Aquatic Fauna Monitoring & Assessment Phase II Kickoff Workshop

Albemarle-Pamlico National Estuary Partnership
10:00 am - 3:30 pm
October 5, 2017
The Imperial Centre for Arts and Sciences
270 Gay Street, Rocky Mount, NC 27804
http://portal.ncdenr.org/web/apnep

MEETING NOTES*

*Notes by Wilson Laney and Tim Ellis. Edited by Wilson Laney, Tim Ellis, and Dean Carpenter.

Aquatic Fauna MAT Members and Guests Present:

- Dr. Brian Boutin (APNEP Science and Technical Advisory Committee [STAC] and The Nature Conservancy [TNC], Director of TNC Albemarle-Pamlico Sounds Program, encompassing everything from land protection to oyster work)
- Chad Boyce (Virginia Department of Game and Inland Fisheries [VDGIF], Fisheries Biologist, responsible for SE VA waters including Back Bay and all extensions of the Currituck Watershed)
- Larry Eaton (retired, freshwater and estuarine macroinvertebrates, NC Division of Water Resources [NCDWR])
- Todd Ewing (NC Wildlife Resources Commission [NCWRC]-Inland Fisheries, Assistant Chief, and supervisor of the Aquatic Wildlife Diversity Program)
- Eric Fleek (NCDWR, supervisor of the NCDWR Biological Assessment Branch, background in marine biology, also doing estuarine biomonitoring, fish tissue monitoring, and fish and freshwater invertebrates)
- Dr. Wilson Laney (STAC and US Fish and Wildlife Service [USFWS], Senior Biologist for Fisheries and Ecological Services, specialist in diadromous species)
- Jason Rock (NC Division of Marine Fisheries [NCDMF], Biologist Supervisor, Washington Office, oversees NCDMF fishery-independent sampling programs)

Aquatic Fauna MAT Members Absent: Dr. Jesse Fischer (STAC and NC State University [NCSU]), Erin Fleckenstein (STAC and NC Coastal Federation [NCCF]), Dr. Joel Fodrie (STAC and University of North Carolina-Institute of Marine Sciences [UNC-IMS]), and Judy Ratcliffe (NC Natural Heritage Program [NCNHP]).

APNEP Staff Present:

- Dr. Dean Carpenter (APNEP Program Scientist)
- Dr. Tim Ellis (APNEP Ecosystems Analyst)

Welcome and Introductions (Wilson Laney, STAC and USFWS)

Wilson welcomed everyone to the meeting and asked each member to do introductions. Everyone did so, with some elaborations which Wilson and Tim sought to capture above in the attendance list.

Dean explained that Chad is not just a token Virginia agency representative. He asked Chad to consider, as we are meeting today, who else from Virginia may be appropriate for membership on this team as well. He also gave a synopsis of the upcoming APNEP symposium this fall (to be held November 1, in the NCSU McKimmon Center in Raleigh), and noted that the Governors of Virginia and North Carolina will be signing a new memorandum of understanding (MOU) soon regarding APNEP. Dean also explained how the MATs work, and noted that he and Tim are the facilitators for this team.

Wilson noted that additional members should be attending future meetings, including Bryn Tracy, who recently retired from the NC Division of Water Quality, and perhaps some other representatives from the NC Wildlife Resources Commission. Wilson asked Todd to address the NCWRC representation on the team. Todd advised that Tyler Black, and Tom Fox, may be coming as well at times, so one of the three will usually participate at a given meeting.   Wilson asked the team to consider, as Dean was giving his overview of APNEP and the MAT process, if this team needs additional members and/or expertise, and if so, who might be good candidates.

Dean asked if there were any questions on the agenda and there were none.

Wilson noted who the other members of the team were who were not able to be with us today (listed under Aquatic Fauna MAT Members Absent above).

Aquatic Fauna Monitoring & Assessment Phase I Review (Dean Carpenter, APNEP)

Dean noted that he will talk about this team in the context of today, in 2017.   The team is not starting from scratch. A list of potential aquatic fauna indicators were provided to the team earlier. Members should review this list and decide whether the indicators are reasonable. Consider with which five to ten indicators can the team begin to conduct assessments and develop monitoring strategies. Also, members need to consider whether additional members need to be recruited, as Wilson had requested. While the initial size of a MAT is 10-12, that is not a hard and fast rule, and it is expected for members to reach out to other colleagues for advice, support and assistance.

Dean presented the APNEP mission statement: to identify, restore and protect the significant resources of the Albemarle-Pamlico (A/P) estuarine system. This National Estuary Program (NEP) is a watershed-based system, taking an ecosystem-based approach. The MATs have an identification focus. The team needs to decide what significant aquatic faunal resources should be tracked, to see if the partnership is having an impact on the ecosystem, making a difference.

APNEP has a Comprehensive Conservation and Management Plan (CCMP) which contains the measures decided upon for implementation.

