

# NC Nutrient Criteria Development Plan – Scientific Advisory Council (SAC)

July 14, 2023

## Attendees

### SAC members in attendance:

|               |               |                    |
|---------------|---------------|--------------------|
| Hans Paerl    | Jud Kenworthy | Michael O’Driscoll |
| Jim Bowen     | Marcelo Ardon | Martin Lebo        |
| Jessie Jarvis | Wilson Laney  | Fritz Rohde        |

### Guests in attendance:

|               |             |                |
|---------------|-------------|----------------|
| Anne Coan     | Nathan Hall | Theodore Lynch |
| Andy McDaniel | Paul Cough  | Clifton Bell   |
| Doug Durbin   |             |                |

### NCDEQ staff in attendance:

|                 |                   |                  |
|-----------------|-------------------|------------------|
| Karen Higgins   | Paul Wojoski      | Pam Behm         |
| Cam McNutt      | Elizabeth Kountis | Elizabeth Liebig |
| Nora Deamer     | Anne Deaton       | Heather Jennings |
| Chris Ventaloro | Charlie Deaton    | Tim Ellis        |
| Rich Gannon     | Mark Vander Borgh |                  |

### SAC meeting facilitator:

Emily Barrett

## Meeting notes

\*\*\*All questions, comments and answers are paraphrased\*\*\*

### 1) Convene – Introductions around the “room” and Approve Minutes from 2/24/23 and 3/31/2023 (Emily Barrett)

- Emily showed and shared agenda, quickly went over it, and called for attendee round robin (people who missed the round robin are DEQ staff person Pam Behm and guest Paul Cough)

- Emily Barrett called for motion for approval of February 2023 minutes and March 2023 minutes
- Jud Kenworthy – made motion to approve both sets of minutes
- Hans Paerl – seconded the motion
- Emily Barrett - Jessie Jarvis wanted to have us double check who is listed as a SAC member on those notes, and we can certainly do that and make sure it is correct before finalizing that. Jud – do you mind if I suggest some verbiage for your motion which is to move to approve the minutes with the caveat that staff can correct SAC designations on the March minutes?
- Jud Kenworthy – That sounds fine. No objection.
- Emily Barrett – I’m supposed to ask if there is any discussion. I don’t see any but feel free to verbally or in the chat indicate that you’d like some airtime. Seeing or hearing none, all in favor say aye, and I will ask for dissenters. All in favor say “Aye.” (SAC members said “Aye”). Any opposed? I’m hearing and seeing zero opposed. Next, we’ll turn it over to Paul Wojoski and Libby Liebig to talk with us about clarity standard moving forward.

**2) Overview and Clarification – Process of clarity standard moving forward, role of SAC vs. CIC, and NCDP goal is to reduce nutrient loading and develop numeric criteria** (Paul Wojoski and Elizabeth Liebig)

- PowerPoint entitled “Overview of NCDP Process and Next Steps” (presented by Paul Wojoski and Elizabeth Liebig)
- Paul Wojoski – Implementation issue (slide 2) more specifically means assessment and modeling considerations for implementation of clarity standard and monitoring questions about functional application of who and where and how will monitor. I am hopeful and optimistic DWR will have a position that will be to help and work with CIC directly, we’re in the middle of recruiting for and hiring an economist position that works to make this fiscal analysis and they’ll be a primary point person working with CIC on standard implementation.
- Elizabeth Liebig – NCDP updated in 2019 did revise roll of SAC tasks (slide 3)

**3) Next Steps for the SAC – Where are efforts going to be focused next? (Chlorophyll a, Nitrogen, Phosphorus)? Once direction established then group can identify data gaps, models, and needs** (Jud Kenworthy and Hans Paerl)

- Jud Kenworthy – Can you pull the table on the screen? (Paul Wojoski pulled up the slide with the table.) What is the expectation now of interaction between SAC and CIC in terms of this very mixed stage of water clarity criteria development? Will we as the SAC be meeting with CIC, or in silos for the moment, or is there some value to interactions when questions come up? My second question pertains to this table; I realize that SAC dealing with NCDP but we do recognize that water clarity is affected by turbidity and so my question is how do we plug turbidity into this because I think we are going to discover once Nathan’s modelling goes that we’re going to be able to explore the thresholds for turbidity and how they play into a water clarity criteria and how they might interact with any of the other nutrient criteria thresholds we might end up discussing?
- Elizabeth Liebig – Right now how it is standing is the DWR modeling group is working on implementation so Cam will reach out to individual members for clarification purposes,

but he will be taking that further himself. CIC will be helping with fiscal impacts of that so as of right now the clarity will be moving forward in that direction, and we would like the SAC to look at the other nutrient considerations and to move forward in that direction so we can have a couple things going at the same time.

