns and habitat use (VEMCO sonic tags and passive receivers)
- Evaluate success of various stocking strategies (baited hoop nets, University studies)
- Identify recruitment bottleneck(s) (university studies)
- Detect natural recruitment (PBT, larval light traps)

He explained the Kootenai Tribe currently produces all the hatchery fish. Since 2011, all of the fish have been marked with genetic tags (PBT). A portion of the hatchery fish are PIT tagged prior to release and length and weight measurements are taken. The majority of fish are stocked at six locations and at varying life stages (e.g., larval, juvenile and adult) but primarily larvae or juveniles. The locations have varied a bit over the years.

The IDFG has set baited hoop nets each year since the 1990s in order to monitor the status of Burbot and better understand where they are spawning. The IDFG has recently documented an increase in the Burbot population. Spawning is occurring around Porthill/Boundary Creek and also at Ambush Rock. Spawning occurs the first two weeks of March at which point there is a noticeable spike of fish. During that spawning period they are seeing multiple recaptures of fish as well as a weight loss among the fish. They have been consistently catching increased numbers of Burbot at the Myrtle Creek SEPP site over the spawning window.

The IDFG is also working to characterize movement patterns. TJ said they currently have a backlog of data that hasn't been reviewed yet. They have had some difficulties with the passive array. Once they are able to get a handle on the data backlog they will get more tags out.

Prior to spawning they capture a few Burbot then there is a huge surge, then they don't capture them again for a while. At present movement dynamics are not understood. The IDFG is also interested in evaluating the relative success of the stocking locations that are currently being used. They are using baited hoop nets, also Mike Quist has a student, Zac Beard, who is doing work in Deep Creek.

The big question they are trying to address is to identify the Burbot recruitment bottlenecks. The fish raised to 6 months old in the hatchery do really well. There is something going on sometime between egg deposition and 6 months. One theory is that it is related to altered temperature regimes (IDFG is working with a PhD student who is looking at this). They are looking at the effects of temperature spikes, etc., in the lab with the ultimate goal of informing dam operations - even if those operations might change just for a one- or two-week time window.

Another thing they are looking at is detecting natural recruitment. Until recently they were depending on tags and fin clips. This year they set larval light traps in the river. TJ noted that he is very interested

in talking with Rich M. about larval drift markers.

Current data gaps, unknowns and attempts to address those gaps include:

- What is the recruitment bottleneck? Temperature regime during spawning and egg incubation, food availability at first feeding, both, other?
    - PhD study with Neil Ashton
    - Larval light traps
    - Kootenai Tribe zooplankton sampling
- How are Burbot using Kootenay Lake and the river?
    - Vemco sonic tags and passive arrays
    - Multi-state models with Steve Dinsmore
- How well are Burbot surviving after being released into the river?
    - Program MARK models with Steve Dinsmore
- What is the trophic status of Burbot? What are they feeding on, and what is feeding on them?
- How are Burbot using tributary habitats? Spawning, rearing, residing, etc.?

Of the bottlenecks IDFG is currently looking at, they will have a good feel for the effect of temperature of when Neil Ashton finishes his PhD work next winter. He will also be working with the Kootenai Tribe to expand on his study and look at potential gamete effects. TJ said the larval light traps are a sure fire way to determine that eggs are hatching and something is happening at the next stage. In terms of the food related questions, Shawn and Kootenai Tribe have been doing zooplankton monitoring for the last couple years.

Another unknown is how are Burbot using Kootenay Lake and the River. Sarah Stephenson has some initial information. Another question is how Burbot are surviving after being released in the river. This information will help to determine the current status of the population and to guide the aquaculture program production. They are using MARK to look at this and hope to have those results by the end of this summer.

A new question regards the trophic status of Burbot relative to other fish in the river. Currently we don't know what they feeding on and what's feeding on them. Also want to better understand how are Burbot using tributary habitats. Historical anecdotal reports suggest that Burbot used tributaries.

<u>Questions and discussion:</u>

- TJ Ross – I see Burbot larvae being highly vulnerable to wherever flow takes them. We're trying to choose the best places to place them relative to likely drift.
- Shawn Y. – A big difference between modeling Burbot versus Kootenai sturgeon larvae is that Burbot are pelagic so they're on the surface, while Kootenai sturgeon are feeding on the bottom until later in life when.
- Jon N. – We can detect surface velocity with great detail.
- TJ Ross – We've been running light traps since the last week of April. We haven't captured any Burbot larvae yet, although we've captured other larvae. It is a manageable workload, but it would be nice to have more data in terms of where to set the traps.
- Shawn Y. – They have little or no yoke sac. As soon as the mouth forms they begin to feed on small prey. As the mouth forms they will eat larger food sources, then they transition to cannibalism, and then they transition to benthic feeding after about 60 days.
- Ryan H. – We have tested some limiting factor hypothesis, for example, we thought maybe stock limitation was a limiting factor but found that it is not. We also thought maybe the spike in discharge was keeping fish from spawning, we found it is not and we know now that there are

plenty of Burbot spawning.