Dean projected a map of the APNEP implementation area and management institutions. APNEP has seven full-time staff, most of them based in Raleigh except for Jimmy Johnson who is in Washington. Funding is federal, from USEPA, about $600,000 annually. APNEP was established in the 1980's, when interbasin transfers were a hot topic between North Carolina and Virginia (Lake Gaston pipeline), therefore the upper portion of the Roanoke Basin was not included in the program for implementation. APNEP funds must be spent in the formally-designated program area. The eastern boundary line runs along the crest of the Outer Banks (due to jurisdictional considerations between the US Environmental Protection Agency [USEPA] which administers the NEPs, and the National Oceanic and Atmospheric Administration [NOAA] which administers most matters having to do with the ocean), but for assessment purposes, APNEP considers the nearshore Atlantic Ocean as part of the ecosystem. Dean provided examples of parallel North Carolina and Virginia state agencies involved in the program. He noted that for the federal agencies involved (USEPA, USFWS, and others), the NC/VA border is often a boundary between federal regions. The geography proportionally breaks down in thirds, with about a third in Virginia, a third in North Carolina, and the middle third the cross-border region.

Dean reviewed the Aquatic Fauna Monitoring & Assessment Team (MAT) Phase I (pre-2010). He explained what the Science and Technical Advisory Committee (STAC) is, and that it is modeled after the Chesapeake Bay Program STAC. There is a section of the APNEP website which is devoted to the STAC and a roster of its 36 members is available therein. The initial work was to develop a monitoring strategy for Living Aquatic Resource metrics with the APNEP Region, produce metric-specific monitoring proposals, and select indicators to be featured in an upcoming APNEP regional ecosystem assessment.

Dean explained APNEP's transition to an ecosystem-based management approach (EBM). This entailed: a holistic vision and plan that includes a comprehensive description of the A/P system and articulation of multiple management objectives; A community that has effective engagement of policy makers, managers, scientists and stakeholders; A process that includes effective adaptive management; and a framework that includes appropriate authority, implementation area, management institutions, financial resources, and effective communications.

APNEP's ecosystem health goals were reviewed. It is envisioned to be a region where we address human communities, native species, and water quality. The APNEP adaptive management cycle has four steps: plan, manage, monitor and assess. The first assessment period was during 1988-1994, known as the Albemarle Pamlico Estuary Study (APES). There was lots of APNEP-funded research and all of the reports are available electronically on the APNEP website. APNEP's original (1994) CCMP came out of that process. As soon as the first CCMP was released, the Republican revolution happened, thus beginning an era of smaller government, federal resources dried up, and APNEP was buried in the NC Division of Water

Quality. APNEP had only two staff and it was difficult to implement the new CCMP. Monitoring got very little attention at the time. In 2000, an USEPA contractor sponsored a monitoring conference to document past and existing monitoring efforts by partners, but there was no coordination and integration of monitoring by APNEP. Dean joined APNEP in late 2003. He noted that it had taken decades-plus, to conduct the first iteration of the adaptive management cycle. He asked for any questions. There were none.

For the 2017-2018 period, one of APNEP's objectives is to produce Regional Ecosystem Assessment 2.0. The 2012 assessment was a proof-of-concept version, using 24 indicators for which there was high-quality regional data available, and a champion to lead the development of an indicator assessment. We anticipate creating CCMP version 2.1 next year, by doing some tweaking to the 2012 CCMP. Finally, there are plans to create Integrated Monitoring Strategy 1.0, and indicator specification Version 1.1. Dean noted that there are six other MATs. Dean asked for questions, and there were none.

Dean reviewed the history of the APNEP monitoring and assessment activities during 2008-2010. APNEP staff adopted indicators and supporting metrics in 2007. There was a plan in 2008 to develop an integrated monitoring strategy for those indicators. This was to be done in concert with APNEP revising its initial CCMP. Because the science was getting ahead of the planning, the MAT activities were placed on hold and staff devoted its full attention to producing a new CCMP, taking two-plus years to complete.

Dean reviewed APNEP's initial regional ecosystem model, low resolution version. It is based on the DPSER model: **D**rivers, **P**ressures, **S**tate, **E**cosystem Services and **R**esponse. Out of the model arose the seven MATS: Human Dimensions, Water Resources, Air Resources, Aquatic Fauna, Wetland Resources, Terrestrial Resources, and Submerged Aquatic Vegetation (SAV).

The Aquatic Fauna MAT was formerly called the Living Aquatic Resources MAT but the aquatic plants were assigned to the SAV MAT so this team can focus on fauna. Dean provided a list of all of the involved partners (agencies and organizations) during Phase I, of which there are many.

Dean shared the updated DPSER modeling flow chart. Initially this team will be working largely within the "biological state" module. He asked if everyone was familiar with the term "ecosystem services." Everyone was. Each model component is color-coded on the flow chart. The "responses" modules are being implemented by the APNEP action teams (ATs), which he will address later.

Dean noted that the term "indicators" mean different things, to different people. The definition APNEP uses: a numerical value derived from actual measurements of a pressure, state or ambient condition, exposure, ecological condition, or measure of human health, or wellbeing over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment in the A-P region."

Dean reviewed the APNEP indicator criteria and noted that he would be posting his presentation to the web site.

The Objectives-Metrics Hierarchy, includes from general to specific: modules, categories, dimensions, and metrics.

Dean shared the list of potential Aquatic Fauna Indicators, for which monitoring strategies were created (the slide was in very tiny font not meant for actual reading). The team however can begin from scratch if desired. All of the team members' agencies are doing monitoring of one sort or another. He suggested that to design an effective monitoring system, the questions that must be answered must be known up front, in order to select appropriate indicators. Precise goals and specific measures for monitoring policy effectiveness should be designed and tested at the time that a policy is implemented.