- Paul Wojoski – The SAC and CIC are a little bit siloed right now in the process. What I want to make sure we do is we don't concern the SAC with having to do with implementation questions. We want to give the SAC a clear box to work in to look at the science and develop criteria that will protect uses and we won't necessarily have to address how that will be implemented and what implementation plan looks like and what effects that has but we do not want to use SAC's time to work through and answer those questions; it's really not SAC's charge but is more the CIC's charge and we are going to be gearing them up and working with the CIC on that. Regarding water quality and turbidity, questions may come up in the implementation of the clarity standard and if it does Cam can bring those forward and we may have information questions that would affect the implementation of that standard, we can reach out and have those questions answered. As for other parameters and variables, that is within SAC 's scope. If there are ties to turbidity and between other causal variables, and we have info that supports that, then within the SAC scope moving forward and addressing other variable pollutants.
- Hans Paerl – If there are no other thoughts on what we've heard, one of my concerns is linking nutrient management to what we now have heard in terms of what's going to be needed to improve clarity in our case looking at the Albemarle for example when we know chlorophyll has increased dramatically over last three decades, and Nathan can really address that issue more because he has worked with that data, really what I'd like to see committee get involved in more and have discussions on is (a) how much do nutrient need to be reduced in order to improve the chlorophyll part of clarity, and (b) is that going to make a significant difference in terms of other factors that affect clarity, namely inorganic turbidity and CDOM. I think that's one of the links that would be instrumental in in linking nutrient criteria to clarity criteria in the system. So, I think what we need to know is (a) we know which nutrients are important to look at, we've done a lot of bioassay work, and others done similar work in modeling, (b) if reduce nutrients, how effective is that going to be in reducing chlorophyll? This is something we've been looking with bioassays, and will have a student this summer conducting or part of class conducting a nutrient dilution type of bioassay to come to some numbers in terms of how much need to reduce limiting nutrients, and really what we're talking about is mostly nitrogen here, and (c) is that really going to make any difference in improving clarity relative to the other factors affecting clarity namely inorganic turbidity and CDOM? This links directly into Nathan's modelling efforts, and this is my own wish list in terms of where it would be useful for us to go in terms of linking nutrient criteria with optimizing optical properties for seagrasses and other microphytes in the system. We know a lot about nutrient limitation, it's mostly nitrogen causing increase in chlorophyll although phosphorus is not off the hook entirely, and the next step is how much would we need to reduce nitrogen inputs; we have a reasonable idea about what those percentages are going to be but that needs to be worked out in a more quantitative

fashion in additional work that's going to be done on the Chowan and Albemarle. Hopefully get Nathan to chime in on that issue if going to make any difference in clarity and whether we can even make that link between lowering chlorophyll as an optically active compound in the system and how that's going to stack up relative to other factors that affect light attenuation in the system.

- Hans Paerl – The nutrient reduction will serve several purposes. One is to improve clarity but the other is to minimize harmful algal blooms and exceedances of acceptable chlorophyll levels according to the state. So, there's really two kinds of targets we are dealing with in the system.
- Nathan Hall – The bio-optical model is going to be able to give us some answers. If we zero chlorophyll out, where are we left? The model can tell us how much we would need to reduce chlorophyll in some instances to get down to the clarity we want. A question I've had since I started this work is how much of turbidity is organic turbidity that is derived from phytoplankton but is not phytoplankton anymore; it's detritus. How much do we reduce turbidity through the nutrient reductions as well? To some extent if we reduce nutrients, we're going to reduce the phytoplankton and we will also reduce detritus. That is something I haven't found in the literature, and maybe because I'm not looking in the right places. If anyone knows of literature on that, I think that is going to be very important to find, even if case studies where phytoplankton has gone down, maybe we can see how much detritus went down as well.
- Hans Paerl – Is the data on divvying up the turbidity between inorganic turbidity and organic in places like the Chesapeake Bay for example?
- Nathan Hall – If there is, I haven't seen it. You mean optically divvying it up. That's the part I have seen, and I don't know how you do that.
- Hans Paerl – It's going to vary a lot seasonally, whether measure during algal growth period or not, and in response to episodic event like storms for example.
- Jud Kenworthy – The other reason we should be paying attention to turbidity comes from recent work that has been done related to deterioration and retreat of our marsh edges. I was recently looking at one of the outputs of the Camp LeJeune study that some of you have been working on and some of the work that Carolyn did where she estimated the volume of sediment being released from these marshes as they deteriorate in association with sea level rise. Our system has built into it kind of an intrinsic turbidity loading factor that in some sense we don't have control of, but we need to account for, and we need to pay attention to it as we move forward, especially if we're relating some of these response and causal variables to optical water clarity.
- Hans Paerl – That's a good point.
- Wilson Laney – I think this question goes to Jud and Hans and Fritz probably more than anybody else but one of things we ought to consider and discuss is the ultimate effect of the nutrient reduction and phytoplankton changes on the biological side, the faunal side of these communities as well, especially larval, post larval and juvenile fishes that use Albemarle Sound in particular but also the Chowan as nursery areas. I am not real familiar, maybe Nathan may be, with studies that have taken a look at what the impacts may be, positive or negative, on the fish community especially as changes are made, and again that is something I can dig into from a literature perspective, I'm not on top of that

