Columbia River Basin Dreissenid Mussel Monitoring Forum Workshop

Portland, Oregon
June 5–6, 2018

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Executive Summary

To address actions identified in the Department of Interior's "Safeguarding the West" strategy, the Pacific States Marine Fisheries Commission (PSMFC) and US Geological Survey (USGS) convened 43 invasive species coordinators and scientific experts June 5-6, 2018 in Portland, Oregon to assess the status of dreissenid monitoring efforts in the Columbia River Basin (CRB); identify key strengths and weaknesses of existing collaborative efforts to monitor for dreissenids; identify priority monitoring gaps foundational to dreissenid prevention efforts; and achieve consensus on a set of strategies to address those gaps and maintain a strong monitoring collaborative and framework moving forward.

Prior to the workshop, two webinars were conducted to summarize how states and provinces are estimating and using metrics that describe dreissenid mussel introduction (i.e., the risk of mussels being introduced into a waterbody) and establishment (i.e., the risk of a mussel population becoming established after an introduction event). The goal of the webinars was to provide context to discussions at the Columbia River Basin Dreissenid Mussel Monitoring Forum. As part of the webinars expert practitioners, gave presentations that summarized the origins and basis for metrics typically used to characterize invasive species invasion risk. During the first webinar which was held on May 7, 2018, Dr. Bob McMahon, University of Texas at Arlington gave a presentation discussing factors affecting the establishment of dreissenid mussels. During the second webinar which was held on May 30, 2018, Samuel Fischer and Mark Lewis from the University of Alberta presented information on factors affecting the introduction of mussels.

Presentations at the workshop were given to update participants on the status of dreissenid mussel monitoring in the Columbia River Basin. Staff from the US Army Corps of Engineers (ACOE), Bureau of Reclamation (BOR), USGS, Bureau of Indian Affairs (BIA), and National Park Service (NPS) gave presentations that described the status of dreissenid mussel monitoring efforts conducted by federal agencies. Participants also heard presentations on the status of other monitoring related efforts. Representatives from the Western Regional Panel and Montana Fish Wildlife and Parks (MFWP) presented information about method and protocol standardization coordination activities. Staff from the British Columbia Ministry of Environment and Climate Change Strategy also presented an update on their sampling and resource allocation protocols. The USGS then presented an overview of the evolution and status of dreissenid mussel monitoring in the CRB as well as summary of the results of webinars that addressed facets of dreissenid mussel introduction and establishment risk estimation.

To facilitate learning from ongoing efforts that address similar invasive species coordination, monitoring, and research activities, Kelly Baerwaldt, US Fish and Wildlife Service (USFWS) presented remotely on the activities of the Asian Carp Coordinating Committee, informing workshop participants of the how the effort formed and is funded, priority goals and activities, as well as key successes and challenges.

The meeting culminated with workshop attendees participating in four breakout groups (risk assessment and research, data/lab analysis, monitoring/coordination, and funding) to identify priority key gaps or weaknesses to existing monitoring/coordination efforts as well as identify priority actions or strategies could help address those gaps or weaknesses.

The recommended priority actions from each breakout group were compiled into one overall recommendation to build on existing strengths and address weaknesses associated with monitoring for dreissenids in the Columbia River Basin:

Using existing infrastructure and datasets, develop a transboundary, interagency, adaptive, coordinated, regional monitoring framework/partnership to ensure optimal resource allocation.

- Form work groups in the summer of 2018 to address regional monitoring needs identified at the June 2018 CRB dreissenid mussel monitoring forum.

Take steps to obtain long-term sustainable funding for the framework/partnership:

- To address vulnerabilities in unmet prevention needs, state and tribal entities will work with existing agency Congressional liaisons in 2019 to encourage Congress to change Water Resources Development Act match requirements to 75:25 in the 2019 appropriations.
- State and tribal entities will develop key messages and implement a coordinated informational campaign to inform Congress of regional monitoring funding needs.
- Develop the funding need for a Columbia River Basin monitoring program based on regional monitoring/protocol needs.
- Conduct a legal analysis for the Columbia River Basin on agency funding authorities and appropriations.

Workshop Goals

The Columbia River Basin Dreissenid Mussel Monitoring Forum was convened on June 5-6, 2018 in Portland, Oregon to:

- Assess the status of dreissenid monitoring efforts in the Columbia River Basin (CRB);
- Identify key strengths and weaknesses of existing collaborative efforts to monitor for dreissenids;
- Identify priority monitoring gaps foundational to dreissenid prevention efforts; and
- Achieve consensus on a set of strategies to address those gaps and maintain a strong monitoring collaborative and framework moving forward.