The Phase I monitoring proposal forms had six sections: justification for the indicator; goal of the sampling/monitoring program; the existing sampling/monitoring program; what would constitute an enhanced sampling/monitoring program; references; and a contact person.

Dean reviewed the monitoring integration continuum: *Independence*, knowledge of partners' monitoring strategies; *cooperation*, taking advantage of common geography and timing; *collaboration*, opportunities to leverage partners' monitoring networks; and *integration*, working toward a common set of regional ecosystem objectives. Dean explained and elaborated on each of these four aspects of the continuum. APNEP provides the framework. The MATs provide the fuel that forms the assessment system. Dean asked for questions, noting that all have agency or organization missions and responsibilities, and these may overlap with those of others as well as APNEP's. All may be of benefit to each member organization.

Dean provided some background regarding how APNEP developed the EBM approach. The EBM Transition Team was comprised of members from the APNEP Policy Board, STAC, Citizens Advisory Committee, a state planner, a federal planner, an EBM Tech Transfer, and APNEP staff. Dean noted that Drs. Carl Hershner and Kirk Havens from the Virginia Institute of Marine Sciences (VIMS) led the group. The team met monthly until the task was completed.

Dean went through the seven steps in the process: 1) articulate program goals; 2) develop system level model for goal attainment (the EBM Transition Team developed a list of factors associated with each CCMP outcome, and they considered importance, and feasibility; there are 58 actions in the CCMP); 3) assess current management efforts, and identify gaps (this was directed by conceptual models, and a survey of partners' strategic and action plans, looking at dates); 4 implement CCMP; 5) develop a monitoring program; and 6) assess performance. Dean referred again to the 2012 interim regional assessment.

Dean gave an example of the format for an APNEP ecosystem assessment indicator: system-wide biological component, sturgeon abundance. The questions associated with each section were: Why is the status of sturgeon important? What does this indicator report? What do the

data show? Why can't this entire indicator be reported at this time? Understanding the data, and Technical Notes.

Wilson noted that he and Jason had a "deal" for the team in that the Atlantic States Marine Fisheries Commission (ASMFC) has just completed a benchmark stock assessment for Atlantic Sturgeon, which will provide a very current and up-to-date body of data the team can use to update the APNEP assessment for Atlantic Sturgeon. NC Division of Marine Fisheries (DMF) staff were key participants in the process, with Laura Lee chairing the Atlantic Sturgeon Stock Assessment Subcommittee (SAS) and Dr. Jared Flowers (formerly NCDMF, presently working for the National Marine Fisheries Service [NMFS]) analyzing all of the Atlantic Sturgeon tag return data, both conventional and acoustic. The assessment had been peer-reviewed, and was approved by the Peer Review Panel for management advice. It will be presented to the ASMFC Sturgeon Management Board at their meeting in Norfolk, Virginia week-after-next. The index generated by the Atlantic Sturgeon data from the Cooperative Winter Tagging Cruises was one of the indices used in the assessment. The bottom line determination was that on a coastwide basis, Atlantic Sturgeon are slowly and gradually increasing, with a number of indicators showing abundance likely higher than it was in 1998 when ASMFC imposed a coastwide moratorium on the fishery. NMFS had listed the species in 2012 (with the Carolina Discrete Population Segment [DPS] being endangered) and had recently (September 18) published a Final Rule designating Critical Habitat (CH) which covers a great deal of North Carolina and Virginia's rivers.

Dean went through the list of sections of each indicator. As they are developed, each one will be rolled out.

Dean noted that APNEP's 2012 assessment just presented the trend in each indicator, without any interpretation or explanation. The 2018 assessment will go further and interpret the trends. Eventually APNEP hopes to answer questions such as: What were historic ecological, social and economic conditions, trends and variability? What are current ecological, social and economic conditions? What are trends and risks under current policies and management? What policy choices will achieve ecological sustainability consistent with social well-being?

Dean returned to adaptive management and how to achieve it. This he views as the most difficult step. This activity be done by APNEP's action teams. Senior management engagement, and placing trigger levels in the plan, are key parts of this action. As responses, or not, to management actions are tracked, we will revisit and revise the management strategy. Some of these desired outcomes may take decades to achieve. So, we must therefore have a monitoring approach to track "early" responses as well. In addition to monitoring the outcomes, management efforts must be monitored as well. Analysts may find that they didn't understand the system, or that partners who said they would participate, did not do so. So, there will be management action indicators that we will track as well. Dean noted that a lot of folks say, if we can do adaptive management successfully, we will have really taken a positive step.

Dean showed APNEP's organizational diagram. The key nodes are: USEPA, APNEP staff and participants (Policy Board, STAC, MATs, and Action Teams [ATs]). The Policy Board name will be changing to Leadership Council soon (new Executive Order for APNEP from NC governor) but the duties will be the same. Dean spent a moment on the action teams, which are responsible for implementing the CCMP actions. Each STAC member is assigned to one MAT and one action team.

Dean reviewed the CCMP's four questions, and linked them to aquatic fauna: What is a healthy A/P Estuarine System?; What is the status of the A/P Estuarine System?; What are the biggest threats to the A/P Estuarine System?; and, What actions should be taken that will move us from where we are today to a healthier A/P Sounds by 2022?