literature at the moment, it has been a good while since I looked at any of that, but hopefully there would be some studies that may give us some insight into what making changes in the nutrient levels, the chlorophyll levels which are directly correlated with the phytoplankton and then the zooplankton going up the food chain, what sort of effects we might expect to see. If anyone has any insights into that, jump into the conversation here.

- Hans Paerl – There are several issues here at play. One is reducing the total biomass, which would obviously have food web implications. But the other one is reducing the incidence of HABs, that if reduce them that takes away a pressure potentially on the food web.
- Wilson Laney – Good point.
- Hans Paerl – So that’s a really complex situation because we would like to reduce the incidences of excessive production of HABs but to what extent would that also impact the food web. I think that’s what you’re asking, right?
- Wilson Laney – Yea, all of the above.
- Hans Paerl - Then there are other issues like reducing hypoxia and biogeochemical effects of reducing the amount of organic matter that comes from excessive production that would lead to more opportunities for hypoxia so there are three things going on here. One is how does it affect the base of the food web, which is what you are asking, how does it start to relieve a pressure due to unwanted and potentially toxic organisms, and then how does it affect the overall biogeochemistry of the system, namely the incidences of low oxygen events, which in part are fueled from the organic matter that comes from the primary producers, so this is a really complicated set interactions, and I don’t know if there is any literature out there but it would probably be out there from Chesapeake Bay would be my guess.
- Nora Deamer – I know I have seen some literature on the value of certain species for fish to consume, so if you switch your population to mostly blue greens or harmful algae, those have less nutritional value for the fish, so in keeping those populations in what is more valuable to the species that inhabit that waterbody as opposed to shifting it to the blue greens that have no nutritional value. I know I have seen some literature and some of that may have come up when we were doing High Rock, but I know some of that is out there. I don’t know that I can put my hands on it quickly, but I know it exists.
- Wilson Laney – Thanks Nora. That’s a good point and a good observation. I agree with Hans that probably Chesapeake Bay would be a good place to start looking to see if anybody has done any work on any of these sorts of inner relationships.
- Hans Paerl – Nathan are you aware of anything there?
- Nathan Hall – No, I can’t think of a particular study right off hand. I know lots of studies that talk about individual aspects like hypoxia or algal blooms but kind of tie all those effects together and then linking that back up to fish communities, I haven’t seen that. Another effect is the loss of SAV, that’s another effect that will have fish implications, a lot of those fish have stages that use SAV.
- Wilson Laney – Nathan that’s a good point. One place that we may want to look is in Ken Able and Mike Fayhe’s book which is “The First Year in the Life of Estuarine Fishes of the Mid-Atlantic” that I have on my desk thanks to Fritz and I have been reading through it.

will try and pick out the species that we know use the Albemarle-Chowan system and try to read those accounts first and try to see if I can pick up any insights that Ken and Mike have to say in their book.

