Integrated Trends Analysis Team (ITAT)
Meeting

Wednesday, February 28, 2024
10:00 AM – 12:00 PM

Meeting Materials: Link

This meeting was recorded for internal use only to assure the accuracy of meeting notes.

Action Items

- **Kaylyn Gootman will connect Rosemary Fanelli with Chesapeake Monitoring Cooperative to see if there is opportunity for collaboration, including sharing their recent prioritization report which identifies the need for more specific conductance data collection.**
  - **Done**
- **Before the next ITAT meeting, Alex Gunnerson will schedule a planning meeting with Breck Sullivan and Kaylyn Gootman to discuss the path forward for the tributary summaries.**
- **ITAT members decided that while there is a potential role for cluster analysis in geographically screening connections between the watershed and estuary, it is not the appropriate method for continuing tidal-nontidal analyses. Elgin Perry and others suggested referring to this paper for pursuing future tidal-nontidal analyses.**

Meeting Minutes

10:00 – 10:10 **Welcome – Kaylyn Gootman** (EPA) and **Alex Gunnerson** (CRC)

Announcements –

- Isabella Bertani will be presenting at the Nontidal Network Meeting (1-2:30pm) on April 17th on her work to gather and harmonize non-tidal stream water quality data from EPA's Water Quality Portal to use in watershed model calibration. This may be of interest to ITAT members.
- Tributary Summary Announcements
  - Alex Gunnerson shared that Sarah Betts, a student from Franklin and Marshall college who is interning with ITAT this spring semester, has been making progress on updating the Rappahannock Tributary summary. Timely responses to Sarah's inquiries are appreciated.
  - Alex Gunnerson shared that since the James Tributary Summary was completed last year and starting the James Story Map this year, new data has been released. Alex asked if the story map should use the most recent data or if it should be in alignment with the corresponding tributary summary. Olivia Devereux said ideally the tributary summaries themselves should be in alignment with the story map, but the story maps should always have the most recent data. To prevent this issue from happening again, Olivia suggested completing all tributary summary updates at the same time. Olivia asked why there was a decision to move away from updating all the summaries at the same time. Kaylyn Gootman explained

that given the changes to the new tributary summary format for the James, more staff time is needed for each update at this stage. Additionally, USGS is requiring us to proceed document by document, although we will note which sections have not changed which should help speed up the process. Kaylyn said any help Olivia can provide regarding automating the updating of text would be welcome.

Upcoming Conferences, Meetings, Workshops and Webinars

- Environment Virginia Symposium – April 9-11, 2024, Lexington, Virginia. Presentation Proposals were due August 31, 2023.
- National Conference on Ecosystem Restoration – April 14-19, 2024, Albuquerque, New Mexico. Abstracts were due September 1, 2023.
- Choose Clean Water Coalition – May 20-22, 2024, Ellicott City, MD. Session proposals were due January 19, 2024.
- Chesapeake Community Research Symposium – June 10-12, 2024, Annapolis, Maryland. Abstracts were due February 1, 2024. Early bird registration closes March 15, 2024.
- American Planning Association (APA) Virginia 2024 Conference – July 21-24, 2024, Williamsburg, Virginia. Session proposals were due February 23rd.

10:10 – 11:00 **Characterizing spatial and temporal patterns of conductivity in freshwater tributaries within the Chesapeake Bay watershed – Rosemary Fanelli** (USGS)

Rosemary presented on work to characterize spatial and temporal patterns in specific conductance (SC) data, which is a surrogate for salinity. There was general discussion following the presentation.

Summary

Rosemary began with a review of key terms used when discussing freshwater salinization (slide 2) and sources of specific conductivity (SC) in the Chesapeake Bay watershed, both natural and anthropogenic (slide 3). Rosemary also explained broad level effects of freshwater salinization (slide 4) and characterized regional stakeholder needs in the Chesapeake Bay watershed (slide 5). Rosemary described the data used for the specific conductivity in the Chesapeake Bay watershed (slide 6).

Rosemary then walked through two ongoing USGS regional projects on freshwater salinization in the Chesapeake Bay watershed. These projects fall under a broader USGS effort to quantify status and trends for seven indicators of stream health, which include: biological endpoints, physical habitat, stream temperature, nutrients and sediment, salinity, flow, and toxic contaminants.

