Portland Area Nitrogen Group
Meeting Summary

Virtual Meeting No. 2 | May 4, 2021 | 9 AM – 12 PM ET

Meeting Objectives

On May 4, 2021, the Portland Area Nitrogen Group (PANG) held its second meeting. The objectives of the meeting were to:

- Review Casco Bay analysis to date through N-STEPS process
- Review different approaches for establishing numerical criteria or thresholds for nitrogen, looking at case studies from Oregon, Long Island Sound and Great Bay

To view meeting materials including the agenda, presentations and Zoom recording, please click here.

Welcome

David Plumb, CBI Facilitator, opened the second meeting of the PANG with a welcome and connecting moment in breakouts. Angela Brewer, Section Leader of the Marine Unit at the Bureau of Water Quality in the Maine Department of Environmental Protection (DEP), then provided welcoming remarks and shared an overview of the agenda and goals for the meeting. Ms. Brewer also held a moment to recognize the passing of Toby Stover.

Update & Discussion: N-STEPS Process & Analysis in the Portland Area

Angela Brewer presented updates from the N-STEPS Process in the Portland area, noting the roles and flow of information between the PANG, DEP, EPA, and Tetra Tech; sharing the timeline and final deliverables for the N-STEPS process; and reviewing the terms and applications of "criterion" versus "threshold" when discussing water quality standards. She shared the Portland-area Nitrogen Conceptual Model and walked through endpoints and potential approaches to developing targets. Ms. Brewer then highlighted the next steps for the N-STEPS process:

- Following the determination of applicable WQS, development of a conceptual model, and identification of potential endpoints, the Tetra Tech team will soon begin data exploration.
- Data exploration will inform feasibility of approaches to target recommendations.

Complete presentation slides are available to view here.

Below are member questions and comments that followed Ms. Brewer's presentation. PANG member questions are **bolded**, answers from DEP staff and/or CBI are *italicized*, and any further comments or questions made by members are in regular text.

- **The "stressor-response" target development approach featured in the presentation has an empirical model comparing total nitrogen (TN) and chlorophyll a (chl *a*). In other municipalities, we have found that the same amount of TN might generate more chl *a* under different climate conditions. How could a graph like this account for covariates like temperature and change over time?**
    - *Greater data analyses by Mike Paul, Tetra Tech N-STEPS contractor, will help determine which indicators would be feasible. In other areas, epiphytes are good response indicators, but the Portland area has a lot of grazers that can interfere*

with tracking epiphytes. Chemical indicators could prove critical for the Portland-area (e.g., dissolved oxygen).

- **Are we looking for a single criterion for the entire geographic scope of the Portland area, or are we looking at a gradient based on adjacent land uses or expected impacts from point sources?**
    - *All those options are possible. One approach would be to divide water based on their distinct characteristics to avoid grouping everything under a single target. The analyses by Mike Paul, Tetra Tech N-STEPS contractor, will help show which approaches could work best.*
- **Has this system historically been soft-bottom with little eelgrass, or has something been lost over time? This was a consideration in the Great Bay context, with challenges around a conceptual model based on feedback operating in a shallow ecosystem, where losing eel grass means continuous recycling of nutrients and kicked up sediments.**
    - *There is not much knowledge on historical substrate changes in the Portland Area. The Fore River has been dredged over time, so it has a modified bottom. Presumpscot Estuary is presumed to have been soft-bottom for a while, where there is no turbidity coming from the riverine portion. Where the Presumpscot River becomes more constricted, there is scour and it is rocky with higher flow, growing rockier as it moves farther from shore.*
    - *Most of Portland Harbor formed after sea levels rose; in some areas, there is marine clay 50-60 feet deep and in some areas there is rock. Therefore, there is a lot of fine material on the bottom that's been there for a long time. An outstanding question is the historic depth profile of Portland Harbor.*
- **Are the narrative goals in the listing methodology considered translators?**
    - *Yes, those are narrative translators within the Consolidated Assessment and Listing Methodology (CALM).*
- **Is there a possibility of upgrading SC classification to SB, and whether that influences our goals or targets?**
    - *There is currently no proposed upgrade from SC classification to SB. The classification is not a likely change because of the level of development of the Portland area – the SC classification is designed for more developed areas of the coast, such as Portland Harbor. If our goals were an SB water instead of SC, it would affect the numerical criterion for dissolved oxygen (DO), and because we do not see a lot of DO non-attainment now at the SC criterion (70%), it is possible that portions of the SC water body would meet that SB criterion (85%) for DO currently. The language for aquatic life protection is slightly different in SB, and states that the marine water "must be of sufficient quality to support all estuarine and marine species indigenous to the receiving water without detrimental changes to the resident biological community".*
- **What is meant by, "Narrative listing language incl. nutrients altering habitat or benthic invertebrate assemblage, diurnal DO sags, abundant epiphytic growth"?**
    - *This is language used to establish a cause of eutrophication/biological indicators to a marine life use impairment. Where we don't have numeric criteria for nitrogen currently, we would use this language as a narrative interpretation to determine if evidence ("*altered habitat or benthic invertebrate assemblage, diurnal DO sags, abundant epiphytic growth") *existed to establish this cause of eutrophication/biological indicators. The data analyses will demonstrate if we can establish strong relationships between nitrogen and those parameters based on the information we have.*
- **How could this target be practically applied in an MS4 Permit context?**