- Martin Lebo - A couple of real complications. The Albemarle Sound a lot of the hypoxia is physically driven because of the small lunar tide, so it is the salt intrusion. So, on the phytoplankton assemblage, a complication is you can have mainly blue green if other forms are growing rapidly and being grazed. The phytoplankton that we go out and measure at any time is the reflection that includes what has been grazed so it is the growth of some of those forms which complicates taking the static which is a parcel of water with a phytoplankton assemblage and trying to equate that to whether there is food present or not.
- Hans Paerl – That is a good point.
- Nathan Hall – Yes. That is a good point, especially since a lot of cyanobacteria, a lot of them there that maybe they're not getting grazed and not growing very fast either. You have a whole bunch of edible stuff that is getting grazed heavily and growing fast.
- Martin Lebo – It's just a complication in trying to understand and manage between the different endpoints.
- Hans Paerl – Although there may be picocyanobacteria there, the really small cyanobacteria, that are neither toxic or constitute a problem and they probably are grazed by microzooplankton mainly, which ultimately are grazed by the bigger guys, so it's a very complicated thing. My gut feeling is the system used to be better a whole lot better in terms of water quality and presumably fisheries before we got into the era of HABs back in late 70s/early 80s so that would argue pretty strongly for reducing nutrients no matter what the complex outcome is going to be of the ecosystem response.
- Wilson Laney – That's a good point but it's still nice if there is information out there that would help us to understand the impacts of management measures that we take, it would be good for us to at least review that, I'm not saying we can do anything about it. Ya'll are very aware of how easy it is to establish cause and effect in ecosystems and then relate those to management actions.
- Marcelo Ardon – No need to make things that are already complicated even more complicated but I want to remind everybody of nutrient legacy so we can think about how much we need to reduce nutrients that are coming down there but there is already a lot of nutrients in these watersheds so it's going to be awhile so it's good to remember that whatever we want to do is going to take awhile to get there.
- Hans Paerl – That's a good point particularly in terms of phosphorus, because phosphorus can't leave really in reality, so I think that's why we have advocated taking the nitrogen route, and that was one of the justifications for the nitrogen based TMDL on the Neuse Estuary, namely there is a lot of phosphorus there naturally and we have added to that with the loads, so I think that's helped us focus on the nutrient that is most likely to give us a positive response in terms of reducing chlorophyll. That's a really good point: the legacy in the watershed and the receiving waters. Jud just put something up; Jud - you want to talk about that?

- Jud Kenworthy – Starting with Wilson’s comment, talking about the food web and cascading effects, there is a brand new paper that just came out of the Chesapeake Bay Program in the Proceedings of the National Academy of Sciences, and it is probably worth a read by everyone on the SAC and CIC to see where they are now and what’s happened and what the realization is and they do link it to cascading management issues with the suggestion that the transition from one foundation SAV species to another is going to have an effect on the fisheries and habitat use, even though it seems that one species may be able to partially substitute for another, there is clearly reason to try to understand if we can manage nutrients in a way or turbidity in this case too to minimize the chance that we end up with this type of state change that’s occurring in the Chesapeake.
- Jessie Jarvis – That’s the Hensel paper, right Jud?
- Jud Kenworthy – Yes.
- Jessie Jarvis – In that paper and same thing with the Lefcheck paper a few years before that, they couldn’t find a way to put TSS in that model, they had a hard time linking turbidity to water quality changes, and their turbidity data and because of the 30 years of that data set and it had been measured so differently over time that they couldn’t include it and they think they had a real weakness. It’s a great paper and huge data set, they make some really great step forward but some of things Mark will tell you is that he wishes he could have linked so I think if there is any way for us to get TSS into this conversation now that would be great especially as erosion begins they’re having issues with their current sediment, what are they going to do when that sediment comes in and all those nutrients that are attached to that sediment.
- Hans Paerl – We’ve heard some really good comments and thoughts over the last several minutes. One thing we could self-assign this to us as a committee, is to dig up anything that would help address some of these complexities in the context of what if we reduce nutrients and have an effect on reducing biomass, maybe even setting aside the issue of whether or not it is harmful. That would be a useful exercise to undertake and see what we come up with as a committee doing some searching around and sharing that with other members of the committee. I think we all agree this is a very complex issue and we’ve already identified numerous positive and negative feedbacks on this, but I don’t think we want to come back as a committee and throw up our hands up and say we’re not ready to recommend a reduction, I think the question is how might that get us back to improved water quality conditions, particularly with regard to the optical issue and the potential for HABs in the system. Just a recommendation.
- Jud Kenworthy – For those of you who are veterans on the SAC and went through the High Rock process, we made a lot of progress with this water clarity standard and there is still ground to cover but my question for the veterans is there a point here where we really need to set some absolute priorities and get focused on those or do we need more meetings with these kinds of discussions? Are we at a point where we might set some priorities? What I’m referring to are the probably two on the right-hand side of this table, probably nitrogen being the priority of the two. So, all you High Rockers, how did you do it?
- Hans Paerl – Jim, do you have any thoughts on this?