- Jon N. – For both TJ and Pete, we can do those calculations for you very quickly (MARK analysis).
- Shawn Y. – Can you get the flow variability?
    - Jon N. – We can do surface velocities. Right now we're doing it from stationary locations. We're going to do a surface velocity survey next year from an aircraft. It will be for a discrete time period. We have an agreement to complete that with fish and wildlife. One thing we'd like to hear from you is when would be the best time to complete that?
- Pete R. – Does the location of the highest surface velocity vary a lot?
    - Jon N. – Locally not so much. But at different times of year there is variation.
    - Rich M. – By the end of the summer we'll have bathymetry all the way down to Copeland.
- Pete R. – So we could give you a latitude and longitude and you could tell us where to put the nets to target a certain range of velocity?
    - Jon N. – Yes.

Actions:

- TJ Ross, Ryan H. and Shawn Y. to develop recommendation regarding timing (i.e., best time of year) for flight to survey surface velocity and provide that information to Jon N. and Rich M. as soon as possible.

2c. Kootenai Tribe Kootenai sturgeon and Burbot conservation aquaculture

Shawn Y. reviewed the release locations for hatchery Kootenai sturgeon and Burbot:

- Kootenai sturgeon 2016-2017 release locations per agreement at 2016 Annual Program Review (APR) meeting
    - Non PIT tagged fish (from Kootenai Tribal Hatchery) scute marked
        - 11,000 to Porthill
        - Release in same location as last year (release last year was in March), this is the second of three years of potential releases at this location
    - PIT tagged fish
        - RKM 145 (BC), 200, 244, 259, 300 (MT) (same locations as last year)
        - Add 3 new sites:
            - Above town near the KRHRP sites Phase 1A or North Side Channels projects (side channel habitat)
            - Above town near Middle Meander Project (mega hole)
            - Kootenay Lake release near Crawford Bay or other (TBD)
        - Distribute families equally (to extent practical) among sites (i.e., approximately 3,125 per site)

Figure 2 shows Burbot 2015-2016 release locations for hatchery burbot per agreement at 2015 APR meeting.

