Chesapeake Bay Program Hypoxia Collaborative Meeting Minutes

Tuesday, March 18, 2025 1:00pm - 2:15pm

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

Participants

Allison Welch (CRC), Durga Ghosh (USGS), Carl Friedrichs (VIMS), Andrew Keppel (MD DNR), Bruce Vogt (NOAA), Christina Garvey (CRC), Peter Tango (USGS), Jay Lazar (NOAA), Rebecca Murphy (UMCES), Marjy Friedrichs (VIMS), Aaron Beaver (Anchor QEA), Mark Trice (MD DNR), Max Ruehrmund (NOAA), Cindy Johnson (VA DEQ), Jeremy Testa (UMCES), Dong Liang (UMCES), Brian Smith (MD DNR), Lew Linker (EPA).

Minutes

1:00pm - 1:10pm: Introduction

Peter shared some introductions. These included:

- There was a Goal Implementation Team (GIT) funding project with the Chesapeake Bay Trust for the sampling design evaluation that some of the buoy work would be tied to. The competition is over and Peter is waiting for the Chesapeake Bay Trust to confirm the results of the award. Stay tuned.
- Kudos to the 4-d interpolator team, Elgin, Jon, and Rebecca. This week there has been extended use of the buoy data for calibration checks in the interpolator development.
- The Criteria Assessment Protocol Workgroup continues to be looking at the decision criteria for water quality standards, linking the 4-d world with the expansion of the network.
- New staffers for the Hypoxia Collaborative. Christina Garvey, Sustainable Fisheries GIT Staffer, and Allison Welch, Scientific, Technical Assessment and Monitoring (STAR) Team Staffer.

1:10pm - 1:40pm: 2024 deployment review (Jay Lazar & Max Ruehrmund)

Overview:

- *Lessons learned*
    - *Maintenance and Recovery*
- *QA/QC report review*
- *Analysis products feedback and discussion*
    - *NOAA plots*

2024 Hypoxia Data Deliverables - *Max Ruehrmund (NOAA)*

Summary: This presentation is a high level overview of the "Chesapeake Bay Water-Column Hypoxia Monitoring End-of-Year Data Report 2024." The four topics being covered are the challenges of long-term monitoring, efforts in the field, validating data, and results.

Challenges with long-term monitoring and nuisance of biofouling. The sensors off the shelf have no mechanism to prevent organisms from growing inside the instruments. One of the ideas to address these challenges was attaching copper screens to the face of the instrument. Inside that screen, they placed a fine mesh that covers the sensors preventing barnacles and worms from growing inside. On the outside of the instruments, they use a light pressure washer to remove biofouling. When organisms grow inside, they use a mild acidic solution to flush out the conductivity cells. In previous years, the growth became so extensive that sensors would need to be swapped or sent back for repairs. In this event, they usually weren't able to get a new sensor for immediate replacement. There has been a large improvement in the quality of data, mostly attributed to having spare parts.

Efforts in the field. Manufacturers gave methods for recovering sensors, but those didn't have the best application on the Bay. When recovering large sea buoys, the team used a chain system to pull the anchors from the bottom and used an inductive cable with loops. The downside of this was that the system was causing damage to the line itself which would create connection issues or breakaways of the buoy. This year, they decided to use a dragline recovery. In this system, there is a slightly buoyant polypropylene line attached to the anchor and anchored, itself, about 100 yards away. They'd make a note of the direction of the line and use a grappling hook to pull the buoy from the bottom. This has significantly reduced the time on station. To make it more efficient, they attached a second buoy to the line anchor. Having these more efficient systems has been a huge relief and saved a significant amount of time on the water.

Validating data, pre-deployment. The team puts a great deal of effort into ensuring that data coming off the system is reliable and robust through their validation process. The methods from these steps are found in the QAPP available on their website. At the start of the season, they go create condition tanks that mimic conditions observed in the Bay. Typically one is really hot and anoxic and the other is cold with air being bubbled through. After the tanks have 24 hours to condition, they deploy all of the hypoxia sensors and are compared to a third party instrument. In this test it was the microCAT, which is considered one of the most reliable calibrations. This initial testing lets the team know whether each sensor is good to go.

Validating data, in-situ. When they are on station, they conduct a Conductivity, Temperature, Depth, and Dissolved Oxygen (CTD-DO) Cast with the third party instrument and compare it to the data coming off the sensors. The team created tolerances for how far the sensors can be off from this third party instrument.