- Jim Bowen – I was looking at Table 1 and thinking it certainly could apply to High Rock and I think there was a long conversation about causal and response variables and where our emphasis should be in terms of a criteria, and we came down on chlorophyll criteria and what that might look like. I think there is a lot of similarity, there is the clarity standard but then all the additional concerns we brought up about the effects on the food web that we looked at in High Rock and it seems like we ought to look at again. What I was hoping for was some conclusion of mine that was here's how to avoid spending 4-5 years on it that we spent, and I don't have a simple answer unfortunately. You do have to grapple with complexity for awhile before you decide okay now knowing something about the system we can move forward. I'm don't know if that helps much but that is where I see it from looking back at 2015 to 2020, wasn't that roughly what it took us?
- Hans Paerl – Yep.
- Marcelo Ardon – I am a High Rocker and when Jud asked that question my thought was let's please not take that long again, so anything we can do to make much faster and it sounds like this needs to be faster if I heard at the beginning, they said something about summer of 2024 the call or challenge for it now is 2024?
- Paul Wojoski – That is correct.
- Emily Barrett – You are discussing what you'll do over the next year.
- Marcelo Ardon – My caution would be is that we've had lots of good discussions in terms of High Rock, and I don't have any suggestions on how to accelerate it, but I think that should be our goal which should be to try to accelerate those discussions, but we need to have those discussions.
- Emily Barrett – I think staff can help, your chairs can help, provide that structure to accelerate. Now we don't want to accelerate so much to make people feel like they're unheard but hopefully people will speak up. Hopefully we have general consensus that folks are interested in outlining what we want our outcome to be over the next year, chasing keeping down. I think we can do it.
- Jim Bowen – What we've seen already for this waterbody is that the SAC has advised DWR more than we did in High Rock, and that proposals were sent to us, were prepared for us, by DWR and I have found that's been very helpful. We have come a lot farther in a much shorter time for Chowan and Albemarle than we did in High Rock, and I give DWR credit for that.
- Nora Deamer – Listening to the conversation, the question that comes to mind for me is the current chlorophyll a standard currently protective of the uses? The current chlorophyll a standard is 40 ug/L but to me that is the question to get asked, if you're looking at the response variables, and then if it is, what should be the nitrogen and phosphorus to keep it that, or if it should be lower to be protective, then what is the nitrogen and phosphorus that would keep it below that level? A lot of the conversation is revolving around good algae and bad algae but to me what is an algal number, a chlorophyll a number, that is protective of the uses that we are trying to protect in this waterbody?
- Emily Barrett – I'm seeing some nods among the SAC members. So, you are suggesting that that's an inquiry they could try to answer?



- Nora Deamer – Right. I'm curious to know if they think 40 ug/L is an appropriate current standard that we have is it that protective of the uses now?
- Pam Behm – Not only the number but also the way it is collected, where it is collected, when it is collected, how it is collected, all of that will help inform how we move forward with this.
- Emily Barrett – That is a vital component.
- Nathan Hall – For the low salinity SAV zones we're talking about right now, I can't give an answer but am working on it. For the high salinity SAV zones, the current standard isn't going to cut it. We do have the answers from that from the bio-optical model and the standard is going to have to come down, about half of that probably.
- Emily Barrett – So a different standard for high salinity versus low to moderate salinity?
- Nathan Hall – Yes, it's something we'll have to talk about.
- Jud Kenworthy – Nathan's conclusion for the high salinity value is very consistent with other estuarine systems where they've attempted to try to identify the threshold value for chlorophyll, 15-20 has been pretty commonly encountered as a threshold for isolated seagrass systems. Getting the bio-optical model up and running for the low salinity we'll be able to explore the answer for it, factoring in the high levels of CDOM that occur.
- Emily Barrett – Karen put in chat that "NCDP SAC will evaluate the chlorophyll a water quality standard and as needed recommend it to be revised by the EMC to ensure protection of SAV in high and low salinity waterbody regions beginning with the Albemarle Sound and Chowan River and continuing with other water bodies that support SAV." That's a nice re-enforcement of what you're saying.
- Martin Lebo – One thing when I hear 15-20 µg/L as thresholds, we're going to have a tension between sufficient production for fisheries and clarity for SAV because when you're pushing your chlorophylls that low in the water, then may be one where it has to optimize between them and not be all about clarity.
- Nathan Hall – I want to clarify that 15 µg/L is a median value, and when you take that and look at would be a 90% quantile which is how we currently assess the standard, it works out to about... I messed up when I said 15 really if the current standard was 30 and assessed the same way, that would get us down to what we need right now for high salinity SAV, assessing at the 90<sup>th</sup> quantile like we currently do with 90% confidence level. That's a big difference.
- Martin Lebo – That's a number that is probably more doable for fish production.
- Hans Paerl – Nathan you've looked at data out there. How often does it exceed 30?
- Nathan Hall – Where? In the high salinity areas, it never does. It is really rare.
- Hans Paerl – I think that is already a high bar. Keep in mind and Nora was angling at this as well, how is that chlorophyll measured? Is it integrated through the water column or anywhere in the water column? The reason I bring that up is because the cyanobacterial blooms we have out there they often aggregate at the surface so you're going to get way high numbers, but if you integrate throughout the water column you could easily get below 40.
- Jim Bowen – I was just thinking about steps toward summer 2024, for the high salinity regions the only interest isn't protecting the SAVs but there is a path forward towards a limit, a criteria, chlorophyll criteria as Nathan has described, when that bio-optical

model is ready and then what does it say about what's needed for chlorophyll in high salinity regions and what would be a criteria that the SAC might recommend. It's not going to be the only thing we do, but it could be one of the things we do.