The first project focused on quantifying status and trends in SC using discrete observations in freshwater tributaries. Rosemary explained methods for how specific conductance status and trends were computed, which utilized both Weighted Regressions on Time, Discharge, and Season (WRTDS) and Seasonal Mann-Kendall (SMK)

methods. Results were presented for both annual and seasonal trends. Rosemary explained how these results were used to calculate indicator site representation for the seven stream health metrics. Rosemary emphasized key takeaways and next steps for this project (slide 17).

The second project focused on predicting SC and departures from background SC across all freshwater tributaries. This project is important because more information on where streams are most impacted by freshwater salinization is needed and stakeholders are interested in understanding where to target efforts that do not have sufficient monitoring data available. Rosemary described the methods and data used in this project, including the model set up and performance. One key result from the study was that snow depth amplifies the effect of impervious cover on SC. Rosemary presented other results of basin-wide predictions of SC, departures in SC from background levels, and how those changes in departure status vary across ecoregions. Rosemary emphasized key takeaways and next steps for this project (slide 25).

Discussion

Elgin Perry asked if municipalities keep records of the amount of salt they use in road deicer applications, as this dataset would seem to be an important variable predictor for these projects. Rosemary said municipalities keep records to various degrees. For example, the Maryland Department of Transportation has detailed records, including a storm-by-storm basis, but other municipalities may just record sales of deicers and not usage, which is less reliable than needed. The USGS maintains a dataset nationwide of road salt application, but when compared to local datasets, there are inconsistencies. For very broad or rough analyses, this dataset might suffice, but for this Chesapeake Bay specific analysis it was not sufficient, so it was not included in these projects. Rosemary said there are ongoing efforts within USGS to improve the quality of municipal road salt application datasets, with one example being the Delaware River Basin.

Rosemary said that in these analyses, impervious snow cover is being used as a proxy for presumed deicer application severity. Carol Cain said the correlation between snow depth and conductivity is very interesting. Carol added that MS4 permits for communities may provide data on application rates/volumes. Kaylyn Gootman asked if this type of information can be combined with any existing state or county operating procedure for deicer application during precipitation events at or below freezing. Rosemary said road salt application varies according to who manages the impervious surfaces in question. For example, many private owners of impervious surfaces, like apartment buildings, overapply salt to avoid lawsuits from any injury or damages. Rosemary said there is no way to capture all that information, but some assumptions can likely be made.

Kaylyn said there are participatory science opportunities to help with the collection of SC data. While data density may be lacking, Kaylyn recalled that SC data collection is not particularly expensive or difficult. Rosemary replied that Salt Watch is a great example of engaging the public. Municipalities like Gaithersburg have also pursued outreach opportunities like painting their snowplows to raise awareness that this is a safety and ecological issue. Rosemary said she likes the idea of crowdsourcing SC data collection. Kaylyn said the Chesapeake Monitoring Cooperative (CMC) has an organizing role in this effort and recently released a report of their priorities, organized by jurisdiction, and

one priority was monitoring freshwater salinization through SC data collection. Rosemary asked Kaylyn to connect her with CMC and share the priority report.

Elgin asked if there is evidence that alternative deicers, like beet juice, are having any effect on reducing SC levels. Rosemary said she is not an expert on this type of deicer. Rosemary thinks it can be effective under certain conditions, but there is a concern about effects on biogeochemical cycling, specifically carbon. Rosemary heard that Calvert County, MD may be using beet juice as a deicer. Kaylyn asked if there are any public communication concerns with the color of beet juice. Elgin said when applied, beet juice looks similar to the white color of salt brine and has seen it applied in his county of residence in Virginia.

Olivia said Greg Sandi (gregorio.sandi@maryland.gov) at Maryland Department of the Environment has been the lead on providing data and would be a good source of information for SC. Maryland has a salt TMDL and sees fish kills from above background salinity, especially nearby speed bumps as excess salt is knocked off the back of trucks, even if there is a calibrated spreader. Northern Virginia had a conference on salt a few years ago.

Olivia asked how the background specific conductivity was determined for the Chesapeake Bay watershed. Rosemary said it was based on a publication from EPA (see slide 3) which used random forest modeling of undisturbed sites, low impervious cover and minor anthropogenic influence, across the conterminous U.S. from 2001 to 2015. One drawback of the dataset is that some settings in the Chesapeake Bay watershed may have been underrepresented, specifically carbonate lithology areas, because those are mostly pasture and there are not many undisturbed forests left in those regions. Based on USGS groundwater data and other sources, Rosemary believes the background SC levels in carbonate lithology are slightly higher than this study predicted.