Validating data, post-deployment. At the end of the season, they review every sensor that goes into the water and all of the data that comes off of it. The top left photo is a time series where

they manually review time plots and address areas of concern. All of this is cross referenced. They all take turns reviewing each other's work to ensure there is no bias. In years past, they have gotten a lot of questions about why certain data points were flagged. Now they have provided explanations to each flagged data point so the user can decide for themselves if they'd like to use the data point. The bottom picture is what it all looks like coming together.

There are only two real results to share. These are the two stations that have the data for 2023-2024. They have seen a pretty large increase in the quality of data by having extra parts, being better at cleaning the sensors, and having better time management.

Discussion:

Peter Tango: That picture of the biofouling, was that even with the copper cages?

- Jay Lazar: Yes, it gets pretty extensive. It seems like the further up river you go, the worse it is. So our Chlora Point in the Choptank and our St. Clements Island location in the Potomac were regularly fouled twice as bad as downstream. There isn't a lot of difference in salinity, which might not be the complete driver of it. The growth is pretty remarkable. This was just two weeks of time.

Marjy Friedrichs: I just wanted to say how great and exciting this is. It's been so great using the data over the last couple of years and the improvement is so exciting.

Rebecca Murphy (in chat): Thanks Max and team - really appreciate all the hard work and improvements!

Jay Lazar: In terms of getting the report out, it is in the final stages. It has been reviewed and is in our communications person's hands. I would be surprised if it's more than a week away from being shared. We will have it on our website and send out copies.

Peter Tango: In our CAP workgroup discussions and in discussions with our jurisdictions, folks are asking for other ways to interpret and use the data to help interpret conditions. This continues to foster discussions.

1:40pm - 2:15pm: 2025 buoy deployment plans & new buoy buildout updates

(Jay Lazar/Bruce Vogt)

Overview:

- *Deployment planning for Choptank and Potomac*
- *Funding uncertainty*
- *Partnerships for new buoys*
    - *NOAA can build, train, and handle IT infrastructure*
    - *Partners need to maintain buoys deployed in new locations*
- *GIT funding project update (Peter Tango)*

Examining the Connections Between Water Quality and Living Resources in Shallow Waters - ***Jay Lazar (NOAA)***

Summary: This presentation reviews water quality monitoring efforts in shallow waters (e.g. Harris Creek, Sharps Island, Lower Choptank) and its connection to living resources in the Bay. This is an illustration from our Chesapeake Climate and Conservation Corps Member, Christina Shaner, which was used in the report. This curtain plot shows the time earlier in the year to the left. The sensors are sending out data every 10 minutes. This is a compressed view of that 10 minute data. This gives a visual of where the dissolved oxygen levels are more reliable. In this chart, the red data is good and the blue is not so great.

There are three stations actively collecting data. This is well ahead of the April 1st target. Jay took some time to thank Max, Anthony, Christina, CJ, and the team for this achievement. Last week, the Sharps Island station was deployed and is the furthest out from the mainstem. Sharps Island will be in its second year collecting data in CB4MH, a main stem segment. The next station to the East is the Lower Choptank which stayed out all winter. It is on its third season of collecting data ChomH1. Chlora Point is in its second year as well and is in the lower portion of the ChomH2 segment.

Moving forward, there are a few funding issues in the federal government. The team's second boat is also in the water with a lower unit. They want to put their best foot forward to put in an equivalent effort into a place where they can work, which is the Choptank. The three other named locations, Tred Avon, Harris Creek, and Little Choptank Rivers are being proposed for additional sensors. The thinking is that Tred Avon has five years of dissolved oxygen from the Eyes on the Bay effort and Harris Creek has Maryland DNR's profiler dissolved oxygen data. The idea is to revisit those stations since it has been a while since they have been there and restoration is maturing. This would be an opportunity to get stations out on these sites with a relatively low amount of effort.

The two orange circles on this map are previous locations. The tread will probably be reoccupying that one. It's in a good spot. For the Harris Creek location, the team is thinking about moving it upstream to a deeper area. The previous station occupied a part of a restoration project that was about two meters of water. They'd like to get into about five meters of water. The purple contour line on the map represents five meters of water, which also represents the limit of oyster restoration efforts in Maryland (5.5m) and Virginia (5m). They are trying to connect some dots with restoration projects while expanding their spatial coverage.