- Hans Paerl – Nathan let me ask you. If we're staying below 30 µg/l in high salinity waters, if that is a threshold, then maybe we should be focusing on is the low salinity region because that is the region where we exceed even the current state standard at times, and the question there is how does that work out with regard to the quantiles you're considering?
- Nathan Hall – I was just reviewing my slides, for the high salinity a median growing season of 10-15 µg/L looks like about what we need and that corresponds to a 90th quantile of 20-30 and hardly ever do we see chlorophyll levels that high in high salinity waters. As far as chlorophyll goes right now, it doesn't seem to be as big of a deal in the high salinity waters. Doesn't mean we shouldn't have a better standard though I don't think to me we get a standard in place knowing where we need chlorophyll a to be for high salinity so that we can have something we can do about it when we do find a waterbody does have 30 µg/L chlorophyll. Currently right now if Pamlico Sound shot to 30, it wouldn't be violating any standards, because the standard is 40, so it's not a bad thing to have a standard preempting the need, but the low salinity is where we need to really work hard because that is where the best accounts are where we've lost half of SAV and definitely not meeting the light requirements for them and we're seeing blooms in Albemarle Sound region. I was there Tuesday and there were blooms.
- Nora Deamer – What is the timing for the bio-optical model in the low salinity? I haven't had an update on the timing.
- Nathan Hall – It's taking me little longer than I thought and still planning on having it all done by end of September.
- Jim Bowen - I do think we should move ahead with a chlorophyll consideration in the high salinity as soon as we can at least from a clarity standpoint.
- Hans Paerl – I would second that.
- Paul Wojoski – Good recommendation to review it. The question coming up in my head moving forward is considering whatever the revised chlorophyll a standard could be, is that a revised standard that's on the book or is this also taking into consideration revised implementation of that standard? Is the question of how we're implementing the standard or is the question should the standard be changed?
- Nathan Hall – One consideration is that there are no chlorophyll data being collected in high salinity waters.
- Hans Paerl – Or a few...
- Nathan Hall - Very little, and even fewer in high salinity where SAV beds exist. There's virtually no chlorophyll data except for the near sites and those co-sites and the park service there's really not any high salinity data being collected where there are currently SAV habitats.
- Hans Paerl – What do you consider high salinity Nathan?
- Nathan Hall – We've pretty much drawn a line across the sound for the high salinity zone, anything greater than 10 on average.
- Hans Paerl – There is data then from ModMon.

- Nathan Hall – There is but not they're not in SAV zones, they're in the middle of the sound, that's why I made that distinction.
- Hans Paerl – Ok.
- Nathan Hall - I consider the Pamlico Sound a high salinity sound.
- Anne Deaton– That brings us back to if we can get those PAR sensors ordered and we can get them out to field sampling crews, we could start to get that data which might help in that decision for high salinity waters and what numbers might be appropriate. DMF said they would help and will help, just need to maybe get that going.
- Emily Barrett – Does that mean DEQ reaches out to you Anne and you all have a chat?
- Anne Deaton – Yes.
- Wilson Laney – A question for Anne or Hans or Nathan: Are there remote sensing chlorophyll a data from satellites that we could pick up for any of these areas either low salinity or high salinity?
- Hans Paerl – There have been efforts to do that actually goes back, I'm thinking of this paper written by who's the guy Ganset<sup>1</sup> who has done remote sensing interpretation, I can dig up that paper, but they used FerryMon data to calibrate the chlorophyll remote sensing imagery. So the answer is Yes there have been some efforts done, and also been some efforts done by EPA calibrating against ModMon and FerryMon data, but FerryMon data it's not extracted chlorophyll, it is chlorophyll that is sensed fluorometrically on the fly but there are data there on the Cedar Island to Roanoke Island run for example which would presumably include some of the seagrass areas, and of course ModMon samples every other month in the western part of the sound that but as Nathan pointed out that's not necessarily a region where there's a lot of seagrass.
- Wilson Laney – It might be something worth looking for, to see if there are some databases that would have remotely sensed data that we could tap into.
- Nathan Hall – That would be good for the deep waters but one of the issues of remote sensing data is that it's not going to tell us anything about what's in grass beds, because the remote sensing imagery is going to see seagrass.
- Hans Paerl – Yea.
- Nathan Hall – And you're not going to be able separate bottom from water column. One of big questions is how similar or different are main channel stations from what the seagrass are seeing, and that's still an open question. I know looking at Pamlico Sound data from ModMon data which is out in the middle of deep water versus the station at Ocracoke, which is really close to the seagrass, is pretty different. There's a lot more turbidity in shallow stations which kind of makes sense because less water over the sediments so if gets stirred up don't get as much dilution, so it's kind of different. Ideally, we would want to know what the clarity is like in the areas where the seagrasses actually are. Currently we don't have that data or not much of it.