Dean noted that the action teams consider some management strategies that will hopefully benefit aquatic fauna. He gave an example for the Freshwater Habitat and Fish Passage Action T, which is among other things charged with implementation of improving fish and aquatic faunal passage.

Dean noted that next he will address the MAT expectations, and noted that he had provided us all with a five-page MAT guidance document. He asked for feedback on that document once members have had a chance to review it.

Aquatic Fauna Monitoring & Assessment Phase II Expectations (Dean Carpenter)

Dean reminded team members that they have a list of indicators from which to start. Hopefully members can agree on a handful of these indicators, on which we can get started. He suggested that members focus on the monitoring, and then consider whether to do a new assessment, and who should be involved in that work. He hoped that members will be the champions for getting the work done. Dean and Tim are here to assist and help move the MAT ahead. Each of the seven MATs can move at their own pace. Their job as staff is to keep things moving. The first two questions are intended to get a conversation going. We are coming back to the science. We didn't get to the point previously where APNEP had core indicators. Once the MAT gets comfortable with a list of initial indicators, they will be forwarded to the Policy Board for their consideration and approval.

Dean noted that he had done a lot of talking, but that would be limited to this first MAT workshop, and hopefully he will do less in future meetings. He noted that everyone on the team are veterans and have lots of experience. They are working with management at the same time as they are working with the stakeholders.

Dean asked for any questions.

Aquatic Fauna Indicators Evaluation and Prioritization Team

Dean noted that the team has the list of previous indicators. Tim added that the indicators on the list were generated from the Phase I process. The goal for this discussion today is to prioritize indicators on the list. The idea is to link candidate indicators back to the CCMP goals. Dean explained the information on the top of the handout, and how the goals relate to the CCMP goals and outcomes.

Brian noted that there may be some indicators that the team DOESN'T want to consider. For example, that Dermo presence in oysters doesn't prevent human consumption of oysters, so we don't necessarily need to monitor that one as part of the "safe for consumption" metric (CCMP Outcome 1D). Brian suggested moving this indicator to "Ecosystem Stressors". Dean concurred, reminding members that the list is more conceptual and the team can certainly refine and amend it.

Wilson asked if everyone understood the idea here. Everyone did.

Wilson initiated the discussion by advocating for Atlantic sturgeon as a priority metric. All the other species under the "Diadromous Fishes" indicator are monitored by NCDMF and NCWRC. Of those species on the list, shortnose sturgeon should probably be eliminated because it is rare in the A-P region, with the only known viable population in North Carolina existing in the Cape Fear River (only three caught since the late 1800s), which is outside of the region.

Brian asked about river herring and the difficulty of interpreting river herring data as being directly linked to APNEP management actions, because there are so many other factors outside of APNEP (i.e., during the marine phase of river herring life cycles) which influence their population abundance. Wilson agreed that it was hard to interpret the results. Jason noted that they do monitor river herring through the Albemarle Sound juvenile abundance index (JAI) program, and he believes that one of the recovery triggers for river herring has been achieved. NCDMF also has some bycatch monitoring data which could be used to generate adult estimates. Members decided to leave the river herring on the list at least temporarily.

Dean agreed that while in some cases there can be great habitat for a species, there are other threats over which managers have no control. River herring could be considered as an important cultural resource as well due to the long history of that fishery in North Carolina and Virginia.

Tim noted that the indicators are also going to help us determine how effective the CCMP is, regarding fisheries. APNEP chose to focus on the fish themselves, through habitat and fish passage. Although harvest itself is not something on which the CCMP focuses, we can still consider whether harvest is affecting the indicator, and we can acknowledge that fact in the assessment.

Brian noted that river herring stocks are very depressed, based on NCDMF's (and ASMFC's) current assessment. For river herring, we are starting from a very low baseline. APNEP may help to drive great fish passage, but if the fish won't come, it will be difficult to claim that we have benefitted the stock.

Tim acknowledged the point, but noted again that the harvest side doesn't preclude us using a given species.

Wilson reviewed the benefits/detriments of using each of the diadromous species. In general, all of the diadromous species, except for hickory shad (not on the list in any case, and which no one really monitors), are at historically low levels.

Brian noted that he is okay with using river herring, but the team just needs to be aware of the difficulties of interpretation. APNEP would be remiss to not include either American shad or river herring in the mix, because of their cultural and former economic importance.

Wilson noted that an updated assessment of American eel is underway.

Wilson shared his conversation last week with commercial fisherman Bobby Lane, regarding American shad in the Chowan River system. Wilson recommended that the team ask to increase the monitoring in the Virginia portion of the Chowan River tributaries. Chad noted that Virginia did formerly sample for American shad up the Chowan (his VADGIF colleague, Eric Brittle). From their perspective, they haven't seen any dramatic change: the Chowan stock (which includes fish going up the three Chowan tributaries, the Black, Meherrin and Nottoway Rivers) has been relatively stable. He indicated that Eric plans to begin sampling American shad again next spring. The Chowan and its tributaries do support a lot of fish. The fish lift on the dam located at Emporia does pass a lot of suckers, according to Chad. He agreed that it doesn't pass shad well at all. The Black and Meherrin rivers are pretty much undammed except far upstream.

