MEETING NOTES

Lake Koocanusa Selenium Technical Subcommittee (SeTSC)

Face to Face Meeting
November 13, 2019

Meeting Objectives

Shared Understanding and discussion on the following topics:

- Seasonal and annual differences in dam operations/effects
- State of the Lake data compilation overview
- Fish species selection for modeling
- Food web selection for modeling

Meeting Highlights

- Lake Koocanusa data compilation overview and update on high frequency monitoring efforts
- SeTSC members developed preliminary draft criteria for selecting fish species for modeling efforts
- Shared understanding on modeling bounding modeling assumptions achieved
- In-depth discussion about foodwebs for modeling purposes

Timelines and Information Flow

SeTSC co-chairs Lauren Sullivan (MT DEQ) and Sheldon Reddekopp (BC ENV) gave an overview of the process for "information and business flow" which included a draft flow chart describing how input/comments from SeTSC members and observers are processed and how final decisions are made and shared. The presentation included a timeline through December 2020, highlighting public engagement opportunities. A more detailed SeTSC monthly timeline was also shared identifying the USGS timeline for modeling; highlighting potential topics of future monthly teleconference calls, and identifying when specific modeling decisions need to be made. The presentation reviewed bounding assumptions and decisions for criteria development as described in the USGS-DEQ workplan as well

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as a detailed list of modeling topics that USGS may discuss with the SeTSC members during future calls.

Assumptions and Decisions for "National" Criteria

Joe Beaman provided an overview of the national selenium criterion elements, the mathematical elements involved in creating the Trophic Transfer Factor (TTF), Conversion Factors (CFs), Enrichment Factors (EFs/Kds), Food Web modeling, deriving protective "default" water column values for aquatic systems, and additional considerations for site-specific criteria development. His presentation can be viewed on the wiki at the following address: [HYPERLINK "http://lakekoocanusaconservation.pbworks.com/w/file/136862142/National%20Selenium%20criteria%20-%20Derivation%20of%20WC%20Elements.pptx"]

Questions:

- Members asked why the 20th percentile cutoff was used in the national water criterion elements for lentic and lotic waters. Joe Beaman explained that the 20th percentile was chosen to be protective and that the hierarchy approach provided a backstop. A 2x2 comparison for false positives and negatives was used to determine that the 20th percentile resulted in a balance of a low percentage of false positives and negatives.

  Commented [MRA1]: Joe Beaman please review this

- David DeForest asked if EPA considered a regression based approach as they worked back from fish criterion to account for concentration when determining enrichment factors?
  - Joe Beaman confirmed that they did but that they also used a median due to limited data (for a national assessment) and that ~~mis-~~/matched data was scarce. ~~which~~ resultings in more uncertainty. In an effort to not eliminate data using outlier analysis they used medians for EFs and TTFs.
  - David noted that for the Lake Koocanusa system, selecting a constant EF and TTF from a water conditions could result in overestimation, and on the other hand selecting a low EF and trying to bring it back to a high condition could result in underestimation. Joe Beaman agreed and stated that we must look at the entire database in terms of spatiotemporal variability before going through selection process for EFs that will be used in the Lake Koocanusa model.

  Commented [MRA2]: Joe Beaman & David DeForest please review this

- Discussion about decisions to be made with food web selection and fish species selection.
  - Joe Beaman commented that the first step is to select the fish species for modeling, the second step is to review food web data for the particular fish species, and then third step is when you start making decisions around whether there is sufficient data for that food web and if not, is there data outside the site-specific Lake Koocanusa dataset that can be used to augment existing data, in scientifically defensible way, ~~to~~ allowing the analysis to proceed.
  - Joe Skorupa pointed out that in general there is very little food web data available and that everybody needs to understand that as a result the food web analysis will be very crude.
  - David DeForest reiterated that we need to look at species sensitivity and fish tissue data since we know there is variability in selenium sensitivity. Joe Beaman responded that the

goal is to have a criteria that protects the entire waterbody. The question David DeForest is asking may be more implementation-focused and a topic for conversation in the future.