The smaller green circles represent Maryland DNR's bottom DO stations. The five down river stations were put out in 2024. The furthest upriver station, downstream of Cambridge, is the sixth station being proposed this year. It's a Fishing Bay profiler that will be redeployed. Given the limits this year with covering as much space, it is going to be all hands on the Choptank this season.

The entire effort was designed to get into multiple geographies over time. There are still desires to do that. There have been those funding issues and the team has also lost a staff member. This presents an opportunity to Virginia or any partner with the bandwidth to do the on-water maintenance. The team would be happy to partner with them and provide the data QC portion and the equipment to hopefully add a few stations.

Next, Jay shows six plots from last fall. The seasonal summary product captures the salinity, surface temperature, flow, and precipitation data for three months at a time. In the fall of 2024, they incorporated each of the stations with these plots. These are the historic data from 1984 to 2023. They took the minimum, maximum, and average from those and overlaid it onto three months of data for each station. Jay's takeaway is that when you get to that 8 meter location, you start to get intermittent dissolved oxygen or hypoxic conditions where the organisms begin to be impacted. It's probably somewhere between 5m and 8m. When you get down to 11m, you're spending extended periods in that hypoxic conditions, with 13m and 15m being consistent. There's not much of a point to spend the resources monitoring below 11m if the lack of oxygen from December to October in the deeper depths remains well documented.

Aaron Bever: Was the range on the previous plot a confidence interval or was it the actual range, like the lowest and highest observed values?

- Jay Lazar: I believe that was the lowest and highest observed from that QC data set. There was a big effort put in to provide a clean data set. The pink area is the minimum and maximum across those three months for those 40 years. If you all have any ideas as to how these could be displayed better or differently, we are open to that.

Presentation (continued): On the next slide, there are sensors at 2m, 5m, and 8m everywhere. Once they get deeper than that, they try to maintain the 3m interval, but oftentimes it is less than that because of the Bay depth. The curtain plot on this side is data from May to June 2024. On the scale, you can see that the lime green to turquoise colors are around 4 milligrams per liter (4 mg/L). You can see what that looks like through the late spring/early summer. They have also superimposed the limit to submerged aquatic vegetation (SAV) at 2m. They're seeing that more with clearer waters and getting SAV down to the six foot depth. The line at 5m represents the lower limit for oyster restoration in Maryland and Virginia, which is a dissolved oxygen concern. The upper limit is driven by trying to avoid interactions with SAV and permitting and vessel traffic issues.

On the next slide, Jay goes back to what he had mentioned earlier with Harris Creek. He was thinking that if they're going to be able to focus the effort, what do they have to compare it to? A lot of what they're doing is new and they don't have that time series. The previous plots are monthly plots representing hourly data. This slide shows the eight years of Harris Creek profiler data from the Eyes on the Bay site. Jay plotted it and added a trend line. Over those eight years, the dissolved improved. He doesn't know if it's because of the oysters. There are probably a lot of variables at play.

Discussion:

Marjy Friedrichs: Is this profiler data?

- Jay Lazar: Yes. It's a floating pontoon that you can see in the bottom right photo. Every hour it drops the YSI down to depth, in this case, it was between 0.5 and 2m.
- Marjy Friedrichs: Is it the average over 0.5 to 2m or is it at 0.5m or at 2m?
- Mark Trice: I'm guessing it would probably be the surface data taken when the sensor was parked near the surface. I don't recall there being a lot of stratification in that system since it's so shallow.
- Marjy Friedrichs: This would be a good example of why we wouldn't want to put a profiler in a shallow place. We wouldn't want to waste four sensors in a place that's pretty much the same throughout the water column.
- Jay Lazar: That's right. What we're proposing for Harris would be in about 5m in one of the deeper holes outside of the channel. I can get more information for you. I should have a better answer for that. I downloaded the DO data from that sensor for those eight years and I don't know which depth that came from.
- Mark Trice: When we were in Harris Creek, we also had sites upriver and downriver from this profiler that were bottom mounted stations. I haven't reviewed the data in a while, but I think the downriver station would sometimes see some incursions of lower DO, maybe from the mainstem Choptank.