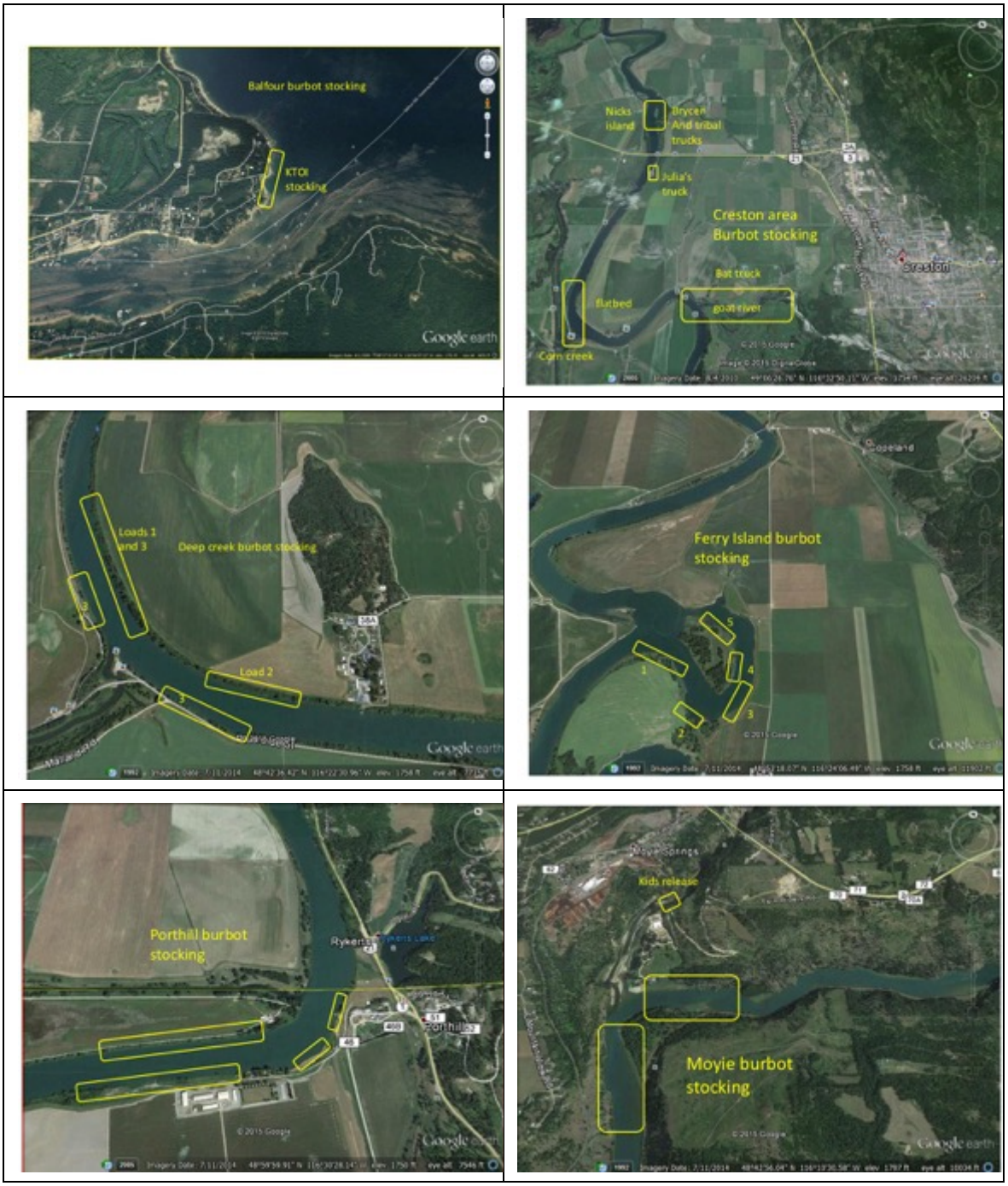

Figure 2. Burbot 2015-2016 release locations for hatchery burbot per agreement at 2015 APR meeting.

Questions and discussion:

- Ryan H. – One of big missing puzzles out of the MARK model is to estimate how many of a specific year class are out there.
- Shawn Y. – There's an upwelling in the area where the Burbot spawning is. A lot of what they're spawning on is slag or similar from railroad retaining walls. We're locating Burbot spawning areas, we know where most of the Kootenai sturgeon spawning areas are. It would be helpful to figure out where they're going to be so we could target our habitat restoration sites.

- Ryan H. – And where to sample zooplankton in that critical time frame.
- Shawn Y. – We're talking about temperature. This winter we're going to start with taking a Kootenai River adapted Burbot that's hit sexual maturity and subject them to different temperature regimes in the hatchery to see the influence on early life stages. It would be great to start in the lab, get a hold on what may be happening physiologically, and then track them in the actual habitat they are being forced into or being selected for. Then if they're successful it would help us understand why.

2d. Nutrient enhancement biomonitoring

TJ Ross and Charlie Holderman gave an overview of the IDFG and Kootenai Tribe jointly managed nutrient enhancement program. The program to restore nutrients lost behind Libby Dam began in 2005 with full implementation starting in 2006. Sampling began before nutrient additions, in 2002. Under the program nitrogen and phosphorus are being physically added at the nutrient addition site to replace lost nutrients. The Kootenai Tribe collects data to measure the response at the lower trophic level while the IDFG collects fish data. Objectives are:

- Improve productivity in the river (Kootenai Tribe sampling)
- Improve the status of native fish populations (IDFG annual electrofishing surveys)

Charlie H. explained that the objective of the nutrient addition is to improve productivity in the river and replace what's lost behind Libby dam and bring it back to that ambient level. After 15 years of sampling, they have had two winnowing processes to tidy up the trophic level sampling. They are currently down from 13 to 8 sites. Two are control and 6 are treated. Of those 4 are in the canyon reach, 2 in the braided reach and 2 in the meander reach. They sample all trophic levels and water quality. Water quality and algae are sampled monthly. Marco invertebrates are sampled seasonally. Fish are sampled in IDFG annual survey in the fall. They also sample at 3 KRHRP sites (including all the same trophic levels, water quality and plankton).

TJ Ross said that IDFG does annual electro fishing surveys at 8 sites each year during the first two weeks in September. There are two sites upstream from the nutrient addition site, 2 downstream, 2 in the braided reach, and 2 downstream from Bonners Ferry. Of those, 5 have been consistently sampled since 2002. Last year they added a site in the braided reach and another in Montana. Those two sites were added primarily to bolster the study design to support the KRHRP. They are having ongoing nutrient project discussions about how to beef up sampling or make it more robust. All of the sampling work is geared specifically to the nutrient project, but has utility for the KRHRP.

Current data gaps and unknowns:

- Effects on Kootenai sturgeon and Burbot
- Lower trophic levels show a very clear (positive response, but the response is much less pronounced in fish. Why?
- Is there value in tracing nutrients as they move through the food web?

TJ Ross said that the effects on Kootenai sturgeon and Burbot are hard to quantify. They look mostly at trout and whitefish. Charlie noted that the nutrient program sampling is also limited by the fact that the fish sampling only occurs once a year, while the other sampling efforts look at a number of points in time. That is a weak spot; more temporal sampling might help out with that.

