DRAFT

APNEP Science and Technical Advisory Committee
Evaluating Ecological Responses Meeting Notes
April 7, 2014

Auditorium
Willis Building, East Carolina University, 300 East First Street
Greenville, North Carolina 27858

STAC Members Present: Marcelo Ardon (ECU), Christie Avenarius (ECU), Lisa Campbell (Duke), Reide Corbett (ECU), Tom Crawford (ECU), Heather Deck (PTRF), Robin Dennis (USEPA), Scott Ensign (AquACo, Aquatic Analysis and Consulting), Adam Gibson (NCSU), Kirk Havens (VIMS), Peter Kalla (USEPA), David Kimmel (ECU), Wilson Laney (USFWS), Bob Miller, Christine Pickens (TNC), Michael Piehler (UNC-CH-IMS), Tim Spruill (USGS, retired), Jessica Whitehead (NC Sea Grant), Rich Whittecar (ODU)

State Agency Liaisons Present: Bill Swartley (NC-FS)

Guests: Rhonda Evans (USEPA), Jim Hawhee (NC-DENR), Rob Howard (ECU), Michael Flynn (ECU), Margaret Garner (ECU)

APNEP Staff Present: Dean Carpenter, Bill Crowell, Jimmy Johnson, Lindsey Smart, John McLeod (APNEP, VA-DEQ)

Call to Order

STAC Co-Chair Reide Corbett convened the meeting and welcomed everyone in attendance. Reide noted that the practice STAC has followed for the current two-year term is to have thematic meetings. Today STAC will be discussing the evaluation of ecological responses, and he asked that members be prepared to ask questions of our presenters, and also be prepared to consider how APNEP can move this agenda forward. Colleagues on the STAC Executive Board (Kenworthy, Piehler, Laney, and Crawford) had developed the agenda together, and he thanked them. Reide noted that this is the last meeting at which he will be presiding as co-chair, and he made an appeal for other members to volunteer for a leadership position.

Reide asked for a motion to approve the draft notes for the STAC's summer 2013 meeting. Kirk Havens moved and David Kimmel seconded the motion. The notes were approved.

APNEP Update*,* Dean Carpenter:

Dean thanked Reide for his introduction, and noted that it has been over eight months since the last STAC meeting. He wished everyone a belated happy new year, and thanked Tom

Crawford for arranging the meeting venue. Tom will be stepping down from the STAC after four years of service, because he will be leaving ECU to assume a position at Saint Louis University.

Tom thanked Dean and the APNEP staff for all the meetings and their assistance. He noted it has been fun to attend the meetings, almost like mini-symposia sessions.

Dean thanked Tom for attending and contributing service until the end of the STAC's term. Dean thanked Jimmy for arranging lunch, Wilson for transportation support, Bill Swartley and Rhonda Evans for their participation.

After reading the names of the 12 STAC members whose terms are ending on June 30, Dean hoped to see all of them at the STAC's summer meeting. He will be contacting them to seek their interest in serving another three-year term.

STAC leadership terms are also coming to an end on June 30 as well. Reide has declined to run for a second term. Jud Kenworthy has agreed to serve a second term if needed. The floor is open for nominations. Pending the election of co-chairs, the co-chairs elect will then nominate three members to complete the STAC Executive Board, who in term will draft a STAC action plan for the 2014-2016 term.

Dean welcomed STAC members, Christine Pickens and Adam Gibson to their first STAC meeting.

The next STAC meeting will be scheduled in the late August and early September time frame, and he will be sending out a Doodle poll to select a specific date.

Dean shared staff highlights for the three quarters since the last meeting. During July-September 2013, staff met with NCDOT Photogrammetry staff regarding the SAV aerial photography delineation; met with VIMS to discuss EBM model development; and briefed partners from NC-WRC, South Atlantic Landscape Conservation Cooperative (SALCC), NC Sea Grant, USFS, and Wake County's Open Space and Parks Advisory Committee (OSAPAC).