Dean asked that in addition to identifying species, members also try to identify the responsible parties for conducting the monitoring. Tim asked that members identify the metrics to be used as well, if known.

Dean noted that everyone gets full credit for their contributions to future APNEP assessments. They either get document/section authorship, or acknowledgements.

So, to summarize for the Diadromous Fishes indicator, shortnose sturgeon is eliminated from the list. Members will provide metrics for each species to Tim later. Brian noted that the team needs to decide what their objective is for each species, whether it is the condition, or what. The agencies most responsible for this one will be the five state/federal fishery management agencies (NCDMF, NCWRC, VDGIF and NMFS and USFWS). Tim wants to also have a metric which looks at fish passage (habitat accessibility) and also looks at the health of the populations. All agreed that was a good addition.

Brian asked if Tim was looking for a metric that can be analyzed with current monitoring, or one that may be a gap. Tim indicated both were legitimate. If there is no information to evaluate, then the team can perhaps come up with a strategy.

Brian asked about river herring spawning surveys. Jason noted that NCWRC is doing some monitoring, upriver. NCDMF has done some monitoring in the past, but Jason wasn't sure if it is continuing at present.

Tim noted that he hoped that the state agencies would be involved in longer-term monitoring, such as on the Neuse River once Milburnie Dam for example is removed. It is difficult to come up with a global metric, versus one which gives information on a certain action.

Brian suggested that the team must be careful not to mix project-based restoration goals, with what can be done here. Brian thought Tim's point about long-term information was a good one.

Tim noted that he only raised the issue because of the USEPA review of the NEPs which occurs periodically, and the need for evaluation of the CCMP. He wanted to have some indicators that provide information on whether their actions are having a positive impact. The EBM stuff is an APNEP initiative important to the USEPA as well, so APNEP needs indicators that both measure CCMP implementation success and "ecosystem health". Having indicators that are relevant to both is ideal and worth considering as this team finalizes and prioritizes its indicators list.

Chad noted that he was struggling a bit. He was trying to track the metrics, with the agencies represented, and some metrics which lie outside the scope of agencies. He gave an example of mercury in fish tissue. Everyone knows that a lot of mercury is coming not from the USA, but from China, so he asked if anything we do here, can affect that metric. For sea turtles, how is their habitat on the Outer Banks going to improve unless APNEP is going to knock on individual doors. He asked again, what we can impact at this level.

Tim noted a challenge of an EBM-approach is that the list is holistic and large. APNEP is trying to ensure that the major components of the ecosystem are represented. While APNEP doesn't expect to have every element monitored, there is the hope to have a positive impact on the system. APNEP is trying to provide managers and policy makers with the status and trends to let them know how the key indicators are tracking over time.

Chad suggested separation of the large unattainable goals, separated from the more specific ones.

Brian noted that while addressing the management goals of APNEP has merit, so too does tracking trends of indicators.

Tim noted that out of this exercise should come a list of things that will indicate health, but also some things on which APNEP can make a difference.

Wilson again summarized the Diadromous Fish indicator discussion: shortnose sturgeon is removed; the rest of the species will remain on the list for now; a habitat metric will be included and we have a couple to consider under Fish Habitat. Everyone was okay with that approach. Wilson will work with Tim to identify all of the metrics used for each species (with assistance from Jason, Todd, and other colleagues).

Brian noted that good data are unavailable for oysters and clams, to use them as an indicator. This is in part due to harvest and restoration activity. While these could be important indicators, not sure what can be said about them until a map of total acreage and monitoring strategy are established. For the freshwater species (mussels) they are very sensitive and would be good indicators. He would like to hear from others on oysters and clams.

Dean asked if it was a major lift to generate those data. Brian indicated he is working with Tina Moore (NCDMF) on that very point, i.e., how to gather those data without it being overly taxing to the agency. Dean asked if APNEP pursued an assessment for estuarine shellfish, is there an imperfect metric that can be used? Brian indicated commercial catch/harvest is one, and NCDMF data on the opening and closing of areas is another data source. Dean asked what the relative proportion of intertidal to subtidal oysters is. Brian noted in North Carolina, they are mostly subtidal. There are oysters along hardened shorelines. Brian noted that it might be around 3,000 acres of current habitat.

Tim noted that a current assessment could include addressing data limitations and developing a strategy to address the gap.

Chad asked if we could use harvest as a metric.

Brian noted that last year shrimp was so abundant, that many people didn't even participate in the oyster fishery, so factors like the abundance of alternative species, especially high-value ones, can affect the oyster landings.

Wilson led a discussion of the afternoon agenda. All agreed to tackle the macroinvertebrates immediately after lunch, since Larry and Eric had to depart at 2:00 pm.

After lunch, the MAT began discussion of the Macroinvertebrates indicators. Wilson asked Eric to take the lead on that discussion, since he and Larry had to leave early.

Eric asked Dean to display the indicator list on the screen. He and Larry had some suggestions for some reorganization of the list, and also will share what they sample, and where, and they would be amenable to requests for future specific targeted monitoring. Eric suggested: (1) to change the list title to Aquatic Macroinvertebrates, (2) delete Benthic Macroinvertebrate Fauna as being too broad and non-specific, (3) move aquatic insects into the Aquatic

Macroinvertebrates (AM), (4) move the EPT Index under AM, and (5) to add "bioclassification" and add an Estuarine Biotic Index (EBI). Larry noted that one includes shrimp and other crustaceans (amphipods). The freshwater habitats are about 50 percent of the APNEP area, and estuaries are about the other 50 percent.