- Discussion about species sensitivity thresholds continued. Various comments and questions focused on referencing previous conversations on SeTSC calls about site-specific sensitivity thresholds in modeling (see DeForest Memo to SeTSC in the October 2019 teleconference folder on wiki); and site-specific recalculation procedure (see October 2019 SeTSC meeting summary on wiki).
- Jesse Sinclair (KNC) asked, to what extent is the SeTSC considering various weighting in the food web model and those species-specific exposure pathways in model runs? What is the process for identifying target fish species used in the model? Should we first understand exposure pathways and food webs to inform selection of target fish species?
    - SeTSC co-chairs responded that this is one of the goals/outcomes of the afternoon meeting session, to discuss the criteria for selecting fish species for modeling.
    - Jesse Sinclair expressed concern in ensuring the target species are appropriately conservative to protect the ecosystem. How do we select fish species without understanding exposure pathways?
- Observer question- Jason Gildea (EPA) asked David DeForest if it is accurate that there are few species with known sensitivities in Lake Koocanusa?
    - Members and observers expressed concern about using site-specific sensitivity. When a species' sensitivity is unknown it defaults to 15.1 for the purposes of modeling. In Lake Koocanusa, there are so many species with unknown sensitivities that they would likely end up driving the criteria because it needs to protect all species in the lake and downstream white sturgeon.
    - Additional discussion focused on the validity of toxicity studies that have not undergone the peer-review process and how these studies/reports may (or may not) be incorporated into the modeling process with regards to species toxicity data. It was noted that the U.S. EPA's national criterion used non-peer reviewed sources as well, however every report used for the US EPA's national criterion went through an internal review process.
    - Jesse Sinclair and Joe Skorupa discussed selenium endpoints. Currently the fish species are considered the endpoint, however, if the species specific sensitivity approach to levels of protection alternatives (DeForest memo, September 2019) is used, then the most sensitive ecological endpoint may be avian and we would need to account for that.

Joe Beaman uploaded the EPA 2016 National Selenium Criterion and 5 documents from the SF Bay onto the wiki site. He encouraged SeTSC members to review, noting that the decisions on modeling parameters are generally the same but assumptions are different. They can be found at the following address: [HYPERLINK "http://lakekoocanusaconservation.pbworks.com/w/browse/" \l "view=ViewFolder&param=Mtg%205%20-%20November%202019"]

Libby Dam Ecosystem Flow and Temperature Operations Review

Greg Hoffman from US Army Corps of Engineers (USACE) gave an overview of the Libby Dam operations. He highlighted the date of construction was 1972 with the purpose of providing headwater storage to the Columbia Basin. The reservoir has variable discharge depending on water levels ensuring that it does not spill over and flood the surrounding area. Other reasons for discharge include:

- specific flows for sturgeon and salmon so they can successfully move downstream of the dam; and
- regulating the temperature of the water in the reservoir.

Greg reviewed the use of the VarQ curve (shorthand for variable flow), which is used to forecast when and how much water will need to be retained or released from the reservoir over the course of a water year.

In 2018 the Army Corps determined that in addition to helping sturgeon and salmon, the amount of water released could also assist the ecological function of the floodplain downstream of the dam. When the floodplain was inundated, not only did it assist in burbot larvae survival, it also warmed the cold water from the reservoir before continuing in the system.

Greg closed by saying they will be trying to manage the temperatures in the reservoir to match pre-dam conditions moving forward.

Overview of Selenium Data

Karen Jenni (USGS) gave a presentation on the latest selenium data compilation. In the water column, dissolved selenium concentrations were sampled most frequently at the forebay and the international border. Particulate data was also most frequently sampled at the forebay and the international border with 178 data records collected from 2015-2018. Selenium concentrations were graphed by location but Karen noted that they would like to graph it by year, date, depth, and sampling method. Also included were:

- 295 data records on zooplankton data;
- A handful of invertebrate records; and
- 2275 records on selenium in fish, including 13 species.

Karen closed by saying that there were very few instances where the data sets matched since the samples were not taken with selenium in mind.