Dean asked Wilson to brief members on the OSAPAC meeting. Wilson noted that basically a mini-seminar was organized to brief the OSAPAC on three higher-level, landscape-based conservation partnerships that might be of interest to them, and with which they might wish to interact in the future. Wilson had worked with Dr. Chris Snow and Ms. Louise Alexander-Vaughan to secure presentations regarding APNEP, the Eastern North Carolina-Southeastern Virginia Strategic Habitat Conservation Team (a US Department of the Interior field team comprised of Project Leaders and/or staff from the US Fish and Wildlife Service (USFWS), US Geological Survey (USGS), and US National Park Service (USNPS), and SALCC. Each of these organizations made a presentation to the OSAPAC about what their mission, goals and objectives are and stated how the OSAPAC might be able to collaborate with them to achieve their respective missions. Speakers were Dean, Louise Alexander-Vaughan, and Rua Mordecai, SALCC Science Coordinator (and STAC member).

Dean reviewed October-December 2013 activities: briefed Carolina Integrated Sciences and Assessments (CISA) regarding drought impact assessments; SALCC Conservation Blueprint Workshops held in Raleigh; Association of National Estuary Programs (ANEP) semi-annual meeting in Mobile, AL; APNEP ecosystem symposium "Embarking on a New Voyage"; tidal creek summit; and STAC Executive Board strategic planning workshop, which included both STAC and Policy Board members. This workshop included discussions on boosting and kicking off APNEP's implementation workgroups, the mechanism for CCMP implementation.

Dean reviewed activities between January and March 2014: The APNEP Director is now serving half-time because he has assumed the deputy director position with NC-CWMTF as well; SAV mapping, monitoring and assessment workshop was conducted; wetland monitoring network proposal support—staff have been assisting with a new grant proposal, in light of NC-DWR declining a grant award from USEPA; NC Nutrient Criteria Plan support, NC-DWR is looking to APNEP for assistance for their estuarine focus area in Albemarle Sound; Director Crowell attended the ANEP semi-annual meeting in Washington, DC, and was advised that APNEP will receive about $538,000 in FY 2014; staff attended and sponsored the Oyster Summit Workshop in Beaufort; an APNEP invited presentation to Chesapeake Bay STAC (Kirk noted that the presentation was well-received, and Bill and Lindsey did a great job); the Chesapeake Bay STAC was especially impressed by the progress that has been made by APNEP staff, especially given the disparity in resources received by the two programs; and SAV aerial survey planning. Bill noted that the Onslow Region is scheduled to be flown in July. Staff are tentatively discussing funding additional flights to support the SAV sentinel network planned for this summer and fall.

Rhonda asked if there would be a map soon, which looked at the change in SAV. Dean noted if Mother Nature cooperates in late spring, APNEP would have the missing segment of aerial imagery from Core Sound in mid- to late summer. A comprehensive map should follow later in 2014, maybe September, which would document SAV status during the 2012-2014 period. Reide asked if any change analysis would be done. Dean said that he would like very much to see such a task completed. It would be great to have an SAV status update in the APNEP 2012 ecosystem assessment, including trend analysis.

Bill Crowell noted that APNEP is now in NC-DENR's Office of Land and Water Stewardship. Now APNEP reports directly to the NC-DENR Secretary's office, so that is a bonus. Also, when STAC last met, staff hadn't received the USEPA-NEP performance review results. APNEP did pass the performance review and thus are eligible for another five years of fiscal support. A condition of his new CWMTF appointment was an evaluation after an initial term on how well having a half-time APNEP director works. There could be more changes. The present APNEP staff are stepping up and doing a lot more, and are doing a good job.

Dean noted that the APNEP Policy Board is schedule to meet on May 15. Kirk and Wilson are the STAC representatives on that body, so if any STAC members have any concerns, talk to either or both of them and they will bring the issue forward.

Dean noted that this is a public meeting, so he offered the opportunity for public comments.

Bob asked if the STAC wanted to take a position regarding the proposed closure of the Beaufort Laboratory. Dean noted that members Don Field and Jud Kenworthy (both absent) could best comment on that issue. Reide noted that he hadn't heard the news and asked for an update.