Dean noted that Aquatic Macroinvertebrates covers freshwater, estuarine and marine habitats. There are monitoring programs for both freshwater and estuarine portions of the system. The Invertebrate IBI and EPT are both freshwater indices. Larry noted that he had provided a paper to APES, years back, on the estuarine IBI. He provided a hard copy to Tim.

Eric noted that everything but the estuarine data fall under the monitoring work that his shop does. They have an online link which shows every freshwater station (10-12,000 stations) that they have ever sampled. Web visitors can click on the station dot and pull up all of the data from that site, including water quality data, and upstream discharger data. Eric is open to collecting additional data, where he can, to answer particular questions.

Dean noted that NCDWR used to do the basinwide water quality assessments on a five-year rotation. Eric noted that those are still conducted. Dean noted that monitoring done in the year prior to the basinwide assessments, are usually incorporated into them. He asked if the monitoring had changed at all. Eric noted that there had been no particular changes over the 17 years that he has been involved in the program, although there have been some changes in emphasis. They have been assisting more with enforcement recently. For the last eight years or so, they had been restricted to doing the basinwide work, due in part to the high regulatory profile of NCDWR. That is starting to turn around now and they are doing more monitoring to support enforcement.

Dean asked Eric to discuss the estuarine system. Eric noted that his background is marine, and when he began working at NCDWR, he began to assist Larry with the estuarine work. The freshwater and estuarine work should be done together. The estuarine work is more poly- and mesohaline in nature. The oligohaline portion of the estuarine system is not as well covered.

Larry noted that estuaries are stressful environments. Too much salt influences the aquatic faunal community significantly. In the oligohaline portion of the system, the biggest threat is salt (too low in salinity for estuarine species and too high for riverine species). So, there is a data hole there, due to the lack of anthropogenic stressors. Larry would like to take another crack at indicators for that part of the system. The managers who allowed him to develop the estuarine IBI insisted on a high degree of precision, and he couldn't come up with that for the oligohaline portion of the system

Tim asked about the stations.

Larry indicated that there are fixed stations, but they do go out and respond to citizen complaints, or to agency data requests for specific locations, especially where they have a decision to make.

Eric indicated the data are a mix of long-term, fixed sites, and a mix of one-off sites, as in cases where it is suspected that a wastewater treatment plant (WWTP) is suspected of modifying their data to make it appear that they are in compliance with the provisions of their operating permit. Most are long-term, historical sites, but there are a lot of special study sites.

Tim noted that if there are fixed sites in the oligohaline zone, one could identify where the historical transition zone was located.

Larry indicated it is hard to tell. Back where marine biology was more fashionable, someone built salinity maps for North Carolina, by month. You could look up each month, and see how far up each river the salinity wedge progressed. Those data were old, but they are out there. You could use those maps to assess where the salt wedge was. [Wilson's note: I think Larry may have been referring to the maps and tables provided in the NOAA, National Ocean Service, Estuarine Living Marine Resources (ELMR) Program. I have hard copies and also some electronic copies of those reports, FYI.]

Tim was wondering if we could use the historical datasets to identify a region-wide zone with that particular salinity interface. Then we can begin to identify who is sampling in that zone.

Larry thought that would be feasible. There is a polyhaline, mesohaline and oligohaline zone, identified based on what species are no longer present in the community assemblage. He noted that the numbers of taxa change in each zone. You can certainly put together subsets.

Wilson asked for the definition of EPT. It is Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).

Wilson asked about the marine system. Is there anyone doing any long-term monitoring of macrobenthos offshore? Larry and Eric were not aware if there is any. Wilson noted that some of the BOEM studies might have provided some snapshots in time (Chris Taylor at the NOAA Beaufort Laboratory did some of those studies) and there have been some historic Duke studies as well.

Wilson noted that there are some long-term offshore fishery-independent surveys (Southeast Area Monitoring and Assessment Program, SEAMAP; Northeast Area Monitoring and Assessment Program, NEAMAP; and the NMFS Northeast Fishery Science Center Trawl Survey), and fishery-dependent data, for whelks (*Busycon* spp.), crustaceans (penaeid shrimps), and some bivalve mollusks (Surf Clams, Ocean Quahogs). There are also some past USEPA programs that looked at benthic macrofauna in some of the spoil deposition areas, and in areas proposed for sand mining. Brian and Wilson noted that there may be some data associated with beach "nourishment" projects, for benthic macrofauna, done in association with the permits issued for such projects, but those would usually be short-term time series, if they were actually required, and typically in the case of "emergency" projects would have no pre-project monitoring data at all.

Wilson noted that NCWRC does monitor some specific freshwater mussels. He asked Todd to elaborate.

Todd suggested that the NCDWR freshwater fish IBI be added to the list. Eric noted that there are no biotic criteria for the Coastal Plain streams. They will have some species accounts for those areas however. Todd noted that the Fish IBI metric should be added under Freshwater Fishes indicator.

Larry suggested that algae bloom occurrence is another metric that we could add. Dean indicated that they have delegated the microscopic organisms to the APNEP Water Resources MAT. Larry noted that his boss, Brian Wrenn oversees that program.