The expected work product was the identification of key priorities and actions to strengthen a dreissenid monitoring framework for the CRB.

Attendees

Eric Anderson, Washington Department of Fish and Wildlife (WDFW); Leslie Bach, Northwest Power and Conservation Council; Jennifer Bayer, USGS; Martina Beck, British Columbia Ministry of Environment and Climate Change Strategy; Rick Boatner, Oregon Department of Fish and Wildlife; Steve Bollens, Washington State University; Sam Chan, Oregon Sea Grant; Marcie Clement, Chelan County Public Utility District; Tim Counihan, USGS; Rhonda Dasher, Confederated Tribes of the Colville Reservation; Lisa DeBruyckere, Creative Resource Strategies, LLC; Shawn Devlin, University of Montana; Samuel Fischer, University of Alberta; Joanne Grady, USFWS; Van Hare, PSMFC; Keith Hatch, BIA; Gina Hoff, BOR; Rayola Jacobsen, RJ Consulting; Kim Johnson, Bonneville Power Administration; Meghan Lyons, National Park Service; Madelyn Martinez, Army Corps of Engineers; Blaine Parker, Columbia River Intertribal Fish Commission (CRITFC); Stephen Phillips, PSMFC; Christine Pratt, Seattle City and Light; Anthony Prisciandaro, BOR; Martyne Reesman, ODFW; Cindy Sawchuk, Alberta Environment and Parks; Stacy Schmidt, Montana Fish Wildlife and Parks (MFWP); Michael Stephenson, Idaho Power Company; Angela Strecker, Portland State University (PSU); Mark Sytsma, PSU; Damian Walter ACOE; Teagan Ward, City of Bellingham; Steve Waste, USGS; Steve Wells, Aquaticus, LLC - remote; Leonard Willett, RNT Consulting; Kate Wilson, MFWP; Cody Youngbull, University of Montana; and Nic Zurfluh, Idaho State Department of Agriculture.

Dreissenid Mussel Monitoring in the Columbia River Basin being conducted by Federal Agencies

- **US Army Corps of Engineers** (*Damian Walter*)

  Walla Walla District (WWD) conducts 7-8 sampling events at 3 project pools; six plankton tows during each event. WWD also sets solid substrates and checks fish ladders and other areas of the facility at each hydroelectric dam periodically. Montana estimates more than 2,500 veliger samples, including environmental Deoxyribonucleic Acid (eDNA) will be collected in 2018; Washington will be conducting plankton tows at 229 sites; placing 458 artificial substrates at 229 sites; conducting visual shoreline monitoring at 229 sites; measuring water quality at 229 sites and collecting eDNA at 229 sites. Idaho will be taking 1,500 plankton samples, 200 shoreline surveys, and 200 benthic ponar grabs. Oregon is doing 50 plankton tows. Seattle District will monitor 3 hydropower facilities (Albeni Falls: monthly May through October; Chief Joseph once; and Libby Dam once for a total of 7 samples). Juvenile fish facilities are ideal habitats for dreissenid veligers; the big concern is the lack of redundancy at the facilities. These facilities are run of the river dams, with little storage capacity.

- **Bureau of Reclamation and US Geological Survey** (*Anthony Prisciandaro/Adam Sepulveda*)

  Bureau of Reclamation has 5 regions spanning 17 western states. The Pacific Northwest (PNW) region includes the CRB. Veliger tows (both horizontal and vertical) occur using a 64-micron mesh. There is a total of 42 reservoirs that are surveyed (22 very low risk, 2 low risk, 13 medium risk, and 5 high risk). A total of 29 reservoirs will be sampled in 2018 (the sampling regime was added on to an existing water quality monitoring program). Every reservoir is sampled once every three years at a minimum. Most Idaho reservoirs will be sampled in 2018 but not as many high priority reservoirs; several in Montana and Washington will be sampled in 2018. Bureau of Reclamation is also placing sediment plates consisting of PVC and Plexiglas, surface: 3-9 meters in multiple locations, and 2x/year, visual and tactile analysis. Settling plates will be placed in the following reservoirs: Island Park, Grand Coulee, Glen Canyon, Jackson, Ririe, Palisades, American Falls, Walcott, Lowell, and Owyhee; these are medium to high risk that do not drain frequently. Temperature monitors are deployed with settling plates at surface and deepest plate up to 9 meters to help determine spawning timeframe and peak. A dive team and shoreline surveys also occur secondarily; especially if visibility is good. Cross-training with paleontologists allows for more eyes to survey for both dreissenids and archeological resources. An eDNA interagency agreement exists with USGS to sample 8 reservoirs in the CRB and 2 out-of-basin sites with mussels; this will help inform the feasibility of adding eDNA to current workloads. BOR is seeking to complete additional Vulnerability Assessments of