Charlie noted that most of the added nutrients (about 80 percent) are used up by the time it gets to the Moyie river. Most of the project's collected data backs that up. Most of the added nutrients are used up in the first 10-15 km, before reaching the braided reach. Charlie noted that they have talked a little at the International Kootenai/ay Ecosystem Restoration Team (IKERT) about how to get nutrients further down the river. One discussion has been about the possibility of increasing the amount of nutrients

being added at the border. However, the Environmental Protection Agency (EPA) may have objections to that. TJ Ross said they've also looked at the possibility of adding nutrients downstream, but at this time the general consensus is that it wouldn't work to add nutrients in the lower river using the same techniques being used in the upper river due to the river depth and lack of rocky substrates.

Questions and discussion:

- Shawn Y. –Kootenay Lake receives direct nutrients successfully, it is deep and has no substrates.
    - Charlie H. – The issue becomes where are you a lake and where are you a river.
- Greg H. – We've got a PhD project stating this fall looking at ecosystem metabolism in the river. We're going to be looking at Fort Steele and the Elk River and a site directly downstream from Libby Dam. Also hoping to put in probes near the nutrient site to understand the daily fluctuations in the river.
- Charlie H. – Macroinvertebrate data is showing really patchy distributions. We're not sure why. Maybe looking at some of the substrate mapping could help with that. For example, KR7 is showing up as a hot spot for macroinvertebrates, if you go downstream they're not very abundant. That might be tied to substrate.
- Matt D. – In our group we refer to Crossport as the middle of the braided reach [the location of USGS gaging station #12308500], but the more historical location of Crossport is near the BLM island.

2e. Rainbow Trout and other native species

TJ Ross reviewed the objectives associated with monitoring of rainbow trout and other native fish species:

- Inform regulation setting for Rainbow Trout fishing on the Kootenai River
    - Hemlock bar population estimate
    - Otolith microchemistry study
    - Annual electrofishing surveys
- Monitor status of the Rainbow Trout population
    - Hemlock bar population estimate
    - Annual electrofishing surveys
- Evaluate the origin and age-at-outmigration of adult Rainbow Trout
    - Otolith microchemistry study

TJ explained that the Rainbow trout survey, which also captures Whitefish and Suckers includes a 3 km stretch of river and has been going on since the 1980s. The IDFG is also working with Mike Q. and Scott Carson to do otolith microchemistry study to look at where adult rainbow trout are spawning. They are doing this basin-wide in Montana and Idaho. Don't know at this time what kind of resolution they'll get, e.g., if they will be able to say they're spawning in a side channel.

Current data gaps and unknowns related to Rainbow Trout include:

- Do bottlenecks exist for the Rainbow Trout population? If so, what are they?
- How do winter operations (hydropower peaking) at Libby Dam affect overwinter survival of Age-0 Rainbow Trout?
- Are current fishing regulations sufficient?

In terms of addressing questions about Rainbow Trout and other native fishes' responses to the KRHRP the IDFG is looking at broad-scale, temporal changes in various fish populations using the Hemlock bar population estimates and annual electrofishing surveys. Two electrofishing sites have been added since 2014 to provide additional data related to the KRHRP. TJ noted that in Montana the MFWP are doing

comprehensive survival estimates for trout. That information will help to inform Libby Dam operations. There is real potential for use of that information in Idaho.

Current data gaps and unknowns related to the fish response to the KRHRP projects or program include:

- How have the various KRHRPs affected the various fish populations in the river and how have these efforts interacted with other ongoing projects (e.g., nutrient project)? Can these interactions be teased apart?
- What is a sufficient study design to evaluate the KRHRPs?

Questions and discussion:

- Brad S. – If we could combine hydraulic modeling to look at how off-channel or juvenile rearing habitats are affected by year class strengths of rainbow trout's – in other systems the juveniles often use off channel/side channel habitats – if you could look at what portions of those are wetted, could you get a correlation with year class strengths.
    - Ryan H. – Our difficulty is you can't get a good estimate on survival.
    - Brad S. – You could do that in Montana.
    - TJ – The problem is the big portion of recruitment in the Kootenai River comes from tributaries.
- Ryan H. – They don't move much. When you pit tag them, they have such small movements. They stay on their side of the river.
- TJ Ross – For each of the projects that we're involved in we have very specific objectives. I know that we're trying to get to that point in terms of the KRHRP objectives. What are the questions? That would seriously help with informing field efforts. For the physical stuff you have clearly defined physical objectives. I'd like to discuss that more to get more clarity on that. We've got a lot of data floating around, but none of it is specifically geared to the habitat projects. It isn't clear of what the biological objectives and questions are.
- Matt D. – We're getting close to being done with the braided reach. It's a good opportunity to have University of Idaho monitoring these projects. So much of our work on the habitat restoration is going to take time. The river will take time to respond and adjust things and the vegetation takes time. It is hard to expect that we're going to see an instantaneous response.
- TJ – You have your long trend series; we want to make sure that we're not making things worse. One thing I was encouraged by with Mike's presentation was the way he broke it down to each of the scales. Based on the information from the University of Idaho studies, a safe interpretation is that the microhabitat scale is not the right scale. Rather it is somewhere between the reach and river scale. That's what we did with the biomonitoring program.
- Rich M. – Maybe that's not so true when you're looking at spawning or rearing where microhabitat might not be so important.
- Ryan H. – And that's why we break this out into different species. We're trying to answer a specific set of questions for these certain species. Can we tailor the sites that we do have to answer some of the questions that we do have?