Regarding data density, Kaylyn said there seems to be a drop off in available data above the Maryland border. Kaylyn asked how the CBP can incentivize including the monitoring of SC during other data collection efforts by community science groups, federal and state programs, and academic researchers. Rosemary said the nontidal network data was not included in this analysis, so she will work with Chris Mason to get that incorporated as that might help alleviate the data density issue in the more northern parts of the watershed.

11:00 – 11:45 **Refresher on Existing Nontidal Cluster Analyses – Elgin Perry** (Independent Statistical Consultant)

Elgin shared previously presented work on cluster analysis work in the Susquehanna to refresh ITAT members on this topic. Participants were asked to consider if this type of approach would be appropriate for connecting nontidal and tidal factors, as was discussed at the Joint Factors/ITAT meeting in October.

Summary

Elgin began by reviewing how the cluster analysis works, which involves taking trend predictions from the model and organizing them into a 3-D lattice data structure for year, season, and station. Season is based on the water year (October – September). Next the data must be transformed into a 2-D structure for cluster analysis to take

place. This could involve clustering the years according to the profile of the stations. When clustering stations with just observed data, it results in the status of the station because stations cluster according to value.

Elgin then walked through results for total nitrogen (slides 5-12) and total phosphorus (slides 13-15) in the Susquehanna, showcasing dendrograms, plots, and maps of the stations.

Elgin concluded that in his opinion, cluster analysis is not an appropriate method for next steps in tidal-nontidal analysis. Instead, Elgin suggested following guidance from this publication to make connections between what is going on above the fall line and below the fall line: https://pubs.acs.org/doi/full/10.1021/acs.est.1c05388.

Discussion

Kaylyn said for the example clustering by year in the mainstem of the Susquehanna, did Elgin also do a similar analysis including the tributaries. Kaylyn also asked if total nitrogen was included. Elgin said he does not quite remember because this was presented a few years ago, but suspects that he did include TN but only presented TP because it was more interesting. Elgin did not include the tributaries in the analysis, but said one was of ordering the profile could be upstream to the downstream confluence with the mainstem. This ordering could be a little confusing on the resulting plots.

Kaylyn said year-based analysis is interesting to her. Would this annual time scale be possibly helpful from a management perspective? More so than monthly or 10-year period? Elgin said he views cluster analysis primarily as an organizing tool. When the team first did baytrends, they realized there were a lot of individual comparisons that became quite tedious, so the cluster analysis approach helped generate generalizable statements for certain portions of the tributary. Elgin said to do below and above fall line comparisons in a single cluster analysis would cause a lot of problems because there is nothing comparable to load divided by watershed area below the fall line. One could argue that measured concentrations could be thought of as a scaled version of yield, but Rebecca's regression approach would be better utilized in this case. Kaylyn said it seems like Elgin views the nontidal cluster analysis as a screening tool for changes over time, less so for connecting tidal-nontidal analyses. Rebecca agreed with Elgin and said we either need a dynamic model or regression type approach. Rebecca said we would need to start with a specific question in a specific geography before we can identify the appropriate statistical methods to move forward with an analysis. Olivia agreed with Rebecca's approach.

Olivia asked Elgin about the software used to create these analyses. Elgin said he uses R to create custom functions to gather the output from baytrends, cluster those R objects, and then produce the plots. For the materials presented today, Elgin worked with USGS to incorporate USGS WRTDS loads into the clustering plots.

Elgin said one way cluster analysis might be useful is to identify where you might expect a response in a certain parameter below the fall line. For example, Rappahannock stations from the fall line to the estuarine turbidity maximum are in a different trend group compared to the downstream stations. If one wanted to connect what is happening above the fall line with the estuary, cluster analysis could help identify where

to expect a response to a change in loads. Cluster analysis could help one determine how much of the estuary is influenced by the above fall-line loads compared to Bay influence. This could be a pre-analysis task, akin to screening.

11:45 Adjourn

Next Meeting: Wednesday, March 27, 2024

Participants: Alex Gunnerson, Andrew Keppel, Carol Cain, Chris Mason, Cindy Johnson, Claire Buchanan, Elgin Perry, Erik Leppo, Gary Shenk, Gopal Bhatt, Helen Golimowski, Isabella Bertani, Joe Morina, Jon Harcum, Joseph Delesantro, Kaylyn Gootman, Mukhtar Ibrahim, Olivia Devereux, Qian Zhang, Rebecca Murphy, Rikke Jepsen, Roger Stewart, Rosemary Fanelli, Tom Butler, Tony Timpano.