Chesapeake Bay Program
Science. Restoration. Partnership.

Scientific, Technical Assessment and Reporting (STAR) Team

Thursday, December 18th, 2025
10:00AM – 12:00PM

Visit the meeting webpage for meeting materials and additional information.

Minutes

I. Welcome, Introductions & Announcements (10:00 – 10:10)

*Lead: **Ken Hyer** (U.S. Geological Survey, USGS) STAR Chair, **Breck Sullivan** (USGS) STAR Coordinator, and **Peter Tango** (USGS) CBP Monitoring Coordinator.*

Upcoming Conferences, Meetings, Workshops and Webinars

- Choose Clean Water Conference – May 18-20, 2026. Lancaster, Pennsylvania.
- Chesapeake Community Research Symposium – June 1-3, 2026. Annapolis, Maryland. Abstracts due February 13, 2026.

II. 2024 Tidal Trends and 2024 River Input Monitoring (RIM) Trends (10:10 – 10:45)

*Lead: **Rebecca Murphy** (University of Maryland Center for Environmental Science, UMCES) and **Jimmy Webber** (USGS)*

Rebecca Murphy: Here we describe how Chesapeake Bay tidal water quality trends are produced through a coordinated partnership across Maryland, Virginia, and Washington, DC. Trends are calculated at roughly 150 fixed monitoring stations using generalized additive models (GAMs) that account for seasonality, flow or salinity variability, and historical method changes, allowing results to remain comparable across jurisdictions. Work is coordinated through the Integrated Trends Analysis Team (ITAT) under STAR, which also supports collaboration with academic partners and provides shared tools for analysis. Full 2024 products, including maps and interactive exploration tools (Baytrendsmap and CAST), are available for users who want deeper detail.

The team evaluates both long-term trends, typically starting in 1985, and short-term trends for the most recent 10 years. Many parameters have 40 years of data, while some begin in 1999. Trends are assessed for surface and bottom waters, and for certain parameters within key seasons (for example, spring chlorophyll and summer dissolved oxygen). Results are presented as both observed trends (raw conditions) and flow- or salinity-adjusted trends that standardize conditions to average long-term flow, supporting comparison with watershed flow-normalized results and helping interpret management effects.

For nutrients, the long-term record shows broad improvement across the Bay. Surface total nitrogen has decreased at many stations, with aggregated results indicating about 80% of stations improving; however, the short-term picture is less positive, with improvement dropping to roughly 50% and more stations showing stable or increasing patterns. Surface total phosphorus shows a similar story: strong long-term reductions, with more leveling or shifts in direction in the last decade. Its important to compare these tidal nutrient trends to watershed load trends, which has been supported by prior research linking loads to estuarine concentrations and ongoing coordination between tidal and non-tidal monitoring groups.

There remains mixed but informative patterns across the other parameters. For instance, long-term Secchi depth trends suggest degraded clarity in many areas, though DC tidal stations show improvement, and short-term clarity trends have become more favorable overall. Spring chlorophyll trends are mixed long-term but mostly stable in the short term, while water temperature shows consistent warming across both periods, with implications for habitat and oxygen dynamics. For summer bottom dissolved oxygen, trends vary spatially due to depth and system characteristics, but the Bay's deep channel shows notable long-term improvement and short-term oxygen trends appear more stable. Overall, nutrient trends are strongly improving long term but more mixed recently, while clarity, chlorophyll, and oxygen show greater spatial and temporal variability. If you'd like to see more information on these results, please visit our Tributary Summaries webpage that go into region-specific insights across the 13 major Chesapeake bay tributaries.

James Webber: Here I provide an overview of nutrient and sediment load trends from the Chesapeake Bay's major non-tidal rivers, complementing the tidal perspective. We will focus on the nine River Input Monitoring (RIM) Network stations that represent the largest tributaries in Maryland and Virginia and together drain about 78% of the Bay watershed. Results are current through water year 2024, with updates for the broader 123-station non-tidal network expected through water year 2025.

The non-tidal monitoring program calculates total loads and flow-normalized trends for nitrogen, phosphorus, and sediment using long-term monitoring data collected at fixed intervals and during storms. Statistical models adjust for variability in streamflow to isolate underlying changes over time. Trends are categorized as improving when loads decrease, degrading when loads increase, and no trend when statistical confidence is insufficient.