- *Any numeric criteria could then somehow be implemented into the MS4 Permit, but more thinking needs to be done about how this process relates to the MS4 process. The third meeting of the PANG may address this discussion.*

- **Are grazers in the Portland area included in the conceptual model?**
  - *Grazers were not included in the original conceptual model. Grazers are a confounding factor altering portions of biomass and are not distributed evenly amongst the Portland area.*

REVIEW & DISCUSSION: EXAMPLE APPROACHES IN OTHER JURISDICTIONS

Angela Brewer and Mike Paul, Tetra Tech N-STEPS contractor, presented two cases of approaches taken in other jurisdictions to address nitrogen: Yaquina Estuary, Oregon, and Long Island Sound, New York. Ms. Brewer reviewed the approach Yaquina Estuary took developing criteria to protect future degradation of water quality and loss of uses from the system, highlighting how the approach was framed around time periods of greatest nitrogen utilization (prioritizing the dry season) and the establishment of two different zones of nitrogen concentration, sources, and response variables. Mr. Paul reviewed the general approach that Long Island Sound is taking to develop nitrogen loads to meet desired water quality conditions, detailing the water quality data and multiple lines of evidence employed to develop nitrogen endpoints.

Complete presentation slides are available to view here.

Below are member questions and comments that followed Ms. Brewer and Mr. Paul's presentations. PANG member questions are **bolded**, answers from DEP staff and/or CBI are *italicized*, and any further comments or questions made by members are in regular text.

- **How will empirically-based hierarchical modeling interact with the process-based or mechanistic modeling that HDR is starting to work on in Long Island Sound? Does Casco Bay move to a place where they have sub-embayments related to total nitrogen criteria where an empirical-based model or a mechanistic model is employed?**
  - *Empirical modeling and mechanistic modelling are complementary. Having a mechanistic model for a system is considered a high-quality analysis approach. However, mechanistic modelling for all embayments in the Long Island Sound context was not feasible for EPA at the time. We hope that spatial grids will go up to allow increased modelling. There are some things that modelling does really well, like dissolved oxygen and some nitrogen relationships, but they are not always the best approach for biological community response, where there has been more luck using multivariate hierarchical models. When possible, mechanistic models are encouraged because of the high quality, the amount of data needed to calibrate, and the support mechanistic models can provide for implementation through capture of confounding variables.*
- **How related is the Yaquina Estuary model to the Portland area process?**
  - *There are three components to the seagrass stressor-response model, only one of which was used for the Yaquina Bay study. There was a component that could address sediment transfer and flux, but those data were not available for this study, so they directly measured Kd values and eelgrass change over time, relying on a robust mapping program.*
  - Here is an example of a seagrass stressor-response model that has a simple carbon mass balance differential equation. Here is a paper from a modeler in