Alison S. reviewed the discussions and outcomes from the May 2015 PRAT and CMART meeting identifying the hypotheses associated with different species, life stages and the proposed ways of monitoring those. She also reiterated the discussions the group had at that time about moving towards a more integrated Kootenai River monitoring program that was less focused on specific programs or projects and more focused on looking at addressing recruitment failure hypotheses and other critical

uncertainties, focused trend monitoring, etc.

3. Discussion: planned hydraulic modeling, additional needs and opportunities

3a. Review planned USACE, USGS and IDFG hydraulic modeling

Greg H. said that the USACE has received funding for FY2017 to complete habitat modeling associated with Libby Dam operations. He has been talking with Rich M., Ryan F., Ryan H. and Pete R. about that that should look like. These discussions are ongoing. He wanted to bring it to this meeting since it complemented the discussions and focus of the meeting.

Rich M. explained that IDFG has been sampling for Kootenai sturgeon spawning events with eggs mats for years. He said they want to combine those results with some computational hydraulic modeling through the reach to try to key-in on the habitat that Kootenai sturgeon are looking at. It is possible to look at what's happening on a daily basis. The objective is to look at how they are using some subset of the available habitat, and what subset are they using? Not lumping it into one curve but looking at it as discharge through the reach.

Greg H. added that they've also talked about looking at degree days, temperature, etc.

Questions and discussions:

- Brad S. – My opinion is that it is not going down a rabbit hole. You're focused in on a life stage and a particular species.
- Sue I. – I was wondering how the USACE is addressing those old habitat attributes that used to have to be attained in the BiOp RPAs now that we have this evolution of understanding. Are those going to go away?
    - Greg H. – I proposed that they go away, but there's an argument to leave them in.
- Rich M. – By looking at the reach as a whole you may find that depth is not very specific.
- Ryan H. – Another challenge is what do you define as an actual Kootenai sturgeon spawning event. Do you narrow it down to a two-hour or a two-week window? Then tying it down to an actual discharge stage.
- Rich M. – the eggs are staged, so you have a day and location.

3b. Opportunities for collaborative modeling efforts to help address biological questions and target sampling

Participants discussed potential opportunities to use hydraulic modeling (1-D, 2-D or quasi 3-D) to help address biological questions and target sampling.

Matt D. said that River Design Group (RDG) has a 1-D hydraulic model for a range of index flows. They also have an unsteady model to simulate actual hydrographs for portions of WY 2006 - 2013 and synthesized hydrographs for WY 1929 - 2013. The USGS has developed a multidimensional model and sediment transport and bed evolution models for the braided reach. Rich M. noted that the 2-D model goes to Klockmann Ranch (USGS gaging station # 12314000). The USGS quasi 3-D model could be used to model short reaches if needed.

Meeting participants identified the following wish list of biological questions to try to address with hydraulic modeling. Participants completed a dot vote ranking to identify the top priorities for near-term modeling work.

1. Larval sampling locations for burbot and sturgeon (votes 10) (note combine 1, 3 and 9)

2. Patchy macroinvertebrate production – why? (votes 2)
3. Zooplankton density/presence/concentration (predictive look – low velocity littoral areas) (combined under 1)
4. Pair zooplankton sampling with 1 and 3 (votes 2)
5. Model reference alcove/off channel habitat at different flows (frequency, timing, and duration) (votes 3)
6. Where do Carson's predicted probability of occurrence (flow requirements) exist (votes 1)
7. Use sturgeon VPS data to see what they're keying in on (depth, velocity, other) (votes 5)
8. Using egg settling velocities, project back to where fish are releasing eggs (sturgeon)
9. Larval drift models to inform stocking locations for burbot and sturgeon (combined under 1)
10. What did the sturgeon spawning area look like at 100kcfs (note: Rich did this a while back and saw no real change, the dikes were kept in place in that analysis)?
11. Nutrient uptake pattern (1D water quality model, temperature modeling) (votes 4)
12. Relationship between depth/turbidity and nutrient transport

Note: Additional possible benefit of modeling work (1 through 4) to kokanee restoration.

Participants then identified what information was needed to support the modeling, who would coordinate with USGS (Rich McDonald and Jon Nelson) to complete the modeling, the approximate time frame to complete the modeling, etc. for the top six ranked questions.