Spatial comparisons of per-acre loads (total load divided by watershed area) highlight differences among tributaries. The Choptank shows the highest per-acre nitrogen yield, followed by the Susquehanna. Phosphorus and sediment patterns are more similar to each other, reflecting the strong association between phosphorus and sediment transport. The Rappahannock and James show high per-acre sediment and phosphorus loads, while the Choptank's high phosphorus loads appear more dissolved, likely reflecting legacy agricultural inputs. Sediment loads in the Choptank are lower due to its low-gradient system and limited erosive energy.

Trend analyses since 1985 show a mix of improving and degrading patterns across stations, while the most recent 10-year period shows slightly more degrading than improving trends overall. Encouragingly, the Susquehanna shows short-term improvement for nitrogen, phosphorus, and sediment, and all Maryland stations show improving nitrogen trends. In contrast, several Virginia stations exhibit degrading trends in recent years, and the Choptank shows increasing phosphorus loads despite already high yields. Comparisons between watershed load trends and tidal concentration trends reveal clear linkages. For example, improving nitrogen loads in the Patuxent and Potomac correspond with improving tidal nitrogen concentrations, while increasing phosphorus loads in the Choptank align with rising tidal phosphorus levels. However, point sources below RIM stations may influence tidal outcomes and help explain some differences between watershed and tidal patterns.

Discussion:

Comment from chat: *Qian Zhang:* Two observations on the GAM trends: (1) Long-term improvements in TN and TP concentrations and lack of widespread improvement in water clarity in the Bay appear to be generally consistent with the RIM trends (more stations showing declines in TN and TP loads than SS loads). (2) For TN concentration reductions in the Bay, it seems that those locations correspond to areas with major wastewater treatment plants (WWTPs, e.g., Potomac, Patuxent), which is consistent with the finding that point source reductions (and other sources) have explanatory powers in explaining tidal nutrient concentration changes. The Choptank stations show a clear contrast -- i.e., improvement at ET5.2 (below WWTP) but not at ET5.1 (above WWTP).

- ***Response:*** *Rebecca Murphy:* Good insights, Qian! Thanks! Also, some research has shown those secchi trends are related to increased organic fraction until about 2010.

Q: *William Dennison:* I am well aware of the eastern shore problem, but the Virginia (VA) river degradation is news to me. I know whats happening on the Eastern Shore but whats happening in VA? What could be driving that?

- ***A:*** *James Webber:* In some systems, increasing phosphorus trends may be linked to sediment mobilization. In the Rappahannock, for example, past large-scale sediment wasting events may still be propagating downstream, influencing current loads. Reservoir infilling may now be shifting from sediment retention to sediment mobilization, similar in concept to past discussions around Conowingo Reservoir dynamics.

- ***Comment:*** *William Dennison:* In a recent trip down there, I heard about the removal of a dam and community members suggested that sediment released following Embrey Dam removal in the early 2000s may still be moving through the system and potentially releasing phosphorus over time.

- ***Comment:*** *Rebecca Murphy:* from the tidal perspective, the team has been closely watching these Virginia trends. Increased development below the fall line in some regions could also contribute to observed patterns, particularly where point sources enter downstream of monitoring stations.

Q: *Kaylyn Gootman:* A question for the group: how do people feel about seeing these trends, tidal and nontidal, as they are presented.

- ***A:*** *Ken Hyer:* my sense over the last 10 years is that the tidal and nontidal groups are interacting a whole lot more than in the past. Of course, they are separate groups but the feeling is that they are no longer silos. It is certainly something that we should continue to work on and improve.

- ***Comment:*** *Bo Williams:* This is a great opportunity to incorporate focused tributary case studies to illustrate how watershed and tidal data combine to tell place-based stories.

- ***Response:*** *Kaylyn Gootman:* I think this sets a really great foundation for telling the story of whats happening and we can now start to work on the why. Especially in response to Bill's comments on the local side and case studies of what might be happening at the local scale.

- ***Response:*** *Peter Tango:* Future efforts should continue strengthening integration while carefully communicating basin-specific drivers, management outcomes, and local context.