Marjy Friedrichs: Are we going to be discussing the locations today?

- Jay Lazar: Yes, that's part of the conversation. We put up the three we had out last year. The other three were just suggestions, but we won't have the ability to get into the Potomac River in the near future. What we are looking for is thoughts about how we can better monitor the Choptank, specifically in these areas where we have significant living resource investment to ask whether any of that investment is making an improvement.
- Marjy Friedrichs: It seems that if it's only 5m deep, you can look into shallow water monitoring instead of the profiler. You could look at model results or past data to see if it's well stratified. If it's well stratified it's a waste of instrumentation and time to put sensors out there every few meters because there isn't much that will be learned. If you put it in a hole, it's not representative of a larger portion of the segment. I'd be careful about putting them in holes as well. In the last few years, we've talked about making sure there is at least 10 meters of water where there's some stratification. Otherwise, I'm not sure this type of instrumentation is worth it. Shallow water monitoring is a huge resource that has given us so much data. In my view, this is a better way to go if we're going to look at very shallow water.
- Jeremy Testa: I feel like it's probably worth looking at the profiler data from Harris Creek to see. I say that because I have seen that low oxygen conditions emerge in shallower water columns. We wouldn't expect it to happen and it's not like these places have a ton of stratification. It's probably system specific and so it's hard to say what would happen

in Harris Creek. We probably can't know that for most places and it's probably safe to get into deeper spots. I agree with what Marjy was saying. In this case, you have profiler data to look at to see if there was some low oxygen emerging. There may be some movement of oxygen laterally, but it could also be that some of these places occasionally go low oxygen, even though they're not that deep.

- Mark Trice: If you downloaded the profiler data from the website directly, it returns data at different depths. Unless you want to graph it at a specific depth, this could be showing multiple depths at the same time.
- Jay Lazar: I think that's right. Because it's compressed over that amount of time, you might have a little variation, but there is seasonality to the levels of dissolved oxygen in the system. I think that's two different questions. Whether this is a good place to attempt to do more data collection, which is something to consider. Even though there isn't a lot of stratification, I found it interesting that it is trending better over time. I think that this is an important part of our effort.

Brian Smith: I think you said that we have five bottom mounted stations but we currently have four. We did have five stations last year, but only four at a time. One of the stations was only out for a single deployment and our field crew was concerned about the rocky substrate. For the questions about the profilers, that is ours. We had that in Fishing Bay last year. We offer that for this project.

- Jay Lazar: Thanks, Brian.
- Mark Trice: Correction. We were communicating with Jay on the profiler location and we had a map of three possible locations. We were not going to put it in Harris Creek, we were going to put it closer to the Choptank River Bridge.
- Jay Lazar: Correct. Sorry if I was jumping ahead of what you guys had planned.

Bruce Vogt: We're monitoring the Choptank in coordination with other sensors deployed by partners to show the relationship. There are three in the water and three proposed. Those are complementary to some of the other assets or platforms that are out there. Maybe we should think about where those other profilers would be deployed or not in the Choptank with the value added question in mind given depth, interest, and water column variability. Our interest was linking changes to ongoing restoration efforts, like the oysters. I think we should go back to the map and talk some more about locations.

To clarify something Jay mentioned, we lost Anthony and don't know if we can get him back because he was part of this probationary reduction in staff. Between losing staff and not knowing what the funding future looks like, we are in a tight spot and need to constrain our operation and maintenance efforts for the foreseeable future.

We're open to suggestions about locations but I want you to recognize there are also some constraints. Those may be able to be mediated by the help of the partners, if there is interest and resources available. We're in a tough situation here. We would have trouble accomplishing

what we did last year with the sensors deployed over two geographies. Jay can speak more to it. The Potomac took a lot of time and resources, as well as a vessel, which we don't currently have to maintain those stations. That's where we are. We'd love to have your feedback on what makes the most sense to keep this going the best we can.

Mark Trice (from chat):
https://eyesonthebay.dnr.maryland.gov/eyesonthebay/documents/harriscreek_summary2015rev.pdf

Peter Tango: With the three sites and segments, under the constraints we have, it is helpful and impressive to think of that coverage, even though it's in a limited area. Kudos on that.