Agreements on next steps:

1a. Modeling to identify best larval sampling locations for sturgeon

- Information needed:
  - Where are sturgeon in the water column (Ryan Hardy, Pete Rust, and Shawn Young to provide information to Rich McDonald)
  - Swimming capability (Shawn Young to provide information if possible)
  - Early life history behavior (best available information) (Shawn Young, Ryan Hardy, and Pete Rust to provide)
  - Egg mat locations (Pete Rust will provide ASAP)
- Who will do modeling: Rich McDonald
- Who will work with Rich to provide information: Ryan Hardy, Pete Rust, and Shawn Young
- When:
  - Rich McDonald will do initial model run week of May 23, 2016 to help inform this year's sampling (with information from Pete Rust)
  - Rich McDonald may do additional model runs in September or later when there is additional information (e.g., location in water column, swimming capability and ELH behavior)
- Funding for modeling: Kootenai Tribe from Kootenai River Habitat Restoration Program (KRHRP)

1b. Modeling to identify best larval sampling locations for burbot

- Information needed:
  - Where are burbot in the water column (Ryan H., TJ and/or Shawn to provide ASAP if possible)
  - Swimming capability (if possible) (Shawn to provide ASAP)
  - Early life history behavior (best available info) (Shawn Young, Ryan Hardy, TJ Ross to

provide to Rich McDonald ASAP)

- Who will do modeling: Rich McDonald
- Who will coordinate with Rich: TJ Ross and Ryan Hardy, and Shawn Young
- When: Rich McDonald will do modeling in September
- Funding for modeling: Kootenai Tribe from KRHRP

1c. Zooplankton density/presence/concentration (low velocity littoral areas) to identify low velocity areas in river to see how they match up spatially with where burbot are spawning and larvae are likely to drift.

- Information needed:
  - Locations of burbot spawning, burbot larval sampling, and zooplankton
  - Modeled areas of river with low velocities
- Who will do modeling: Rich McDonald
- Who will coordinate with Rich: Shawn Young, TJ Ross, and Ryan Hardy
- When:
  - Fall 2016 to coordinate between Shawn, TJ and Ryan with Rich McDonald
  - Winter/Spring 2017 to implement paired sampling
- Funding for modeling: Kootenai Tribe from KRHRP

1d. Pair zooplankton sampling with 1a and 1b.

- TJ Ross, Ryan Hardy and Shawn Young coordinate on design/implementation of zooplankton sampling

2. Use sturgeon VPS data to see what sturgeon are keying in on for spawning (depth, velocity, other)

- Information needed to support modeling:
  - Sturgeon location information X, Y, Z (depth) and date
  - Egg mat data
  - Fish tags to identify individual fish (send Rich full data set)
- Who will do modeling: Rich McDonald
- Who will coordinate with Rich and provide info: Pete Rust and Ryan Hardy
- When:
  - Ryan Hardy and Pete Rust to get information to Rich ASAP (pending discussion with Rich)
  - Target to complete modeling is spring 2017 (pending funding approval)
- Funding for modeling:
  - Rich to develop time estimate to Sue Ireland
  - Tentative funding under Kootenai Tribe's KRHRP depending on time needed

3. Nutrient uptake pattern (1D water quality model, temperature modeling

- Information needed to support modeling:
  - Water quality sampling data (from Charlie Holderman)
  - Temperature data (from Ryan Fosness)
- Who will do modeling: Chris Nelson
- Who will coordinate with Chris: Charlie Holderman and Ryan Fosness When: Charlie will provide data to Chris by September, Chris will do modeling in September –December window
- Funding for modeling: Kootenai Tribe's KRHRP

4. Model reference alcove/off channel habitat at different flows (frequency, timing, and duration)

- Information needed to support modeling:
  - Pick reference sites (Mike Quist will provide list ASAP of sites with high fish use to Matt Daniels)
- Purpose: To inform design of similar habitat conditions for possible future KRHRP projects
- Who will do modeling: Matt Daniels
- Who will coordinate with Matt Daniels: Mike Quist
- When: Complete modeling in September
- Funding for modeling: Kootenai Tribe's KRHRP

4. Discussion regarding continued Kootenai River monitoring integration and collaboration

To set the stage for the continuing discussion about Kootenai River biological monitoring, Alison briefly reviewed the history of the KRHRP. Sue I. reminded the group about the initial KRHRP focus on addressing the Kootenai sturgeon BiOp and the reasons the co-managers and agency partners agreed on the need to away from the single species/single life stage focus and towards an ecosystem-based approach. Matt D. reviewed the changes to the Kootenai River prior to and after construction of Libby Dam and reminded participants about the KRHRP approach to restoring river functions within existing constraints (i.e., Libby Dam operations, diking, infrastructure, and current land uses) by addressing limiting factors associated with morphology, aquatic habitat, riparian habitat, and river stewardship.