BOR projects, boat ramp mapping, managing partner identification, and analyzing NPS samples from Lake Roosevelt.

- **Bureau of Indian Affairs** (*Blaine Parker, CRITFC*)
  The Bureau of Indian Affairs provided funding to CRITFC to sample for mussels within the CRB. Washington State University (WSU) and USGS coordinated with CRITFC to conduct the monitoring and to better engage the tribes in this effort. Plankton tows, eDNA, and shoreline surveys during June, July, August, and September of 2018. Microscopy and FlowCam analyses are done by the WSU lab; eDNA analyses are done by the USGS. The 2018 sampling schedule starts June 25, 2018 and occurs during alternate weeks. Tribes in the United States are the 2nd largest land manager behind the federal government, but they lack the resources to cooperatively manage with federal and state partners invasive species threats. The next steps include regional participation by tribal ANS contacts, increased opportunities for monitoring, ANS awareness opportunities for tribal youth, continued outreach to tribal fishers and enforcement staff, development of tribally-based ANS plans, and engaging tribes moving forward.

- **National Park Service** (*Meghan Lyons, NPS*)
  Yellowstone, Grand Teton, Glacier, and Lake Roosevelt National Parks (NP) are sampled.
  - Lake Roosevelt monitoring includes 19 sites (2018). Nine samples are analyzed by WDFW; the other 10 are analyzed at BOR.
  - Glacier NP has been conducting veliger sampling since 2011; in 2017, they initiated eDNA sampling. eDNA samples are analyzed at the Flathead Biological Station.
  - Grand Teton NP conducts veliger tows in 3 lakes and inspects marina infrastructure for adult mussels. BOR conducts veliger tows in Jackson Lake – they are transitioning to settling plates. Samples are sent to the laboratories in Wyoming.
  - Yellowstone NP conducts veliger tows, eDNA and visual surveys (16 sites), and aquatic vegetation surveys annually. In the future, they will be doing settling plates and visual surveys, and participating in the Montana boater AIS passport program. Samples are sent to the Wyoming labs.

Ongoing Monitoring Protocol and Method Coordination Efforts

- **Western Regional Panel** (*Stephen Phillips, PSMFC; Steve Wells, Aquaticus, LLC*)

  The Western Region Panel has a Lab Standards Committee. Since the November 2017 CRB meeting, a draft final report was sent to committee for review, and Sherri Pucherelli has replaced Denise Hosler (retired). Next steps are to incorporate comments into the review process (June 2018) and produce a final report to the Western Regional Panel in July 2018. There are 14 members on the committee representing a variety of state, federal, provincial and other organizations. The report describes the different laboratories and their protocols for sample preservation and handling, sample analysis, quality assurance/quality control, and equipment decontamination. Divergence exists with handling protocols and the concentration of alcohol used to preserve the samples (preserve it in a high concentration, i.e., 70 percent, or preserve in a lower concentration, i.e., 25–50 percent) – much of this is driven by shipping regulations and costs (lower alcohol concentrations require refrigeration). What strategy would provide the best outcome across the board? Those best management practices might drive changes in how samples are processed. Quality control needs to be related to decontamination; there must be clear procedures with chain of custody and communication plans. The quality of the samples Steve Wells is receiving is good; everybody is buffering samples and using sodium bicarbonate. There are discussions about using different buffers.

  The Western Regional Panel is also working on *Dreissenid Mussels Sampling and Monitoring Protocol* (Martha Volkoff and Erin Raney are the committee co-chairs). They produced a document that is currently under review. The document includes plankton sampling, artificial substrate sampling, and shoreline sampling recommendations. These are a set of best management practice recommendations. Comments on the document are being taken by June 15th.