Rebecca Murphy: I agree with Marjy that the deeper the sight, the better, at least for how I have been using the data. Getting the deepest oxygen, high frequency dynamics, and movement of the pycnocline has been helpful. I am curious about the East Goose Reef, the yellow square on the map. Would that be a possibility? I am also curious about the Little Choptank option and how deep that location is. It might be a nice addition.

- Jay Lazar: I will look up the depth of the Little Choptank location. East gooses has two years of data on it. There would be a one year gap though. But reoccupying that station is a great idea. We've got to maintain Gooses Reef's CBibs buoy as well, so that would save resources. That is in about 30 feet of water. The channel to the east is significantly deeper. The proposed location in the Little Choptank is about 11 meters. On the map, it is the red circle to the right of the yellow square.

Marjy Friedrichs: Do we have to have four sensors on every deployment or is it possible to have six on a deeper deployment and two on a shallower one?

- Jay Lazar: We currently have six on Sharps Island.
- Marjy Friedrichs: If we put something in Gooses Reef and Little Choptank, can we have more on the Gooses Reef and less on the Little Choptank? Since the Little Choptank is shallower than Gooses Reef.
- Jay Lazar: The limitation there is that if we have partners that want to pick up other geographies, there is a limited number of sensors. One takeaway from the 2024 effort was that for every depth that we have a sensor, we need two more to get us through the season. This is given the timeline for returns when they get sent out there. We can put more out there but there is a limit. For every sensor, you need two more. We have about 100 right now. If our efforts focus here and no one is interested or willing to pick up another site, then we are willing to do more here. We'd also like to see if someone else can take on the on-water maintenance for extra locations.
- Marjy Friedrichs: My thought is that if the station is only five meters deep, all you need are two sensors. The addition of four sensors at a five meter location is not providing much more data. It would be better to put six sensors at 35m deep. There is no point in having the sensors too close together.

- Jay Lazar: I agree. That's why we've been doing the 2m, 5m, and 8m depths. Deeper sensors are valuable but we have been trying to maintain consistency so you could compare stations. We were thinking that we would ultimately get more stations out there. There are a lot of little trade offs at play. If we find ourselves only here, it's possible we can collect more data where it's needed. We weren't proposing putting four sensors at a five meter station. We were proposing to revisit what is happening in those systems from the restoration effort.
- Marjy Friedrichs: I also want to echo Rebecca's comment that a location at Gooses Reef would be tremendously helpful. If we can't go into the Potomac, collecting data from anywhere deep would be hugely beneficial. From my standpoint in using the data, it doesn't really matter if it's the same depth or location throughout the years. I am fine having it at new locations or different depths. To our work, that doesn't matter too much.

Mark Trice: I posted a chart from a report we did back in 2015 with the profiler showing the difference between surface and bottom DO. There were times when we did see it, even in that shallow area, that the differences between surface and bottom DO were a bit over 4 mg/L. I believe we also did some more reports on this, which should be on the website.

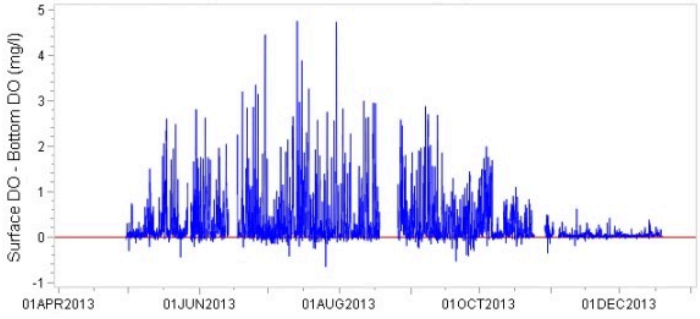

Figure 9. Calculated difference between surface dissolved oxygen concentration and bottom dissolved oxygen concentration at the vertical profiler station.

Chart referenced in Mark's comment.

Jay Lazar: I've always been curious about if you're getting the dissolved oxygen intrusion up into the Choptank from the mainstem, then there is potentially localized hypoxia happening up in the rivers where you do have a sill and then a hole. What's contributing to that low DO in areas of critical resources? Is it something that we can't control coming up from the main channel? Or is it something we have the chance of controlling that has a more localized source? Maybe in a local trough, like what's in Harris Creek. Maybe that's an opportunity to outfit sensors that way. There are a lot of questions that we could potentially answer.