III. Briefing on the STAC AI/ML Workshop (10:45 – 11:10)

Recommendations and MB Responses

Lead: ***Qian Zhang*** *(UMCES)*

The Scientific and Technical Advisory Committee (STAC) Artificial Intelligence and Machine Learning (AI/ML) workshop in February 2025 was to leverage AI/ML to advance Chesapeake Bay research and management. You can access the full report from the workshop here. This workshop brought together many collaborators from federal, academic and nonprofit partners. The objectives were to summarize recent AI/ML applications to the Chesapeake ecosystem and lessons learned; Identify the challenges and gaps in applying AI/ML tools; and to outline recommendations and future opportunities identified by participants.

In the report, there were recommendations provided for the Chesapeake Bay Program (CBP) that followed four major themes: strengthening data infrastructure and integration for AI/ML applications; leverage AI/ML for restoration of Chesapeake Bay tidal and nontidal regions restoration and decision support; promote transparency and engage managers and stakeholders; and build collaboration and capacity.

The first theme focuses on data. Effective AI/ML applications depend on well-organized, harmonized datasets. As a partnership, we have exceptional data resources collected at varying spatial and temporal scales. Harmonizing these datasets is essential. Workshop participants emphasized integrating diverse sources such as remote sensing products, in situ monitoring, and high-frequency data.

The second theme addresses how AI/ML can be applied once data are prepared. Identified use cases include evaluating restoration practices, tracking management progress, identifying drivers of water quality conditions, and enhancing existing models. AI/ML can help identify systematic biases and improve model diagnostics. One particularly innovative idea discussed was developing a Bay-specific AI tool, similar in concept to ChatGPT, to support scenario planning and priority identification by accessing data through the partnership's Data Hub. This idea has already generated follow-up interest.

The third theme centers on transparency and stakeholder engagement. Participants emphasized the importance of explainable AI to address the "black box" perception of these tools. Visualization techniques can help illustrate model processes and outputs. Critically, managers and decision-makers must be engaged from the beginning of AI and ML projects and not simply presented with results after analyses are complete.

The final theme focuses on building collaboration and capacity. Participants proposed creating a community of practice or discussion forum to sustain momentum from the workshop. Continued collaboration across federal, state, academic, and management partners will be essential to ensure AI tools are both scientifically rigorous and practically useful.

The MB responded to these recommendations at the December 11th MB Meeting (link here) and they acknowledged a lot of the workshops objectives and recommendations. They identified three priority areas: leveraging diverse datasets; enhancing models with AI; and communicating uncertainty and limitations.

The first priority is leveraging diverse datasets for modeling and monitoring applications, particularly to address water quality data gaps and support best management practice (BMP) verification. Potential next steps include identifying example use cases that demonstrate how AI can integrate remote sensing, high-frequency sensors, precipitation data, and tidal monitoring. Guidance on documenting data sources, assumptions, and limitations in a way accessible to managers was also emphasized. This work may involve collaboration with data integrity and monitoring network teams.

Their second response was to enhance watershed and estuarine models by integrating AI/ML model outputs and insights. More specifically, the MB recommends that STAC provide advice as to how AI/ML can provide greater precision between modeling, land use/land cover, and monitoring data, especially in communities where data on BMPs remains incomplete.

The third priority focuses on clearly communicating uncertainty. AI-derived outputs should include confidence intervals and explicitly distinguish between observed, modeled, and AI-generated information. This will be particularly relevant to modeling teams and reporting groups.

Lastly, the MB responded on building harmonized response and predictor datasets and develop exemplar use cases to guide widespread AI/ML applications and that STAC provide advice and greater specificity on data structure and relationships that need greater attention or improvement to better support AI/ML models.

<u>Discussion:</u>

Comment from chat: *Matt Baker:* To piggyback on some of Qian's ideas: Apply high-resolution/high-frequency imagery to assess phenology of land cover to detect success of revegetation efforts in BMP implementation relative to seasonal fluxes of nutrients. Also to link patterns and location of BMP implementation to downstream patterns and seasonality of water quality.

Q: *Bruce Vogt:* I heard a lot of stuff related to water quality and I am curious about if there were any conversations around the use of AI/ML with living resources or even linking water quality data and living resources? I know there is some work being done around this but I am curious if that is a goal to better connect outcomes and targets under the revised agreement to support more informed decision-making?

- ***A:*** *Qian Zhang:* The short answer is yes! Before the workshop, we conducted a literature review of AI and ML applications in both tidal and non-tidal systems. While water quality applications remain dominant, there were clear examples beyond water quality, including fish habitat and stream habitat work. The workshop included synthesis presentations covering watershed science and estuarine science, and living resources were addressed in both contexts. I believe these examples are also summarized in the workshop report.
- ***Comment from chat:*** *Matt Baker:* One of the things that was preeminent in the session was using AI to help parameterize existing models using data from within and outside of the Chesapeake Bay watershed (CBW) to help derive new insight.