Alison S. reviewed the broad KRHRP objectives that the Kootenai Tribe included in the last NPCC/BPA proposal:

- Restore and enhance habitat conditions that support all life stages of Sturgeon
- Restore and enhance habitat conditions that support all life stages of Burbot
- Restore and enhance habitat conditions that support all life stages of native focal fish species (Bull Trout, Kokanee, Redband Trout, Westslope Cutthroat Trout)

Alison S. also summarized how the KRHRP is addressing various limiting factors with a toolbox of treatments that have to date included:

- Instream treatments
  - Pool excavation or enhancement (pool ladder, depth, provide places for Kootenai sturgeon to stage for spawning, resting areas for other species)
  - Pool forming structures (scour and/or maintain pools, direct flows away from banks, create alcove habitat, create complex flows)
  - Bank restoration (stabilize eroding banks, provide conditions that support floodplain and riparian habitats)
  - Side channel restoration and reconnection (provide complex habitat for multiple species, food web enhancement)
- Riparian and food web treatments
  - Islands construction (creates floodplain habitat, contributes to food web, redirects flow)
  - Floodplain enhancement or creation (enhances food web and habitat complexity and variability)
  - Native riparian planting and enhancement (bank stabilization, food web, habitat for non-aquatic species)

Tom P. noted the importance of remembering that like fish, plants are living things.

Alison S. recapped the biological monitoring discussions and recommendations from the KRHRP May 2015 PRAT and CMART workshop (see notes from that meeting). This also included the development, review and discussion of an independent review Brad S. conducted as part of the PRAT to look at ways that existing IDFG and other biological monitoring might, or might not, be able to help determine the response of various native fish and the food web, to the KRHRP.

One of the biggest challenges identified at the PRAT and CMART May 2015 workshop was how to determine food web response as well as the response of native fish other than Burbot or Kootenai sturgeon. The Burbot and Kootenai sturgeon the objectives and sampling approach is well-defined and designed to address specific hypotheses. For all of the monitoring programs it will be difficult to tease apart the effects of various actions e.g., Libby Dam operations, nutrient addition, or KRHRP projects.

Discussion:

- Ryan H. – We're concerned about the power on some of our sampling sites. Right now we don't feel like we have enough information to determine whether there's an effect from the KRHRP. We lack power at the addition nutrient site too.
    - TJ Ross – A concern is that to increase the number of replicates for the rest of the river would sacrifice the biomonitoring program.
    - Sue I. – Ryan, TJ and Charlie have you talked about this together yet?
    - Ryan, TJ and Charlie – No, not yet.
- Brad S. – The way it was originally designed was totally reasonable. You're looking at 1 km chunks. Your inference is good in those chunks. But to extend that inference to the river is really challenging. It depends on what you want your inference to be from your sampling. It was a reasonable design for those 1 km chunks when you just wanted to know the nutrient design.
    - TJ Ross – The number of replications is the challenge.
- Mike Q. – I've seen those data; it comes down to your question. It comes down to if you're trying to answer a question about a single area or make these broader inferences. Looking at the data, there aren't enough replicates of those sites. It's probably doing a poor job of tracking the response to the nutrients, so what are you loosing if you go another way? If you're trying to look at habitat, you're at a transition from the Burbot, to Kootenai sturgeon, to nutrient. And there are designs that are very focused on that specific work. But with the nutrient monitoring you can kill a couple birds with one stone. Having a broad-based sampling design makes a lot of sense. Just spread the sites over a larger area. I think we're looking at a system-wide sampling design. For any change, it is not just for nutrients.
    - Charlie H. – I'd want to see it in in more detail before committing.
    - Ryan H. – I'd want to talk with the IKERT group as well. Are we missing a portion of this population that we're not sampling? It would be nice to switch to that unit (electrofishing unit).
    - TJ Ross – If we change the layout of any of the four core sites at all, it's going to change the catch rates.
    - Brad – But you could go back and just do the subsections.
    - Sue I. – But he's saying your changing the shocking units.
    - Mike Q. – You don't want to throw out the nutrient sections, you want to pair them down.

    - TJ Ross – We had a statistician look at it and he said you need 8 to 10.
    - Mike – I think it's tricky.
- Charlie H. – I think we should talk about it, but I'm willing to evolve and more forward if there's a better way to do this.
    - Sue I. – think IKERT would be open to having that discussion.
    - TJ Ross – I think we need to ask the question when is enough, enough?
- Mike Q. – So if you add another nutrient site, or turn the spigot off for a couple years, it would be smart to have another design in place. With sampling design, it becomes really important to identify clear objectives.
- Sue I. – With the Kootenai sturgeon and Burbot, IDFG, the Tribe, BC MFLNRO and MFWP are more connected. We are working together in multiple forums including the annual APR meetings. In terms of other fish species that you're sampling through your annual electroshocking, what are the time criteria?
- Shawn Y. – I had the same question about time criteria. It's important to set delineated time points with specific goals.
- Alison S. – In the physical habitat monitoring (morphology or vegetation) we have specific time frames and success criteria for different time periods. Tom, could you describe what's set up for vegetation to give an example?
    - Tom P. – In our monitoring plan for physical habitat and vegetation we have time frames. We differentiate for the first 5 years for vegetation and habitat as its becoming more established. After that we're looking at 10-15 years. On other sites we've recognized that the long time frame can be a benefit over time. You don't have to monitor every year.
    - Matt D. – And I think the interpretation is always going to be the most challenging part. We maybe don't want to get hung up on trying to tie results back to specific projects.
- TJ Ross – We're talking more about river-wide responses. Minus doing the types of things that Mike's students are doing (microhabitat studies) you can't really hone in on the project specific response.
    - Tom P. – We're looking not only at changes, but differences. We have really specific criteria for physical characteristics. But not for biological response But it would be really interesting to know if we built this type of bank versus another type of bank is there a difference. Could we look at paired studies?
    - TJ Ross – I feel like there would probably be latitude to do some of that. But every September we're fully dedicated to doing biomonitoring. We can't pick up more work but we can rearrange our workload.
    - Ryan H. – In a single night we could increase our sampling exponentially if we just thought about how to prioritize it.
- TJ Ross – Thinking about specific measurable objectives, one limitation is if I was forced to come up with some objectives I default to Rainbow Trout. We're more narrowly focused just because of our agency mission and constituency.
    - Mike Q. – But you can work around that. You could say, if these are the changes I expect to see in rainbows…