Peter Tango: From the criteria side, there is a little augmented rule that if you don't have 3 consecutive years, you can use the best 3 out of 5. If we already have two in Gooses, then one more in that five year window would be complementary to that effort.

- Jay Lazar: How much latitude do you have in the location? Do you want the exact location? We lost a few of those East Gooses stations to traffic issues, so are we able to move them a bit?

- Peter Tango: I don't think we have a rule set. That is a good question with the inter-annual variability. If you are off by 10s of meters, that's not a big deal, maybe even a couple hundred meters.
- Rebecca Murphy: That's in CB4. If you are talking about being able to cover 3 of the 5 years for criteria assessment, it seems that it could be anywhere in the segment. Make sure it is in CB4 and not over the line into the Choptank segment.
- Jay Lazar: We have two years in East Gooses, which is CB4MH, West Gooses, in CB4MH, and you have Sharps Island, in CB4MH.
- Peter Tango: Yeah, it works.

Bruce Vogt: I don't think we will get to in depth discussion about building out new deployments in Virginia. We need to have more conversations with the Virginia partners on where those will go and the maintenance of them. We can build them but we need someone to do the maintenance of those sites. That'll be a follow up conversation.

- Peter Tango: Cindy, is that a possibility for you all?
- Cindy Johnson: I know we have been interested in it. Coming up with the funding is a different question. We'd probably need to have more discussions.
- Peter Tango: We can coordinate with folks here and gather information to bring to our meeting with DEQ in April.
- Jay Lazar: If anyone is thinking about whether they can or can not, please reach out. We can get into a more detailed discussion on how locations will influence the cost. In an ideal situation, we'd provide everything other than the people power and vessel.

Carl Friedrichs: I'd like to jump in on behalf of VIMS and CBNER. We've been helping out with maintenance of CBib's buoys. We don't have the funding internally, but if there is funding, we'd be very interested in the discussions of helping maintain profiler deployments in Virginia waters.

Bruce Vogt: I just wanted that temperature test. We didn't expect to get into that detail today. We just wanted to find out who would want to be part of that conversation. That's good.

GIT Funding update - *Peter Tango (USGS)*

Peter Tango: When I have the final check off from Bay Trust that I can say anything, I will. The competition happened and there were applications. The same things I said in the beginning.

Further Discussion:

Bruce Vogt: Jay presented the plots from the profiler data. Those are things we are thinking about building into the seasonal summaries we put out. We have been looking at those along with the model outputs from Marjy and Aaron. What we liked about the profilers was we were able to look at a clean line of those different depths. From an interpretation and visual standpoint, we were hoping that would resonate with audiences. We would love your feedback on that, either in this meeting or emailed to us later. If you think those are appropriate. If you have any other ways that we might be able to display that data. How we should or should not

reference some of the model output data alongside those, if we need to? It would be great to get your feedback on that.

- Marjy Friedrichs (from chat): Happy to help with that, Bruce!

Peter Tango: One of the exciting things I saw in the past week with the 4-d interpolator testing was appreciating that our fixed sites are biweekly assessments and gives us that visual. The data is providing the opportunity to see our hourly and daily habitat conditions, which is very informative. The states that are on board thought that was a huge jump from the view that we've had in the right direction. The ability to qualify habitat conditions comfortably given the variability. I don't know if we should recommend seeing a daily level on the visual. It was helpful in the eyes of the states and those commenting.

- Jay Lazar: The curtain plots have over a month of information. It's compressing 10 min data to probably a daily average. On the other plots, we were looking at the daily averages at a single depth.
- Peter Tango: Sorry if I mixed that up. Those were both helpful.

Bruce Vogt: With the seasonal summaries, the idea is to connect those environmental conditions to living resources. By looking at those steps, we are looking at the variability. The surface stays above the biological threshold, using 4 mg/L because that's when you see the change in organism behavior. The middle water column is where we see the higher variability so things have to start moving towards the surface, which has implications. The bottom of the water column, during the summer, was mostly below the threshold. We're trying to show, in a clear way, what the changes are within the water column to make a tighter link of what living resources are experiencing and how they respond.

Peter Tango: Thank you all. We look forward to making some decisions on additional locations and work towards checking on resources there. Maybe confirming the number of sensors in a particular location, so there is maximum flexibility while maximizing information gain. We'll get back to you with updates about other analysis and funding as the season progresses.

2:15pm **Adjourn**