Comment: *Bill Dennison:* One observation I would add is that AI/ML cannot be treated as a one-time discussion. While we held a workshop and received a response from the MB, these tools are evolving rapidly. We need to consider how to incorporate ongoing review of AI and ML applications into our regular operations. I am not proposing a new workgroup, but we do need a mechanism to keep this conversation active. This is not a one-and-done effort.

- ***Response:*** *Qian Zhang:* I completely agree. We should continue these conversations in one format or another. During the workshop, there was discussion about whether to establish a new workgroup, and that idea was ultimately not pursued. However, follow-up conversations have continued. For example, the workshop speakers presented at subsequent modeling-focused meetings organized by USGS, which extended the discussion. We need a way to maintain momentum. This could take the form of webinars, recurring conversations, or possibly leveraging existing forums such as the Chesapeake Research Consortium (CRC) Roundtable. The key is ensuring regular engagement and keeping the topic visible. At some point, another workshop may also be appropriate.

- ***Comment:*** *Matt Baker:* One of the key insights presented by Chaopeng and his group during the workshop was how AI can be used not only to generate predictive water quality models but also to parameterize and improve physical process-based models. What was particularly striking is that AI approaches allowed them to incorporate data from outside the CBW to improve predictions within the watershed. This has important implications for Bruce's question about living resources. The same principle could apply to models of living resource abundance and distribution. Rather than relying solely on Chesapeake Bay data, AI could incorporate information from other estuaries nationally and globally to improve local predictions. Currently, that type of cross-system learning happens through traditional scientific communication and inference. AI has the potential to accelerate and formalize that process by directly integrating external datasets into model development. I have continued participating in modeling workgroup discussions and am still processing how these ideas could be applied more broadly.

- ***Response:*** *Joseph Delesantro:* Within the Modeling Workgroup, we are incorporating AI and ML techniques into calibration and parameterization efforts for Phase 7. We hold regular technical discussions with researchers at Penn State, who were also instrumental in the STAC workshop. Progress is presented during our quarterly Modeling Workgroup meetings. In January, we expect to provide an update, likely about ten minutes, on how AI is being integrated. As we approach final calibration, you will likely see more detailed discussion of these applications. While it is important to continue broader conversations, AI integration is already occurring within existing workgroups on an ongoing basis.

Comment: *Ken Hyer:* I want to emphasize that there is strong support for this work across EPA, the jurisdictions, and federal partners. There was no hesitation about the value of AI and ML. The consensus was that these tools provide significant opportunities to improve management decisions and identify solutions. Regarding a community of practice, there was discussion about formalizing that effort. Ultimately, language about establishing a specific group did not make it into the letter primarily due to funding considerations, not because of opposition to the idea. In 2026, it is entirely appropriate to continue building a community of practice to support colleagues working in this space. The three priority areas identified in the MB letter were intended to communicate where the MB sees the greatest value. For example, linking AI applications to management actions and evaluating the effects of restoration activities. The workshop was an excellent starting point, and in ten years, we may look back and realize how foundational these early conversations were.

IV. Improving Nutrient Management in the Chesapeake Bay Watershed through System and Transdisciplinary Approaches **(11:10 – 11:35)**

Lead: ***Jun Suk Byun*** *(UMCES)*

Jun Suk Byun: This research examines how nutrient management in the Chesapeake Bay watershed can be improved through both systems-based analysis and transdisciplinary stakeholder engagement. Despite decades of effort to reduce nitrogen (N) and phosphorus (P) loads, progress has been uneven. Between 2009 and 2018, roughly 60% of non-tidal riverine monitoring stations showed increasing or stagnant nutrient load trends. In addition, nutrient contributions vary substantially by jurisdiction and source sector, highlighting persistent spatial and structural management gaps.

Using the CAFE nutrient budgeting framework (Cropping system, Animal-crop system, Food system, and Ecosystem), the team quantified nitrogen and phosphorus flows across four interconnected systems: cropping, animal–crop, food, and ecosystem systems from 1985 to 2019. Cropland nutrient use efficiency improved significantly over this period, and phosphorus surplus declined, indicating more efficient fertilizer use. However, nutrient surpluses remain substantial beyond croplands, particularly within ecosystem and food systems. Nitrogen losses have increased disproportionately relative to phosphorus, as reflected in rising N:P surplus ratios, suggesting emerging imbalances across systems.