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<sup>1</sup> The conversation was recorded accurately. Dr Paerl distributed the paper to the group and the paper he was referring to was: Keith, Darryl J. Satellite remote sensing of chlorophyll a in support of nutrient management in the Neuse and Tar-Pamlico River (North Carolina) estuaries. REMOTE SENSING OF ENVIRONMENT. Elsevier Science Ltd, New York, NY, 153:61-78, (2014)

- Emily Barrett – Jessie Jarvis said in the chat we have 3-5 years of chlorophyll data in Back Sound in seagrass meadows.
- Nathan Hall – Ok.
- Hans Paerl – I will send the paper to you Emily, that I can't think of the author right now, but I'll send that to you so you can put it out to the committee.
- Emily Barrett – I'd appreciate that to help us close that loop. As a facilitator, I'm into hearing people talk about schedules and things like that so I'm wondering looking at a year is there a way to break down the question in a way that seems doable into time periods, or is it too soon for that?
- Hans Paerl – When we get the final results from Nathan, we'll be able to come up with a little bit more of a quantitative set of answers, so the answer is a qualified yes.
- Emily Barrett – Gotcha.
- Jud Kenworthy – Circling back to what Jim Bowen suggested earlier, perhaps we're in a position to maybe move forward with chlorophyll in high salinity even though it may not be as much of an imminent threat as we recognize conditions for Albemarle Sound, and like Nathan pointed out a preemptive strike and if we were comfortable with that we could put that on the agenda to move forward with. Another high-level discussion maybe will be to make a decision on that, and perhaps we could be doing that between now and September in the interim while Nathan finishes his optical modeling work in the Albemarle Sound, and then we will have a lot more empirical information to fuel that discussion.
- Emily Barrett – That sounds like a reasonable approach. Hopefully Nathan does not feel too much like we're waiting with bated breath even though we are kind of.
- Jud Kenworthy – One thing about Nathan's work which thanks to APNEP this is getting done and it's helping us and it's having implications. I'm wondering if we couldn't somehow figure out how to do a project like Nathan has just done, for example one of the things Nathan did was he surveyed the entire field of information that we had on light in our estuary, and he showed this graph the other day, I think you've seen it, or different versions of it, sort of a coastwide kind of best we have information and when you throw all that together and you summarize it the way he did like it's sort of this red flag frequency category, you really get the sense of where the issues are and where we stand in general and actually there is more information there than we thought we really had to begin with but it took that effort to do it. If we're thinking about chlorophyll and nitrogen, that kind of synthesis effort might be really helpful, so whether we do it as a SAC or we try to figure out a way to fund it and farm it out or have someone else do it that might be something else to consider as well.
- Emily Barrett – See several nods Jud.
- Jim Bowen – On the to-do list this issue of chlorophylls in mid-channel versus chlorophylls over the seagrass needs to be simultaneously or in parallel examined, because if we say from the bio-optical model here's what we suggest for the criteria then the issue will come up as to where those chlorophyll measurements were taken, and to the extent that we can have/if Jessie can help us get our hands on those data in some sort of analysis as to how they compare to the mid-channel, I think that would be worth looking into and we can do that right now; there's no reason to wait on that.

- Emily Barrett – Jessie Jarvis in the chat said happy to share!
- Nathan Hall – Jessie, do you have any mid-channel data to compare that to? And in Back Sound not sure what you'd call a channel.
- Jessie Jarvis – We don't have the direct mid-channel stuff. That's always the issue of what is out there. We can compare it to the near sites which are nearby and see how that would compare. And then there's Duke but that's not necessarily in the channel. All of our stuff we have is in the seagrass meadows. We also have a project in the New River but I'm not sure that would help. Nathan, can we chat after this?
- Nathan Hall – We can catch up.
- Emily Barrett – Would you like me to push you along to the next item in your agenda? Have I let you discuss long enough? Anyone simmering on something they want to say that they haven't said including DWR folks? Chairs are you ready to move on?
- Hans Paerl – We have a sense of direction here as Jud laid out that I feel pretty comfortable with; I will scour the landscape a bit for more remote sensing imagery that's been done particularly on Albemarle Sound. I'm aware of a couple papers but just can't remember the authors.
- Emily Barrett – Jud any closing comments before I turn it back over to Paul to discuss next steps and schedule and things?
- Jud Kenworthy – No, let's move on the agenda.
- Emily Barrett – So the next item is next steps for the SAC and schedule.