Maryland on hydrodynamic modelling in Yaquina Estuary, focusing on particle tracking and bivalve feeding.
    - It will be important to understand the role the receiving water is playing in retaining pollution or nitrogen load.
- **Has the Portland area attempted to define zones, similar to the Yaquina Estuary approach?**
    - *Considering if and how to divide up the Portland area water will be part of the data assessment and analyses. There are other potential approaches to determining zones, absent the stable isotope data used in Yaquina Estuary.*
    - Response diagrams could be made from parameters like discharge or tides or other environmental factors as well.
- **Will isotopic fractionation be used to identify nitrogen sources and set reduction targets for how much wastewater contribution must be reduced versus stormwater contribution versus septic/groundwater contribution?**
    - *That is one possible approach to determine potential sources, by measuring where in the actual environment nitrogen is potentially being sourced from. There is a 2021 pilot project looking specifically at eelgrass and sediment to determine potential nitrogen stable isotope signatures, though these data will not be part of the analysis conducted by Mike Paul. A first approach could model different load allocations and then this effort could be later supported empirically with isotope data.*
- **Thinking about end use and implications for individual users, how will we tell the story of identifying a nitrogen problem and moving to discovering an equitable regulatory response?**
    - *That is helpful framing. This process is somewhat divided between this earlier, more technical phase of understanding the targets, and the second phase will be more geared towards implementation and designing an equitable regulatory response.*
    - We should consider if a response should be something as simple as concentration versus load-based limits to equitably distribute the responsibility across sources? Not sure that it's feasible or advisable.

CASE STUDY: KEY LEARNINGS & TAKEAWAYS FROM THE GREAT BAY

Melissa Paly, Great Bay-Piscataqua Waterkeeper, presented a final case study closer to home, providing an overview of nitrogen management in the Great Bay Estuary and highlighting key learnings and takeaways that could apply to the work of the PANG. She shared the 20-year history and context of nitrogen management in Great Bay, starting with a NOAA assessment in 1999 through the ongoing development of the Great Bay Total Nitrogen General Permit. Ms. Paly highlighted the complexity of the Great Bay ecosystem and impairments, with 50 impairments identified by New Hampshire state throughout the estuary in 2012, as well as the complexity of its political and regulatory environment, spanning 52 towns across Maine and New Hampshire. She detailed how the process of developing numeric criteria has navigated and responded to various parties, including a municipal coalition formed to push back against nitrogen management efforts, as it progressed to the general permit under development today.

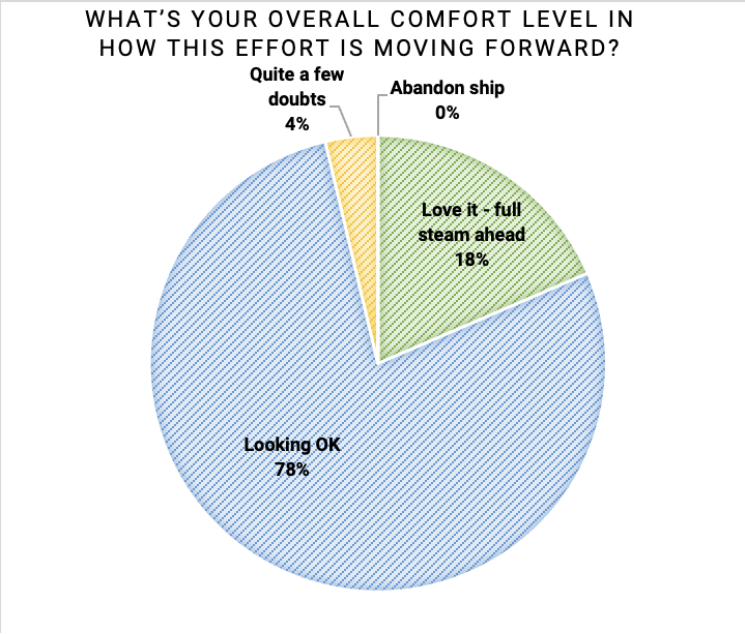
Complete presentation slides are available to view here.

Below are member questions and comments that followed Ms. Paly's presentation. PANG member questions are **bolded**, answers from DEP staff and/or CBI are *italicized*, and any further comments or questions made by members are in regular text.