One promising solution identified is improved manure recycling. Analysis showed that in over 60% of counties, unrecycled manure nutrients could theoretically substitute a significant share of mineral fertilizer inputs. While logistical and socioeconomic barriers exist, this finding highlights the potential to better connect nutrient flows across systems and spatial boundaries rather than focusing solely on field-level management.

The transdisciplinary component engaged stakeholders including farmers, government representatives, non-governmental organizations (NGOs), academics, and consumers through surveys and interviews. Results revealed a gap between measured water quality improvements and public perception, with many participants believing conditions had worsened. Stakeholders perceived state governments and agricultural producers as having the greatest capacity to reduce pollution, while individual consumers were seen as having limited influence. Interestingly, respondents expressed willingness to adopt individual practices such as reducing food waste, even though they perceived these actions as less effective.

Overall, the research demonstrates that while cropland management has improved, nutrient surpluses beyond croplands remain a significant challenge. Strengthening cross-system nutrient recycling, improving science communication, and broadening stakeholder engagement are critical for translating scientific advances into actionable policy and management outcomes across the CBW.

Discussion:

Q: *Bill Dennison:* You are advocating for more effective manure recycling, which is an important message. We do not want to rely on incineration, as that does not help close the nutrient loop. However, one issue you did not address is the N:P ratio in manure. Poultry manure, in particular, is phosphorus-rich. How do we best manage a fertilizer source that is high in phosphorus when crops may require additional synthetic nitrogen? How does that balance work in practice? Many people have been thinking about this challenge for a long time. Given the stakeholder data you presented of what they are willing to do and how they perceive these issues, do you have any insights on how we might better educate farmers and provide incentives to improve manure utilization and recycling?

- ***A:*** *Jun Suk:* From what I have read and based on my understanding; many farmers feel that university recommendations on nutrient inputs are not always well integrated into real-world production systems. As a result, there can be a lack of trust in those recommendations. One way forward would be to provide more field-based evidence like demonstration projects comparing different combinations of synthetic fertilizers and manure. We could work toward identifying a more balanced nutrient strategy and show, through field trials, how the N:P imbalance can be managed. Moving forward, we need to engage directly with farmers, present clear data, and develop applied field experiment results that reflect current production realities. This approach could help build trust and encourage greater use of manure as a nutrient resource.

- ***Response:*** *Bill Dennison:* That's great! I also think jurisdictions can play a role by supporting manure transport programs so that manure is moved from areas of surplus to areas where nutrients are needed. Your maps clearly show where manure is generated and where it is needed. The next step is ensuring that policies and programs facilitate that movement appropriately.

Q: *Peter Tango:* I appreciate your comment about trust in recommendations. We have also heard about the importance of using trusted networks and having information delivered by individuals or organizations that farmers already rely on. One key takeaway from your presentation is the need for stronger science communication around water quality and nutrient management. Combining effective science communication with trusted messengers could make a significant difference. I have a broader question. There are 18 million people in the watershed, and human waste is treated through wastewater treatment plants to manage N and P before discharge. Is there anything comparable in animal agriculture for managing the waste of millions of animals at a similar scale? Could we treat animal waste in a way that adjusts the N:P ratio? I realize this may be a simplistic question, but is it simply too cost-prohibitive to treat animal waste in a way similar to human waste treatment?

- ***A:*** *Jun Suk:* There have been investments in startups that capture ammonia from animal waste streams. By removing ammonia, they effectively recover N while leaving P behind in the remaining material. These efforts are underway, but they are not yet implemented at a large scale.

V. Leveraging High Resolution Data to Develop Insight about Urban Forests **(11:35 – 12:00)**

Lead: ***Matthew Baker*** *(University of Maryland, Baltimore County, UMBC)*

Matthew Baker: I have been working with Baltimore Green Space since 2011 to understand how high-resolution spatial data are transforming the assessment and management of urban forests in Baltimore. This was initially motivated by a city policy that allowed adjacent landowners to purchase and clear small forest parcels, exposing a lack of data on urban woodland extent and condition. In response, our team developed new, patch-specific sampling protocols to better understand the composition, structure, and soil characteristics of Baltimore's urban forest fragments.