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Lake Koocanusa Contaminant Inputs: Transitioning to Process Directed Monitoring

Dave Naftz (USGS) gave an overview of the new monitoring process put in place by USGS. This includes a servo sipper platform with water quality sondes that take water chemistry readings at multiple depths. There were two sites installed this summer: the primary platform installed at the international border and a second more limited sampling mechanism on the Kootenai River. Dave reviewed data results on temperature, specific conductance, and dissolved organic matter. He highlighted with regards to salinity, that there is a plume uncharacteristic of what one would expect in the system. This may be Elk River water diving under the reservoir surface when it enters the reservoir. This highlights the level of small scale variability that can now be detected.

The future applications of the high frequency data streams that the platform provides include:

- Mass retention/export of selenium in the reservoir;
- Statistically robust 30-day mean of dissolved selenium at multiple depths; and
- A fine tuning of monitoring depths at the international border.

Scientific Basis of Selenium Ecological Protection in Support of Criteria Development for Lake Koocanusa

Theresa Presser (USGS) introduced the planning goals for modeling which include

- Sampling matric with spatially and temporally matched samples
- Locations: forebay, border, and reservoir
- A fish grid with the who, when, where, and why for predator species

Theresa reviewed the Kd modeling parameter which is needed to translate a tissue guideline. The USGS 2015-2017 data, located on the USGS ScienceBase site showed variation in dissolved and suspended particulate material Se concentrations with location, lake depth, and seasonal hydrographs.

Theresa presented slides on Kds at forebay in 2017 as compared to the reservoir hydrodynamics and noted how different those hydrodynamics were in 2015. Theresa also presented slides of selenium concentrations in suspended particulate material (SPM) samples at the forebay and in SPM and water column samples south of the Elk River from 2017 and 2018. These data were presented on time series graphs of hydrometric parameters (elevation, discharge, inflow).

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Post-lunch Re-cap on the Morning

Due to time constraints, co-chairs moved the final agenda item (Kd's) to a subsequent conference call. Sheldon Reddekopp asked the group to share any thoughts and ask any additional questions pertaining to the morning's presentations and discussions.

- David DeForest commented that using the BAF as a check is important as well as clearly defining what a "matched sample" means for this system.
- Joe Skorupa elaborated that the concept of matched samples is something the SeTSC will need to think about given how dynamic the system is. Joe referenced a 2016 Beckon study. In that study, the system received periodic pulses of selenium and the lag time of those pulses were analyzed for when they were detected in the biotic tissues. The results showed the lag time was dependent on the trophic level of the system and found it varied from a few days to months. There was additional discussion on statistical methods, selenium pulses, receptor groups, and frequency of sampling with regards to the 2016 paper.
- **Action:** Joe Skorupa to send a copy of the paper to the co-chairs to circulate to the group. (The paper was circulated with the draft meeting summary and can be accessed on the wiki at the following web address: http://lakekoocanusaconservation.pbworks.com/w/file/137247411/Beckon%202016%20Bioaccumulation%20lag%20times.pdf).
- Sheldon asked the group - in thinking about lag time, water and particulates - do we have water particulate matched data at some locations and times? Karen Jenni responded that yes, there are some clear matched data.
- Sheldon asked Dave Naftz about one of the charts which showed a draw-down and there was one data point that showed selenium above 2, any idea why? Dave responded that he had no explanation for that. The step down in discharge did not change the water elevation, which would have helped explain the higher concentration.
- Jesse asked if the servo sipper looks at data along a transect to see if there is spatial variability laterally? Dave responded that they are depth integrated samples, not done across the whole river channel. At the boundary, they are just single samples, but it would be interesting to see what the profile would look like across the whole transect.
- Marko (Teck) asked what a 30-day integrated sample meant? Dave responded that he did not present on DGT (Diffusive Gradients in Thin films sampler) results, but they were deployed as a backup in case the servo sipper did not work, but it did work so DGT samples have not been analyzed yet. This would give a composite look at what the selenite is at those sample sites over a 30-day period.
- Marko asked if there was work done to find the ideal deployment time? Dave responded that there have been a few studies where they used the DGT samples for selenium concentrations, and the deployment times for those were short, about 2-3 days, but due to logistics, the USGS is putting them out for 30 days.