- **Montana eDNA Forum** (*Kate Wilson, Stacy Schmidt; MFWP*)

  Montana convened an eDNA science panel at the Flathead Lake Biological Station in 2018. Montana State House Bill 622 provided funding to convene a science panel to address priority issues and scientific questions. eDNA was chosen because many people sample using eDNA, and it's a regional/national issue. The steering committee included state and federal agencies, tribes, nonprofit organizations, and others.

The purpose of the Montana eDNA Forum was to:

- Evaluate the use of eDNA for mussel early detection
- Review the state of the science
- Identify gaps and challenges
- Figure out how to identify efforts to address gaps, and inform use by management.

Governor Bullock is reviewing the recommendations, and there is regional consideration for next steps.

Challenges identified included:

- Lack of standardized protocols
- Balance of risk and uncertainty
- Detection threshold of eDNA for false negatives
- Limited number of labs
- No coordinated eDNA group
- Few published peer reviewed studies for dreissenid eDNA
- Communicating what a positive eDNA sample means.

The recommendations included:

- Developing, refining, and agreeing upon methods/standards with adaptive capacity
- Developing consistent language
- Developing a communication plan between managers and lab
- Coordinating across western partners
- Identifying risk tolerance and mapping management actions
- Testing assays with round robin process
- Gene sequencing any positive results to confirm optimal condition for eDNA; and using eDNA as one tool in the toolbox.

Suggested parameters of a standard method include:

- Grab samples
- Surface water collection
- The use of bleach for decontamination (50% solutions)
- Minimizing contamination with onsite processing
- Canvassing the water body with smaller samples
- Standardizing assays
- Using controls in the field
- Using qPCR.

- **Canada (***Martina Beck, British Columbia Ministry of Environment and Climate Change Strategy*)

  The *British Columbia Dreissenid Mussel Lake Monitoring Field Protocol* was presented. Updated field and lab protocols include protocols for conducting veliger plankton tows, adult substrate, equipment decontamination, and a water body risk assessment/prioritization tool. The target audience for the updates to protocols included government staff, contractors, and the public. Protocols were updated to reflect the best available science and to align with protocols used by the Western Regional Panel, and to attract increased funding for lake monitoring by developing a criteria-based method to prioritize sample collection. The water body risk assessment tool, which was based on a prioritization tool developed by the State of Montana, is the most significant addition. The tool includes risk of establishment (i.e., probability of survival), risk of arrival (i.e., introduction risk), and impact of invasion (e.g., on threatened and endangered species, hydroelectric facilities, and recreation). Risk categories included critical, high priority, medium priority, and low priority. It is important to understand that the tool is only as good as the data that is available, and because of the sheer number of water bodies in British Columbia (20,000 lakes), there are numerous water bodies that lack calcium and pH data. When data is absent, the federal risk assessment is the current default – the province seeks a finer scale. Next steps include assessing how watercraft inspection data can inform prioritizing sampling efforts (to be conducted by Sam Fischer at University of Alberta).

Overview of Dreissenid Monitoring Efforts in the CRB

(Tim Counihan, USGS)

The presentation focused on the evolution of effort in the Columbia River Basin as well as strengths, weaknesses, and challenges, and introduction and establishment risk.

Evolution of effort—Prior to the discovery of Quagga mussels in Lake Mead, AZ in 2007, Portland State University was the primary organization conducting dreissenid monitoring; the effort was geographically widespread, but the effort was minimal. There has been a rapid expansion of the geographic distribution of samples from 2012 to 2017, and many agencies are now collecting information. Methods targeting adults comprise almost 50%; plankton tows comprise about 30%, and eDNA and other categories comprise the remaining amount of sampling methods.

Two webinars have been held during the past two months that focused on establishment risk and introduction risk. States and provinces provided an overview of their program's use of introduction and establishment risk data.

- Crosswalk of programs – Strengths, weaknesses and challenges: Strengths included partnerships, program attributes, increased funding, and quality of staff.
- Weaknesses included funding, staffing, program attributes, and messaging (the messaging of early detection)
- Challenges included funding and staffing/hiring/contracting, messaging, and methods

Each state and province characterized how they use water quality parameters to describe establishment risk:

- Water quality – information regarding the characterization of high and low risk for a variety of water quality variables were summarized including for calcium concentrations; water temperature, pH, hardness, secchi depth, conductivity, dissolved oxygen, and substrate.
- Takeaways
    - Agencies are using combinations of variables to assess risk
    - Variable ranges are ranked and then combined in different ways
    - Veliger stage was called out as a critical life stage
    - Calcium and pH are particularly important for successful veliger development
    - Need to consider spatial and temporal variability in water quality