Using geolocated sampling points, rapid vegetation assessments, prism-based stem measurements, soil compaction tests, and a vine encroachment index, the team generated spatially distributed data across dozens of forest patches and nearly 900 sampling points. We found that while the overstory canopy is overwhelmingly native, ground cover is largely dominated by invasive species. Vine encroachment is common, though soil compaction levels are generally low and organic matter accumulation is consistent with regional forest norms. The approach allows managers to identify site-specific priorities, such as invasive control or targeted restoration.

A major contribution of this work is its ability to map forest structure and edge effects at high resolution. Species composition shifts significantly within 15 to 18 meters of forest edges, with additional structural changes deeper into patches. By distinguishing between larger forested natural areas and smaller "groves," we can show that not all tree canopy functions as true forest habitat. Historical aerial imagery further revealed how current forest patches emerged over the past century and highlighted complex ownership patterns, particularly the high proportion of privately held woodland in Baltimore compared to other East Coast cities.

More recently, LiDAR-based (Light Detection and Ranging) analyses have enabled classification of forest structural types and remote monitoring of canopy height and biomass distribution.

Overall, high-resolution spatial data now allows urban forests to be characterized, mapped, and managed in ways that were previously not possible. This work has informed policy changes, strengthened stewardship efforts, and is expanding beyond Baltimore to other cities seeking to better understand and manage their urban woodlands.

Discussion:

Q from chat: *Jeremy Hanson:* These are all leased properties and you mentioned Baltimore Green Space. Do they use your analysis to coordinate with landowners to take actions like volunteer invasives removal on the most heavily impacted sites or to work with landowners to do chemical applications for certain species, since you were able to identify the dominant veg cover?

- ***A:*** *Matt Baker:* Baltimore Green Space does and my role is primarily advisory and collaborative rather than regulatory. They regularly attend steward meetings to answer questions, but much of the coordination and outreach is conducted through Baltimore Green Space staff, whose mission centers on community engagement. In this capacity, the speaker serves as a scientific advisor, supporting the organization's efforts to translate data into actionable guidance for local land stewards. One significant outcome of assembling this urban forest dataset has been the development of a broader research network. Other researchers in Baltimore and beyond have built upon the data, integrated it into their own studies, and developed new research questions tied to both Baltimore Green Space's stewardship efforts and the underlying forest assessments. This has expanded the impact of the work beyond its original management focus and fostered interdisciplinary collaboration. Regarding management practices, discussions have focused on non-chemical strategies for removing invasive ground cover species and integrating native plantings. The team promotes experimental, adaptive approaches that allow stewards to test different restoration techniques and evaluate their effectiveness over time and across varying site conditions. Finally, the work has contributed to broader institutional shifts. Although not the sole driver, the research and ongoing dialogue have helped prompt the Natural Resources Conservation Service (NRCS) to reevaluate soil mapping in Baltimore City. By persistently highlighting data gaps and management needs, the team has influenced improvements in how urban soils are characterized and understood.

VI. Adjourn (12:00)

Next Meeting: *January 29th, 2025, from 10 AM – 12 PM.*

Attendees:

Qian Zhang (UMCES), Jun Suk Byun (UMCES), Ken Hyer (USGS), Breck Sullivan (USGS), Peter Tango (USGS), Allison Welch (CRC), Gabriel Duran (CRC), Kaylyn Gootman (EPA), James Webber (USGS), Rebecca Murphy (UMCES), Keith Bollt (EPA), John Wolf (USGS), Julia Fucci (CRC), Marisa Baldine (Alliance for the Chesapeake Bay), Tou Matthews (CRC), Meg Cole (CRC), Amanda Shaver (VADEQ), Sophie Watermen (USGS), Larry Sanford (UMCES), Amy Handen (EPA), Christina Garvey (CRC), Ashley Hullinger (PADEP), Matthew Baker (UMBC), Liz Chudoba (ACB), Stephanie Nummer (ICPRB), Mary Stack (ICPRB), Bill Dennison (UMCES), Jeremy Hanson (CRC), Bo Williams (EPA), Joseph Delesantro (ORISE), Katherine Brownson (USFS), Krista Crone (PADEP), David Wood (CSN), Peter Claggett (USGS), Michelle Katoski (USGS).