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- Marko asked if there was a summary on the velocity data collected? Dave responded that the plan was to deploy the hydro-acoustics, but they weren't able to put it out this year. It will be deployed in April 2020.
- Observer Question - Jason Gildea asked if the gage at the Kootenai river would stay in all winter? Given how the selenium is changing in the river, is there a need for another platform in the reservoir?
    - Dave responded yes, it has been covered in heat tape to keep it warm; and yes the USGS is looking into adding a platform at the forebay.
- Jason asked the committee if they still felt that they had enough data to proceed with the modeling? Joe Beaman offered a comment about the amount of data was used to develop the national EPA criteria, and the co-chairs opinion is that there is enough data to proceed.

Working Session: Fish Species

This session led by Karen Jenni (USGS) discussed fish species selection for the USGS Ecosystem Scale modeling effort.

Karen presented a fish chart which included all of the fish species in Lake Koocanusa. The chart included basic information such as life history, selenium toxicity and available data on the species.

She then posed the question to members: which factors need to be considered for modeling the species?

- David Deforest suggested the most important considerations would be any special listings (i.e. endangered or especially sensitive species); feeding guilds; and resident and abundant species.
- Jesse Sinclair agreed with David that species most sensitive to selenium were important, as well as any culturally and historically important fish. He also noted that it is necessary to understand the prey species and how selenium accumulates in their tissue.
- Genny Hoyle added that fish species' relative place in the food chain was important as well as consideration of the downstream fish affected by the dam such as the white sturgeon. She also suggested looking at feeding guilds such as benthic feeders like the largescale sucker.
- Joe Skorupa asked why the group couldn't model all fish species, to which Karen responded the purpose of the discussion is to capture the most important criteria for fish species selection. With that in mind Joe offered that whatever the final decision, the choices need to encapsulate all species in the reservoir, and provide protection for them.

Theresa Presser asked if there would be any difference between spring and fall spawners in terms of when selenium concentrations were highest in the reservoir; is consideration of the life spans of certain species of fish important and should one be prioritized over the other? She also asked, if there are higher concentrations of selenium in certain places in the water column should the feeding locations of the fish be considered? Jesse Sinclair noted that there would be variability over time for what the fish are feeding

on so there may be differences in outcomes - without consideration for whether those species bioaccumulate differently.

Joe Skorupa noted that benthic feeding cyprinids tend to drop out first when there are high levels of selenium and that both rainbow and cutthroat trout have a high sensitivity to selenium. Jim Dunnigan, a fish biologist with MT FWP was brought into the conversation to identify which species are benthic feeding cyprinids. Jim answered: peamouth chub and likely redside shiner but we have no data on redside shiner because they are so small.

Erin Sexton (CSKT) asked how are we going to protect fish for which there is little or no information?

Theresa Presser asked Jim Dunnigan and Trevor Selch, a toxicologist with MT FWP, if they see differences in spawners feeding in July as opposed to feeding in colder temperatures? She asked, is there a relationship between time of feeding and spawning? Jim responded a useful dichotomy is obligate tributary spawners vs. reservoir spawners based on residency timing outside the reservoir.

Karen Jenni opened the room up to questions and comments from observers on the topic.

- Stella Swanson (Elk River Alliance) commented that species that are pelagic during times of thermal or chemical stratification might be most vulnerable. Why not construct a conceptual model that considers that and combine bioaccumulation at those thermocline and chemoclines?

- Greg Hoffman (USACE) echoed the need for protection of downstream white sturgeon and commented that Kokanee are the primary food source for bull trout which may need to be considered.

- Jason Gildea (EPA) asked if Kokanee should be given a lower priority because it is a non-native species?

- Dave Naftz (USGS) asked which fish are most often caught in the reservoir? Jim Dunnigan (MT FWP) responded that Kokanee is the most caught species and it is also prey for trout.

Sheldon Reddekopp asked the group if we are choosing from egg-ovary threshold or muscle tissue when choosing fish? In considering Kokanee as a prey fish, that's a whole body or muscle tissue translation.

- Jesse suggested that they needed to find which fish species have the highest sensitivity as well as those that have a high bioaccumulation factor.