Bill explained that NOAA supports closure of the laboratory at present, due to the condition of the old building, which apparently would require a great deal of funding for repairs. Bill noted that all of the NOAA staff would be reassigned, and contract employees would have to contract somewhere else.

Wilson noted that Dr. David Eggleston (NCSU-CMAST director) had written a strong letter in support of keeping the lab open, and suggested that it would be very appropriate for the STAC to express an opinion on this issue. He suggested that STAC members Don Field and Jud Kenworthy be consulted as to what exactly to say.

Lisa noted that DUML and others will be writing letters as well.

Reide noted that there will be a tag team approach on the next presentations.

North Carolina Coastal Atlas, Michael Flynn and Rob Howard

Michael Flynn noted that he has been at ECU for about a year, and is working on the NC Coastal Atlas with Tom Allen. Michael has been determining who the partners are and whether they want to add to the atlas. Partners include ECU, APNEP, and the Coastal Studies Institute.

The NC Coastal Atlas is a collaborative effort to enable access to coastal data all in one place. Michael reviewed the what, how and who of the atlas. It includes static and interactive maps, spatial data, base maps, and reference layers, as well as research and literature. It enables users to explore and analyze what is occurring within the NC coastal zone. An atlas was the product identified by NC coastal managers and researchers to make NC-specific data available for users. The emphasis is on thematic maps tied to user needs. The data catalog provides the ability to customize maps. Information technology embodies a unique library partnership with geotagged bibliographic resources.

The atlas included the NC CAMA counties, Coastal Plain, rivers, estuaries and adjoining marine areas. Michael reviewed the technology behind the atlas: ArcGIS Server technology……etc.

Michael shared the details of the database. Many layers are based on streaming in data, they are not directly managing many of them. They are partners on bibliographic search and databases with the ECU Joyner Library: there is a steering committee and stakeholders/partners, and a formal memorandum of understanding. There can be some political dimensions to the work, which render part of it sensitive.

Michael shared a flow diagram of all the partners showing who is providing what to the database. Users can view downloaded data to their own computers. They will be developing a mobile app for use in the future. He sought ideas from the STAC regarding what they would find useful. He noted that Lindsey would be talking about "I-Naturalist" shortly, which is one application of potential interest. Water monitoring data and wind data may be the subject of future apps developed.

The atlas can provide some foundation for decision support, for example interactive reference and thematic maps, data catalogues, research and literature, and geoprocessing.

Michael depicted an example of the estuarine shoreline maps, and flood risk mapping for the Town of Plymouth, NC. The latter map also included all of the town's infrastructure. The wetlands, habitats and threats mapping capability is also very useful for project planning. Another example layer was an ECU coastal research map, which can be expanded to include other components of the university system. Also shown were pages for the various capacities, for bibliography and other uses. His team wishes to add managerial-type reports to the atlas as well. He shared a use case, in the form of community resilience to flooding (again for Plymouth). Future projects include a permitting tool, mark-up, and map sharing, which could be used by applicants. This may make permitting more seamless. They developed a living shoreline screening tool, with multi-criteria evaluation capabilities. A wetlands component was also referenced.

The NC Coast Atlas team has promote the program at various venues, including North American Cartographic Information Society (NACIS), North Carolina ArcGIS Users Group (NCAUG), Southeastern Division of the Association of American Geographers (SEDAAG), NOAA-Coastal Service Center's Social Coast Forum 2014, and Carteret County Community College.

Regarding future venues, Tom Allen is attending the American Association of Geographers conference, in Tampa. They will be attending the 2014 NC Sea Grant Symposium; The The Coastal Society (TCS) and Restore America's Estuaries (RAE) 2014 Summit; and community events.

Rob Howard provided a demonstration, noting that while the NC Coast Atlas web site is fairly functional, it is not yet complete. He gave a tour of the web page. The maps and data layers that are currently getting the most hits are readily accessible. Current and upcoming events are also listed. Most users will probably come to use pre-constructed, thematic maps. Only a few are currently accessible. Users can create their own map. Rob explained the ocean and estuarine shoreline map. He noted that Reide and J.P. Walsh were involved in the construction of some of these maps then explained how to get to the maps. The "map layers" function is not yet enabled. Some elements have more information than others. The wetlands, habitat and threats map contains APNEP data. The flood inundation vulnerability map is streamed from NC Division of Emergency Management. Rob is working with the North Carolina Sentinel Site Cooperative to map their sites.