**4) Next Steps for SAC and Schedule – Currently meet last Friday every-other-month. Would another repeating schedule work better for the members? Or should we keep existing schedule? (Emily Barrett)**

- Almost always during this time of year you are getting new academic schedules, so we wanted to ask to make sure we're allowing for the best participation. Jim asked how many SAC members do we have today?
- Elizabeth Liebig – 1 SAC member missing, right?
- Emily Barrett – Just 1?
- Elizabeth Liebig – I believe we knew ahead of time that one would not be able to make it.
- Emily Barrett – We were definitely told one.
- Karen Higgins – We can just ask them to raise their hands and then count how many hands are raised.
- Emily Barrett – I wanted to share with everyone what I am seeing in the chat. 9 (SAC) hands and Friday works for me from Jim, Michael, Jessie, and Hans, so sounds like we're going to stick with the Fridays. Last Friday of every other the month is typically what we've been doing; do I have a thumbs-up from all of you on that as a repeating schedule for the next year? Ok. Government people work on a fiscal year so this really is the beginning of our year. We appreciate you centering yourselves, getting ready for the new schedule, and making a new plan. Paul and Libby and anyone else in the room have closing comments? Additional comments from the room? We have Cam here live and in person.

- Cam McNutt – I will start reaching out to folks starting next week regarding questions about monitoring and assessment, a lot of that was started off today, but I am going to try to get very specific on a lot of these things.
- Paul Wojoski – I'll add some comments on next steps and scheduling going forward is that, again to be clear we're going to try to convene the SAC every other month, so next meeting looking at last Friday in September. Again Nathan, it would be great if you could share your latest, where you are with the bio-optical model on that point. From what I heard today and also would defer to SAC co-chairs Hans and Jud, is consideration of nitrogen as a variable but conversation shifted to examination of chlorophyll a standard, I think that was the consensus of where we're going looking forward to the next meeting. I would encourage everybody as we distribute these minutes that DWR communicates in the interim to bring the questions we have, we've heard questions about remote sensing and there's going to be some work done to see what information we gather there, questions about mid-channel versus in the seagrass and what kind of data we have on there, high salinity question, bring all these questions clearly forward at our next meeting, so with the idea of begin with the end in mind, the end being if we reexamine and propose a new chlorophyll a standard, at what level does that need to be to protect against the HABs that allow recreation and protect the aquatic vegetation that allows for aquatic life, and thinking how this information would feed into deriving a possibly revised standard for chlorophyll a, just wanted to leave with thinking forward. Hans and Jud please chime in here to frame it up in any way if missing anything there.
- Jud Kenworthy – Did I understand it correctly that we're not meeting until end of September? There will be no meeting in August?
- Emily Barrett – That's correct.
- Jud Kenworthy – Ok.
- Emily Barrett – You're welcome to try to make progress on research and information between now and then. Sounds like Cam is going to help with that.
- Paul Wojoski – You will hear from Cam on some clarity questions, DWR will be doing some work, connect with DMF on par sensors, and do some work in between and also as we work through this hopefully, we will be able formulate an agenda proposed meeting early between now and then so that will help drive folks to better prepare for when we convene back in September.
- Hans Paerl – I'd put in a plea for folks to look into any case studies where nutrient reductions have occurred and get into some of that material Wilson discussed with us, food web implications, things like that. I think there probably is a lot of literature in the Baltic Sea region so I will focus in on that which actually is not that inappropriate because it is a brackish system and they have had their version of TMDLs now in some places for several decades so I'll invest some time in that but also look at our own systems, Chesapeake Bay, potentially Florida Bay, Puget Sound, other places; Puget Sound would be a good place because if they have done any nutrient reductions there's a lot of fisheries and shellfish interest there for example.

##### 5) Adjourn (Emily Barrett)

- Thanks to our chairs for helping us make some progress in this meeting, I appreciate all of you taking the time to lend your expertise to this really important effort, and we'll see

you in September. Feel to reach out if you need anything. Paul, Libby, myself and rest of DWR staff are at your disposal.