- Sheldon noted that not only were feeding guilds important to consider, but also where and when the fish were eating, i.e. pelagic or benthic. In response, Jesse suggested they could look at the isotopes in the fish to see what their eating patterns are. Although there was general support for this proposal, it was determined that this additional data collection is not feasible for the derivation of site-specific selenium criterion for Lake Koocanusa,.

Action item: Co-chairs to follow up with David Janz about fish eating before spawning and any implications for matching things up with the data we have.

Karen Jenni clarified for the larger group about the levels of protection and the species to be protected. One of the bounding assumptions is that we are assuming we are trying to protect 100% of the species in

the reservoir, and someone asked during a break: why not just model the most sensitive species? The reason is that we do not have much data on them, but also that we are building the ecosystem scale model to understand selenium in the system. This conversation is more about understanding the ecosystem, building a model of our understanding of the system which can validate more than just which fish to protect. That's why we don't just model the most sensitive fish at this point.

Karen Jenni shared a list on the screen of the criteria that SeTSC members discussed during the working session, which she categorized into three groups. The species most discussed in the working session were: White Sturgeon, Kokanee, and benthic feeding cyprinids.

Group 1	***Group 2***	***Group 3***
Special status	Feeding guilds	Future uses of the reservoir?
Resident species that are abundant and common	Fish that are prey for other fish and aquatic dependent wildlife	How to protect species for which we have little or no data?
High bioaccumlating species	Pelagic feeding fish	
High sensitivity species	Spring and fall spawners	
Human consumption	Long-lived and short-lived	
Cultural importance	Reservoir spawners and tributary spawners	
Downstream fish		
Fish that feed at/during thermos and chemo clines		

Working Session: Food Web

Karen Jenni began this session by showing the group a matrix of the fish species in Lake Koocanusa alongside the types of food that they consume. The categories were zooplankton, aquatic insects, terrestrial insects, unknown insects, and fish. Karen asked the group to reflect on the target species discussion, review the table on the screen, and provide additional questions or comments.

Joe Beaman noted an interesting observation on burbot when thinking about seasonality of prey. With the limited data we have burbot do not have a high concentration of selenium in their tissue, yet their diet (based on the available data) seemsis to be made up of mostly high concentration fish (I.e. redside shiner, peamouth, kokanee). In terms of seasonality of prey selection, are they eating these fish at certain time of the year when the selenium concentrations in the ovaries is not yet high? This may be a consideration to take into account when we are selecting target fish species for modeling.

Genny noted that burbot are also cannibalistic and eat each other often. She also noted that their diet changes to primarily fish as soon as they are large enough.

Joe Skorupa commented that we do not want to miss an important pathway, for example in the San Franciso Bay work that Joe Beaman ~~presented on~~ briefly discussed earlier, if they hadn't modeled clams they would have gotten very different results. A possible parallel could be birds that feed mostly on fish. It tends to be the species that feed on insects that have the highest concentrations of selenium, and not the ones that feed on fish. Fish selenium is not as toxic as in insects and other food sources, so it is important to not select all piscivore species as they may not be at the highest risk. Joe Skorupa recommends that the fish species and food web pathways include piscivores but also non piscivores.

Genny wondered if the productivity in the lake had changed since the data in this matrix was collected in the 1980's. Trevor Selch responded that although recent food web data is limited, nothing suggests that there have been changes.

Jesse suggested looking at benthic feeders such as peamouth chub and largescale sucker. If they could validate somehow that the fish have similar concentrations of selenium in their muscle tissue based on what they are feeding on, it could be understood how fish are accumulating selenium based on their diet. How selenium accumulates in muscles may be less species specific and more based on diet? And would this help guide the discussion and decision on fish species selection? Could we build a conceptual model based on what the fish are feeding on and where they are feeding to help guide selecting a subset of fish?

Dave Naftz noted that when looking at Kds and characteristics of fish to select, Kokanee has a lot of advantages. It is consuming organic particulates that are characteristic of the Kds that are accumulating high selenium.

Theresa asked if there were plans to focus on protection of stocked rainbow trout? Jim responded that most rainbows in the reservoir are wild fish. FWP catches both wild and hatchery fish and less than 5-10% caught are hatchery fish.

Joe B and Jim noted that the food web information from rainbow trout are from wild fish.