Wilson asked if anyone had anything else for Larry and Eric before they have to leave. Tim noted that he can provide the entire list of potential indicators for all the MATs to Larry and Eric, if they want to see it.

Eric will be the point of contact for getting the information on their standard operating protocols to Tim.

Tim asked that we jump back to bivalve mollusks since we had been sidetracked somewhat. Todd noted that all of the mussels on the list are good species. The dwarf wedgemussel, and Tar River spinymussel, have a lot of work done on them and would be good indicators. Todd agreed that the Roanoke slabshell, and Triangle floater, are good indicators, but they are not placing a lot of priority on the former, since it appears to be doing well, so it won't likely be monitored on any regular basis. Triangle Floater may be a priority in the future, but for the moment, he would recommend dropping both of these metrics.

Dean noted that ideally, you want a metric that is not really abundant, but is sensitive to change in stressors. He noted that it will be too bad if monitoring for those species gets dropped.

Todd noted that they would continue to get some data, as periodic surveys are being done. One of the species which has improved in the Neuse Basin, for example, is Roanoke slabshell. This species will probably be delisted at the state level.

Dean confirmed that for monitoring purposes, the Dwarf wedge, and Tar River spiny, will be good indicators.

Todd noted that they will be monitoring those two species for the foreseeable future. They may rotate monitoring.

Tim asked about invasive mussel species. Todd noted that there is the Asian clam, but it is everywhere. There is the Chinese Mystery snail, which might be worth tracking. They do document them when they find them.

Brian noted that everyone always asks about Zebra mussels. They haven't shown up in North Carolina yet, thankfully.

Wilson asked about adding some species to the list for consideration, which could potentially be federally-listed in the future. Todd noted that the yellow lance has been proposed for listing as threatened. It is only found in the Neuse and Tar Basins. Todd likes to use presence-absence as a monitoring metric for these mussel species.

Wilson asked if the metric we used could be the percent habitat occupied. Yes, it could. Wilson noted that for the Species Status Assessments (SSAs) that USFWS is preparing in collaboration with partners, they are looking at occupancy in each 12-digit HUC. Todd confirmed that is what is commonly used.

The team moved to the Crustaceans indicator. NCDMF is monitoring penaeid shrimp and blue crabs, so data on both of those are available.

Todd noted that none of the freshwater crayfishes would be good candidates, at least none of the native species.

Red Swamp Crayfish was discussed as a potential candidate for use in the Non-Native Invasive species category, because NCWRC is opportunistically gathering distribution data on that species.

The team returned to a discussion of penaeid shrimp. Jason noted that there are many variables affecting their abundance and landings, one being recruitment. Brian noted that because shrimp are considered an annual crop, it would be difficult to use them as an indicator. Wilson noted that there have been some recent stock assessments conducted for pink shrimp, in the Gulf of Mexico and perhaps south Florida (Florida Bay?). Wilson will send the shrimp assessment from the Gulf of Mexico papers to the team for their information and to see whether the might serve as a model for use in APNEP.

Brian asked about the estuarine fish indicator. The team had just listed the economically-important fish species. Tim noted that he had thought a finfish closely linked to the environment (i.e., habitat and water quality), such as blue crab is for crustaceans, might better capture the ecological as opposed to just the economic interest. For example, species tied to submerged aquatic vegetation habitats (SAV) may be good ones to select. Wilson noted that he was supposed to be updating the SAV literature survey for the ASMFC SAV policy, which is 20 years old this year, so he will look for potential candidates in the species that use SAV. He noted that bay scallops are not on the list.

Jason and Brian noted that bay scallop is another species which is deemed an annual crop, so would be difficult to use as an indicator for assessing the impact of APNEP management actions.

Brian suggested that any of the sciaenids might be good candidates. The pros and cons for each species was discussed, and the team decided that the three best candidates might be spotted seatrout, Atlantic croaker and spot.

Wilson asked about non-commercial species, for some of which we have long time series thanks to some of the NCDMF programs (i.e., Primary Nursery Area, PNA, small-trawl, Program 120). Atlantic menhaden is one such species. Wilson advocated for hogchoker, which he noted may be a good indicator largely of anthropogenic changes, because it is largely unaffected by commercial fisheries (most hogchokers pass through the mesh sizes used in the gear) and are not at all recreationally fished. Wilson and Dr. Chuck Manooch (retired from NMFS) had some discussions in the past about using that species for an indicator, particularly for Albemarle Sound. It also travels widely within the freshwater and estuarine portions of the ecosystem, with juveniles ranging far into freshwater, riverine habitat. There wasn't much enthusiastic support for that one. The team also rejected bay anchovy because of the difficulty in deriving truly quantitative samples (Jason noted that they are very small and hard to sort from the samples, etc.).

Wilson asked about nearshore marine species that might be suitable candidates. Brian mentioned gag grouper, red grouper and sheepshead. The team acknowledged that pinfish also could be a possibility.

Jason suggested striped mullet be added to the list, and it was added. A striped mullet fisheries management plan (FMP) and assessment are available as a data source.