The following were discussion items occurring during this presentation:

- Establishment risk—Tie the criteria back to a critical life stage (or other biological requirements).
- It was noted that many of the water quality variables have the potential to be correlated.
- Wisconsin mapped propagule pressure with water body characteristics (and other factors, such as proximity to infested lakes) – high risk of introduction and establishment. They used these characteristics to define top tier lakes, which informed prevention and monitoring efforts. Minnesota used that model to designate lakes and work with private landowners.
- There is also temporal variability within each water body – the critical life stage should be assessed for those temporal conditions.
- If some of the variables are easy to measure, and substantial sums of money are being spent to collect those samples, it could be helpful in terms of other AIS issues and broader questions about trends and ecological conditions to collect that data.
- Significant information gaps exist – water bodies where no data is available.
- Introduction risk included boater use (survey data, recreational boat use, number of boat launches, motorized watercraft, presence or absence of moorage, water body events, water body

characteristics (proximity to known invasive mussel populations, accessibility, waterbody type and size, boatyards capable of working on large commercially hauled watercraft, commercial use, and position in watershed, recreational area - campgrounds and other high public use sites). Does the potential exist to weight the introduction risk in term of large boats, boats transported by commercial haulers, and length of time the boat has been in the water body? A model would combine both introduction and establishment risk.

- Can they establish? Will they survive? Are the resources important to protect (e.g., Threatened or Endangered species, recreational activities, etc.)? There are frameworks that exist; we need to hone in on the modeling of the environmental factors. Connectivity is also important; it's connection to the Columbia River system. Is it beneficial to identify the low-risk lakes first?
- Obstacles to summarizing the status of efforts include issues with data standardization.

The Asian Carp Coordinating Committee Framework

(Kelly Baerwaldt, USFWS)

For more than 10 years, the Midwest has been dealing with the Asian carp challenge to form an interagency team to address protection, prevention, and control of Asian carp, black carp, and grass carp. There has been a legacy of invasive species introduced to the Great Lakes through ballast water, canals, unintended movement, and release. As of 2016, at least 184 nonindigenous species were reported with reproducing populations in the Great Lakes. In the Mississippi River basin, 60 nonnative animal species were introduced from outside the United States, including 37 fishes, nine mollusks, and several invertebrates. A total of 37 nonnative fishes were introduced; 12 nonnative fishes have established. Bighead, silver, and black carp are listed as injurious under the Lacey Act. The Great Lakes has experienced some successes in managing AIS, e.g., sea lamprey – preventing further introduction is the most effective strategy to protect a $7 billion fishery. It costs millions of dollars per year. There are four species of Asian carp – Bighead and Silver (planktivore), Black (molluscivore), and Grass (herbivore). Bighead and Silver Carp populations are widely established in the Mississippi River Basin; Grass Carp and Black Carp populations are increasing with evidence of reproduction in the wild. Establishment includes the presence of all life stages (eggs, larvae, juveniles, and adults). The problem with Asian carp is that they compete directly with native fish and mussels for food (plankton and algae) and space; they are direct predators of native mussels; they destroy aquatic habitat (submerged vegetation; and they are a human safety risk.

The 2007 National Plan provides for the management and control of Asian Carp in the United States and informs regional plans. An Asian Carp Regional Coordinating Committee was created in 2010; 27 US and Canadian agencies work together to produce a comprehensive strategy (annual plans since 2010) that includes more than 60 projects focused on prevention, control, monitoring, early detection, communications, pathway closures, Research and Development (and tools), and multi-year management goals. The Asian Carp Regional Coordinating Committee have $50 million in base funds to prevent the introduction, spread, and establishment of Asian Carp in the Great Lakes via a Federal Executive Committee, a Monitoring and Response Work Group, and a Communications Work Group. The annual action plan is a comprehensive approach to Great Lakes defense that includes detection, management, and response, supports the tactical annual monitoring and response plan, and supports the goals of the National Asian Carp plan.

The 2018 Action Plan includes:

- Prevention actions such as a new electric dispersal barrier and addressing secondary inter-basin pathways
- Control measures include increased use of targeted contract commercial harvest, as well as use of an Asian Carp population model for management decision support
- New control technology development
- Early Detection and Rapid Response and assessments of emerging threats, such as Black and Grass Carp
- Inter-basin collaboration.