    - TJ Ross – If we wanted to go out and set up a standardized sampling protocol for juvenile suckers, we're probably not going to do that.
- Brad S. – So you could easily have objectives for Rainbow Trout, but as long as you capture the other species and index them we're in good shape.
- Ryan H. – We're talking about using species as indicators for project implementation. The state is concerned about fisherman but also the effectiveness of what we're involved in.

Actions:

- Alison to send out summary of planned 2016 construction to IDFG and others (these were send in May).
- Continue discussions of monitoring coordination and refinement at next PRAT and CMART meeting and at future Burbot and Sturgeon Annual Program Review meetings.

5. Wrap up

The Tribe will send out draft notes and actions from the meeting. A PRAT and CMART workshop is tentatively planned for October 2016. The Tribe's team will coordinate with participants prior to that workshop to identify specific modeling and biological monitoring topics for further discussion and/or updates on progress.

5a. Closing comments

- Sue I. – I'm excited about the convergence of connecting biological needs with the modeling. I am happy to start to be able to capitalize on all of the data we've got for the river. Also, I'm excited about the possibility of the fish sampling being more broadly applicable.
- Pete – I'm excited about seeing the physical and biological data coming together.
- Shawn Y. – I was contemplating today that I made a good career choice. I'd much rather wake up and do every day than the time share sales they're doing in the other room. I also want to give a shout out to vegetation. We are releasing all the juvenile Burbot from the hatchery into the newly constructed areas with vegetation.
- Brad S. – It is cool that Sue has brought the physical folks in and that the Tribe is paying them to work with the biological folks to bring this all together. I think this is going to leap us ahead in what we need to do the in river system as a whole. I'm really excited about the fish monitoring work.
- TJ R. – I appreciate Mike's presentation and the scale perspective. It triggered something in my head about the fish sampling – that we're not in a bad place, we're actually pretty close to that sweet spot.
- Charlie H. – Even through my patchy macroinvertebrate model only got two votes; Rich offered to sit down and compare the data sets. It's really cool to have this cross-connection between the disciplines.
- Ryan H. – I think both TJ and I appreciate Mike's council in our sampling design. Later on down the line other folks are going to be implementing projects. Looking at it that way other folks will be looking at that. If we do change we're changing for the better.
- Rich M. – To add to what Brad said, I want to thank Sue and Greg for the opportunity to work with the biologists.

- Mike Q. – It's exciting to see possibility of making some changes with the fish stuff. Also, nice to see the really hardcore physical habitat very determinist modeling tied to messy biology. I'm really excited about the opportunities to target the Burbot and Kootenai sturgeon sampling, that could make things much more efficient. It is amazing how much comes back to sampling.
- Ryan F. – It is good to see the physical models starting to blend in with biological models. Steve Dinsmore's presentation at the recent Kootenai River White Kootenai sturgeon Recovery Team meeting was good too. We maybe should loop him in to these discussions too.
- Chris N. – It is really interesting to get a different perspective on the work you do. Seeing Mike's presentation, it is an opportunity to learn more about the context of the river system looking at the different spatial scales.
- Tom P. – Not knowing much about fish, I learned a lot today. It really helps to think about design criteria.
- Matt D. – It is great to hear how the science is being applied to improve our understanding of the limiting factors. When it's time to design and refine future projects we will have enhanced understanding.
- Greg H. – Every time I walk in I'm always coming from the operations world and it's about natural function. I think how to adapt a machine to what's going on in here. It's because of these groups that we continue to try do that.
- Jon N. – (Had to leave early but said this in closing before he left) I think if we try to make a specific recipe, no matter what we do we'll run into issues. I think we need to generalize the approach over more species. Otherwise were just setting up a situation where people 20 years down the road are going to be looking at what we did and say they really messed us up. I like predictability, but we should avoid making things overly specific.

Adjourn