SeTSC Next Steps

Co-chairs thanked the sub-committee and observers for their participation. A December teleconference call will be scheduled and meeting summary will be distributed.

Co-chairs will create the tracker and add it on the wiki page.

Co-chairs will work on filling out some of the blank columns on fish spreadsheet Karen shared. Co-chairs will use this spreadsheet going forward to inform further committee consideration of target fish species.

The criteria used to determine how many fish species will be modeled will be revisited in a later call so that members can spend more time with the data presented and additional ideas about information needed can be collected.

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APPENDIX 1 – MEETING AGENDA

Selenium Technical Subcommittee Meeting, Wednesday November 13, 2019: 8:00 – 4:00 MST

	Time	*Item*	*Lead*
	8:00	**Meet and greet, coffee**	
	8:15 – 8:30	**Introductions and review agenda**	SeTSC Co-Chairs (Sheldon & Lauren)
1	**8:30 – 9:00**	**Presentation: Process for decision making** *Goal: Shared understanding of draft decision-making process* *Desired outcome: Updated draft process for decision making*	SeTSC Co-Chairs
2	**9:00 – 10:00**	**Presentation: Assumptions & Decisions for "National" Criteria** *Goal: Shared understanding of how the decision points during the development of the EPA national criteria relate to the current modeling process* *Desired outcome: Information share and discussion to support afternoon sessions*	Joe Beaman
	10:00-10:15	**Observer Comments/Questions**	SeTSC Co-chairs
	10:15 – 10:30	**BREAK**	
3	**10:30 – 11:00**	**Presentation: Reservoir Operations** *Goal: Refresh SeTSC members on seasonal and annual differences in dam operations/effects* *Desired outcome: Information share and discussion to support afternoon sessions*	USACE (Greg Hoffman)
4	**11:00 – 11:50**	**Presentation: Data overview** *Goal: Shared understanding of the State of the Lake data compilation, new continuous data collected by USGS, and Kd relevant data.*	USGS (Karen Jenni, Dave Naftz, Theresa Presser)

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		Desired outcome: Information share and discussion to support afternoon sessions	
	11:50-12:00	**Observer Comments/Questions**	SeTSC Co-chairs
	12:00 – 1:00	**LUNCH ON YOUR OWN**	
5	**1:00 – 1:50**	**Working session: Fish species selection** *Goal: shared understanding on fish presence & criteria for spp selection* *Desired outcome: draft list of target spp for modeling*	Karen Jenni to introduce and facilitate
	1:50-2:00	**Observer Comments/Questions**	SeTSC Co-chairs
6	**2:00– 2:50**	**Working session: Food Web selection** *Goal: Shared understanding of food webs & criteria for food web selection* *Desired outcome: draft list of food webs for draft target spp list*	Karen Jenni to introduce and facilitate
	2:50-3:00	**Observer Comments/Questions**	SeTSC Co-chairs
	3:00 – 3:15	**BREAK**	
7	**3:15 – 3:45**	**Presentation/discussion: Kd's / EF's** *Goal: Shared understanding of USGS ScienceBase study on water and particulate concentrations and implications for Kd/EF and what it means for standard development* *Desired outcome: Discussion on what Kd choices mean for standard development*	USGS
8	**3:45 – 4:00**	**Wrap-up & Next steps**	SeTSC Co-chairs
Adjourn: 4:00pm MST			

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APPENDIX 2 – ATTENDEES

Members Present	Organization	Email
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Acronyms:

DEQ – Montana Department of Environmental Quality
ENV – British Columbia Ministry of Environment & Climate Change Strategy
CCRIFC/KNC – Canadian Columbia River Inter-Tribal Fisheries Commission / Ktunaxa Nation Council
CSKT – Confederated Salish and Kootenai Tribes
EPA – Environmental Protection Agency
FWP – Montana Fish, Wildlife and Parks
USGS – United States Geological Survey
USACE – United States Army Corps of Engineers
USFWS – United States Fish and Wildlife Service
UBC – University of British Columbia
UofM – University of Montana
UofS- University of Saskatchewan
CEAA – Canadian Environmental Assessment Agency

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