Environmental DNA has been used as a genetic surveillance tool since 2009. In 2017, there were no positive detections in 5,332 eDNA samples taken on Lake Erie and Lake Michigan.

Commercial harvest is used to control Asian Carp populations. Pet foods and fertilizer are made from the fish; however, there are currently few fish processing plants that process Asian Carp They are working on emerging markets for human consumption but exportation is currently limited. Enhanced contracted removal seeks to eliminate upstream progression of Asian Carp. Experts from China with experience fishing for Asian Carp have taught the Great Lakes staff a "unified method", in which the fish are herded into a single confined location for mass harvest. A single adult **S**ilver Carp captured by commercial fishers triggered a two-week response called Operation Silver Bullet; a total of 25,000 fish were caught – but no Bighead or Silver Carp.

The strategy is working; there have been no new detections of Bighead or Silver Carp in the Great Lakes; there is enhanced understanding of what the fish are doing and where they are doing it; and numbers of fish

in key locations in the upper Illinois River have been reduced. There are new contingency plans in place for faster/stronger interagency response.

www.AsianCarp.us is the new website for this initiative.

Breakout Sessions

Workshop attendees convened in four breakout groups (risk assessment and research, data/lab analysis, monitoring/coordination, and funding) to identify **priority** key gaps or weaknesses to existing monitoring/coordination efforts as well as identify **priority** actions or strategies could help address those gaps or weaknesses.

A. **Risk Assessment and Research**

Gaps

a. Human dimensions – communicating the importance of early detection and managing expectations of early detection programs to decision makers, funders, managers, and the public
b. Assessments of the cost of monitoring
c. Assessments of the cost of infestation – economy/social values/ecological
d. Data exchange standard – all variables needed to assess optimal resource allocation
e. Protocol standards
f. Better understanding of invasion probabilities
g. Water quality data

Brainstorm list of action items

a. Establish bibliography of valuation of natural resources
b. Move toward a ranked valuation of resources and water bodies
c. Develop a flexible regional model that incorporates establishment, introduction risk, and a valuation of resources/optimal resource allocation
d. Develop a data exchange standard
e. Fill the gaps in water quality data
f. Develop a framework of methodologies that details the strengths and weaknesses of early detection tools and discuss how you respond to detections from particular tools used for early detection (e.g., how do you interpret the results and what actions are reasonable?)

Proposed action item(s)

a. Compilation of living library/database of citations of reports and journal articles related to mussel topics (e.g., biology, management, economics, and social science, available for all)
    - Hosted by PSMFC
    - Key word searchable

b. Develop a flexible regional model to facilitate optimal resource allocation that incorporates establishment, introduction risk, and monetary/non-monetary valuation of natural resources.

- Fill gaps in
  - i. water quality data - collection and discovery
  - ii. human behavior - boater trips
  - iii. data describing valuation of resources
  - iv. data exchange and collection standards
  - v. monitoring, WQ data
  - vi. protocols

c. Develop framework/action of using multiple tools for early detection and response (e.g., How do you respond to a positive eDNA result? Develop suggested set of actions coordinated across states/regions)

B. **Data Standards/Lab Analysis**

<u>Gaps</u>

a. Lack of standardized lab/data standards
b. Reporting format this is consistent among groups
c. Field data collection and lab data analysis for eDNA and microscopy with SOPs
d. Watercraft inspection data collection/collection
e. Define SOPs and labs for accreditation
f. Quantification of eDNA or veligers
g. Understanding the contribution of dreissenid subspecies to population spikes or infestations
h. Lack of protocols for determining whether a dreissenid specimen is viable
i. Technology to help with monitoring and analysis
j. Committee for emerging techniques and technology

<u>Brainstorm list of action items</u>

a. Responsible plan for eDNA early detection
b. Source tracking
c. Standardized control – negative
d. Replicates of positive
e. Technology to help with monitoring and analysis
f. Public education of eDNA committee for emerging technics and technology
g. Rebrand the language to be consistent and non-biased
h. Reform and quarterly yearly reporting
i. Educate public for protocols for data collection
j. Remediation
k. Identifying potential resources
l. Fall for group formation – Request for Information for future solutions
m. Prioritized action list for funding
n. QAQC by ownership – Data source

Proposed action item(s)

a. Form three work groups in the summer of 2018 to document technology, field, and data standard protocols. First report due pre-spring 2018-2019 (current information – response, monitoring and detection).