- **Great Bay has shared lessons on how to develop numeric criteria and the limits of science versus politics in doing that. A unique aspect in the Portland-area context is that we have not yet reached the state of impairment that was met in Great Bay – we are starting this process at a different moment in time, with more focus on preventing loss based on the anti-degradation principles of the Clean Water Act.**
- **The Great Bay case also raised this heterogeneity issue we've talked about in Portland. There are a lot of unmanageable non-point sources, such as those coming from forests, being accounted for in Portland. Our response needs to be more focused on inorganic sources, like fertilizers and animal waste, when it comes to non-point source contributions. Point sources are generally steady all year long, including the summer. Non-point sources tend to be dominant in high-flow events when residence times are much shorter.**
- **One good thing from the Great Bay case is encouraging towns to work together to collaboratively respond to a problem.**
- **My assumption is that the science has not changed much since those original targets were proposed by New Hampshire in 2009. I think we are well-suited to do something meaningful here, and there is a lot of capacity for collaboration.**
- **As municipalities will likely bear the largest burden for both point and nonpoint sources, I would advocate an approach of determining the cost per pound of reduction of nitrogen and figure out the cheapest way to get there. Actions like fertilizer controls and managing pet waste may get you farther than structural land use changes like retrofits.**
    - Conservation Law Foundation commissioned Dr. Rob Roseen, a stormwater engineer consultant, who produced a feasibility analysis based on this permit and the cost per pound in each municipality based on land use analysis across structural and non-structural BMPs. This analysis looked at how communities could achieve the reduction required at the 100kg threshold and found that the costs were a fraction of what was claimed based on an antiquated idea of how an engineer would develop a structural management practice. There are newer and creative ways to implement BMPs that can be more cost effective, efforts like septic system retrofits and nitrogen trading.
    - Here is a link to Dr. Roseen's feasibility analysis.

Wrap Up & Next Steps

To wrap up the meeting, David Plumb, CBI Facilitator, put forward a quick poll to assess how PANG members were feeling about how this process is advancing:



He then asked members to share what is raising concerns that should be addressed in the third PANG meeting. Members responded that they would like more opportunity to dig into the data and analysis from the N-STEPs process and more focused discussion on how to communicate the results of this process to lay observers. Looking ahead, Angela Brewer, Maine DEP Bureau of Water Quality, shared that the third meeting of the PANG in September will be focused on the N-STEPS data analysis and implementation challenges and the fourth meeting will focus on final analysis recommendations and continued discussion of implementation challenges. In advance of the third PANG meeting, Ms. Brewer offered to hold an informational webinar session on the data analysis results when they become available at the end of the summer. Ms. Brewer then closed the second PANG meeting, expressing gratitude for members' time and engagement.

APPENDIX A: PANG MEETING PARTICIPANTS

Susie Arnold, Island Institute
Al Basile, US EPA
Marti Blair, Casco Bay Estuary Partnership
Curtis Bohlen, Casco Bay Estuary Partnership
Damian Brady, University of Maine
Angela Brewer, Maine DEP
Pete Clark, Town of Falmouth
Michael Cobb, US EPA
Kelly Cole, University of Maine
Paul Collins, City of South Portland
Fred Dillon, City of South Portland
Cindy Dionne, Maine DEP
Mike Doan, Friends of Casco Bay
Scott Firmin, Portland Water District
Sara Freshley, Friends of Casco Bay
Ivy Frignoca, Friends of Casco Bay
Nancy Gallinaro, City of Portland
Galen Kaufman, US EPA
Matthew Liebman, US EPA
Rob Mohlar, Maine DEP
Bill Needelman, City of Portland
Melissa Paly, Great Bay Waterkeeper
Michael Paul, Tetra Tech (N-STEPS contractor)
Ben Pearson, City of Portland
Kristie Rabasca, Maine Water Environment Association
Jesica Waller, Maine DMR
Don Witherill, Maine DEP
Wil Wollheim, University of New Hampshire
Gregg Wood, Maine DEP
Emily Zimmermann, Maine DEP

David Plumb, Consensus Building Institute
Maggie Osthues, Consensus Building Institute