Chad had asked us about striped bass. Brian noted that the Roanoke/Albemarle portion of the A-P region is the only place in North Carolina where there is a self-sustaining population. Dean asked about species benefitting from the freshening of Currituck Sound. That was largemouth bass and yellow perch, which benefitted greatly when the historic ocean inlets through Currituck Outer Banks closed and the sound went from mesohaline, to oligotrophic or fresh. Wilson noted that the invasive SAV, Eurasian watermilfoil, also provided cover and benefitted those freshwater species, both of which can also tolerate some salinity.

Brian explained about striped bass. After conversation, the team discussed the potential for using it possibly as a sub-regional indicator. They may want to work with Virginia to conduct more work in the Chowan River watershed, in view of the information which Chad had provided regarding fish abundance in the Chowan River tributaries, and the fact that recreational fisheries for American shad, and striped bass currently exist in them. Chad noted that he believes that striped bass are also spawning within that system, in addition to the American shad. Wilson shared that American Shad, which Fritz Rohde (NMFS) has been implanting with

acoustic tags, after being captured in eastern Albemarle Sound, had largely moved up the Chowan, rather than the Roanoke as had been somewhat anticipated.

Dean asked that the team address the herpetofauna species on the list. Wilson thought that American alligator would be a good species, in view of the new Alligator Management Plan and the fact that NCWRC has recently begun monitoring the species. Todd after some reconsideration agreed, although he had during lunch felt that it wouldn't be a good species. A suggestion was made to talk with David Allen (NCWRC - wildlife diversity supervisor, eastern region) about using American alligator as an indicator species. The team decided to eliminate the diamondback terrapin, and the freshwater turtles, with the possibility of looking at snapping turtles (for which the harvest is monitored by NCDMF). Wilson noted that the SALCC initially had removed sea turtles from their indicator list but then added them back. Tim noted that there may be some good public relations reasons for keeping them on the list, because they are very charismatic species much appreciated by the public. Brian noted that they are very abundant in the sounds during their juvenile stages, especially Green Turtles and Loggerheads. Tim indicated that they had some conversation with Dr. Matt Godfrey (NCWRC) about these species. Wilson suggested that we keep them on the list for the time being, with a note to discuss with the SALCC staff the reasoning behind their putting them back on the SALCC indicator list. Tim agreed that we may be able to keep them but put them in a different section of the assessment.

Brian suggested that as long as we can link them back to the connection to the estuary (importance as a nursery area) we should include them. Brian noted that everyone thinks about the sea turtles being on the beach, not realizing that they are so abundant in the estuary.

Wilson noted that the remaining herp on the list is the Neuse River waterdog. The team discussed the likelihood of whether the species will be listed. Wilson noted that there was a historic survey for that species done in the early 1980's, by Alvin Braswell and Ray Ashton of the North Carolina State Museum of Natural Sciences (NCMNS), and that survey was recently repeated by the NCWRC and USFWS (Sarah McRae). Both the Carolina madtom and the Neuse River waterdog are restricted in occurrence to the Tar-Pamlico and Neuse drainages.

Dean asked about any other species or metrics.

The team discussed condition factor of individuals within an individual species as a possible metric for use with fish. They weren't sure that it would be useful, but Wilson thought it might be worth a look. They noted again that just because the condition factor might show an upward, or downward trend, wouldn't necessarily mean that the trend was in response to some APNEP management measure.

Brian noted that the team should try to pare down our list to something more manageable. Wilson suggested that our next step should be to produce a matrix table which compares the merits/attributes of each species with respect to the APNEP indicator criteria.

We briefly discussed Fish Condition Patterns (fish kills) as another metric. We have good data on North Carolina fish kill events, which Wilson noted are the subject of annual reports. Tim noted that it isn't always known whether the events are natural, or anthropogenically-driven.

The team agreed that the next step will be for Dean, Tim and Wilson to come up with a matrix table that will compare the attributes of each species, and send that out to the entire team for review and comment.

Wilson noted that for the fish kill events, there would be a lot of other potential metrics of interest, which will be developed by the Water Resources MAT that will be related to fish kills and of interest to us. Wilson asked if there was any sort of cross-MAT body of team leads, which will talk about interrelationships.

Dean indicated that body is envisioned to be the STAC, with those leads invited to participate in any STAC discussions, who are not STAC members already.

Chad noted that he liked the idea of considering occupancy as one metric for assessment.

Dean noted that for the SALCC region, there were specific habitats, for which they wanted to have at least three indicators in each, and they would have to be based on available data. Dean noted that there may be good indicators based on more local data once we begin digging into what is available.

Aquatic Fauna Modeling Discussion and Ideas Team
This topic was not discussed in depth during the meeting.

Aquatic Fauna Monitoring Discussion and Ideas Team
This topic was not discussed in depth during the meeting.

Aquatic Fauna Assessment Discussion and Ideas Team
This topic was not discussed in depth during the meeting.

Action Items/Course Map Discussion Wilson Laney
Wilson reviewed the action items:
1) Wilson will send out the penaeid shrimp assessments and related papers
2) Dean, Tim and Wilson will prepare the matrix and distribute
3) Follow up where Dean noted we will need follow-up, i.e., discuss sea turtles with the SALCC staff and why they put them back in the mix.

While Wilson noted that all of the agenda topics were not addressed fully, Tim and Dean indicated that was okay given that creating the priority indicators list was job one.

The meeting adjourned at 3:10 pm.