- Identify funding needs and related work plans.

C. **Monitoring/Coordination**

Gaps

a. Lack of consistency/framework
b. Discrepancies in prioritizing where to monitor (by organization/agency)
c. Lack of coordination (timing of sample collections by location)
d. Data/format/parameters
e. PSFMC collects data and maps after the fact
f. Uncertainty – How much monitoring is enough?
g. Priority of monitoring varies widely by jurisdiction
h. Temperature range research – variability – depends on system/species?
i. When is the best time to sample? Natural variability versus optimal time
j. Monitoring efforts can be hard to fund – if not finding anything, no problem.
k. What to monitor (just quagga/zebra mussels versus aquatic invasive species)
l. Calcium/substrate: Are we missing parameters? (proxy measures, etc.) – For a nominal amount of additional funding, we could collect additional data
m. Research question – trend versus snapshot
n. How to share data on other parameters and species – privacy issues, lack of coordination

Brainstorm list of action items

a. PNW Aquatic Monitoring Partnership – Common protocols and data sharing
b. FERC license – Dams/PUD dataset; AIS program monitoring required long-term
c. Prioritize high-risk water bodies during optimal sampling time
d. Cultural shift in acceptance and comfort with data sharing (interagency, interjurisdictional, citizen science)
e. USGS Water Science Center – exists in most states – see what is available
f. Use existing infrastructure (FERC, dams, WQ datasets, state data, local data, G4CC risk assessment)
g. Expand regional data app to entire CRB (criteria for determining risk) – other tools?
h. Interagency coordinated sampling schedule
i. Volume of water body versus timing of sampling (streamline efficacy/maximize detection probability)

Proposed action item(s)

a. Building on existing infrastructure and datasets, develop a transboundary, interagency, coordinated monitoring framework (who/what/where) that addresses a needed cultural shift in data sharing.

- Identify parameters for sampling frequency – link to research and risk assessment r
- Incorporate multi-taxa monitoring and datasets where possible and/or efficient

D. **Funding**

Gaps

a. No consistency/sustainability
b. Inadequate funding
c. Strategic funding
    i. Research and development
    ii. Early detection
    iii. Prevention
    iv. Partnership/co-managers
d. Finding matching funding
e. Multi-taxa monitoring through collaboration
f. Carryover funding (rollover) – recognize multi-year funding needs

Brainstorm list of action items

a. Establish a process to develop coordination
b. Reliable funding/modify match requirement
c. Synergy for efficiency
d. Acquire funding to monitor priority CRB waterbodies (e.g., Wildhorse Reservoir)
e. Acknowledge the successes of support provided to date
f. CRB-based legal funding authorities and appropriations
g. Agency Congressional liaisons to encourage Congress to change the Water Resources Development Act match requirements to 75:25 in the 2019 appropriations.

Proposed action item(s)

a. To address vulnerabilities in unmet prevention needs, state and tribal agencies work with existing agency Congressional liaisons in 2019 to encourage Congress to change WRDA match requirements to 75:25 in the 2019 appropriations.
b. Develop bullet points to inform Congress of regional funding needs.
c. Develop a price tag (funding need) for a basin monitoring program based on regional monitoring protocols/needs.
d. Conduct a legal analysis for the CRB on agency funding authorities and appropriations.
e. From groups – help Congress identify where to establish funding within agency authorities and appropriations.
f. Develop a coordinated informational campaign for Congress, showing accomplishments and ongoing needs.

Recommendations

Using existing infrastructure and datasets, develop a transboundary, interagency, adaptive, coordinated, regional monitoring framework/partnership to ensure optimal resource allocation.

- Form work groups in the summer of 2018 to address regional monitoring needs identified at the June 2018 CRB dreissenid mussel monitoring forum.

Take steps to obtain long-term sustainable funding for the framework/partnership:

- To address vulnerabilities in unmet prevention needs, state and tribal agencies work with existing agency Congressional liaisons in 2019 to encourage Congress to change Water Resources Development Act match requirements to 75:25 in the 2019 appropriations.
- State and tribal entities will develop key messages and implement a coordinated informational campaign to inform Congress of regional monitoring funding needs.
- Develop the funding need for a Columbia River Basin monitoring program based on regional monitoring/protocol needs.
- Conduct a legal analysis for the Columbia River Basin on agency funding authorities and appropriations.