Rob noted that the resolution is coarser than he would have hoped, using the projector available today. The mapping is based on AdobeFlex, which is not going to be around too much longer, so they are re-writing the user interface to better suit users' needs. The maps do have a search bar, which will allow the user to locate specific points. There are zoom and scroll tools. Additional data can be added to the map by using a layer panel. Users can toggle layers on and off. There is a World Imagery layer. Each map also has a legend, which is accessible through the panel as well. There is a point marker tool, which will provide latitude/longitude. There is a measurement tool. Rob walked through each tool in turn and explained its use.

Rob demonstrated using the tool. The search results are color coded, green, yellow and red, which are tied to the degree of confidence in the location data. Rob explained how to use the "add data" function. ECU is hosting much of the NC Division of Coastal Management (NC-DCM) data because they don't have a server to host them. Rob demonstrated how to measure the distance between two points. There is an area tool for the site as well.

Kirk asked if users could clear individual markers, or had to clear them all. Rob stated that right now you have to clear them all. Rob demonstrated the "swipe" and "spotlight" tools.

Michael asked Rob to demonstrate the bibliography tool. Rob did so. What it produces is a map, showing the points at which studies within the bibliography have been done. There are currently 546 documents in the bibliography. Students and staff at the Joyner Library have georeferenced many of the documents. They include theses and dissertations, with the departments in which the work was done specified. The bibliography is fully searchable. You can drill down and find a particular document. This feature uses open-source software. Some of the papers have geographic information in their database, and can also appear on the map. Rob indicated that they would like to add as many papers and reports as possible. They would like partners to recommend adding documents, and asked that partners let them know. The lists are not yet searchable from the map viewer yet, but they hope to make it so in the future. They are currently working with coastal planners, to test the tool. They will be updating the features in the future.

Users can complete a survey form on the site and that will provide feedback.

Reide asked if users can import their own data. Rob replied that an importing feature is currently unavailable but is planned, as well as the ability to allow users to bring up a web map. Reide asked about marking maps. Rob stated in a future edition, users will be able to do that task. Users can also give a select group of partners access, as opposed to full public access.

The question was asked if LIDAR layers would be added to the site. Rob confirmed that they will be adding 50-foot and 20-foot resolution data layers. Users will be able to build a profile using the tools. It will be a vertical layer. Tom Crawford thought that the vertical units are in centimeters.

Christine noted that USGS has received funding for updating the LIDAR layers, and half of that has been flown already. Christine thought that some were flown in February. Rob noted that it is supposed to be much improved over the previous version. Robin asked if the resolution was supposed to be one-meter. Rob wasn't sure. The best resolution available now is 20-feet. Some layers are available on the NC Floodplain Mapping Program site.

David Kimmel asked if there was a way to export maps, once users have them set up. Rob indicated that there is the capability to allow export of a pdf file. The next iteration of the viewer will support allow exporting a map that you can modify.

Rhonda asked if the atlas will include water quality data. Rob indicated it will, if users don't have any objection. Rob noted he wished Tom Allen was present, because Tom has been contemplating more about the future vision. There is no reason why they wouldn't provide those data. They don't plan to truncate data layers at the Coastal Plain boundary.

APNEP Conservation Atlas, Lindsey Smart

Lindsey Smart gave a presentation showing the APNEP decision support planning tools. These are in visualization, modeling and decision support categories. Visualization requires less input and technical expertise. Models can show future conditions and require the most technical expertise. The decision support tools help in user planning and embodies "what-if" questions. Planning tools can be used in stakeholder engagement, scoping/inventory, planning, and inventory and monitoring. There are many web map applications out there, so APNEP needs to consider target audiences, main objectives, spatial scale/resolution and gaps. Lindsey indicated that she would review several options, which could serve as bases for APNEP. Examples shared included Puget Sound Partnership, SALCC, the Governors' South Atlantic Alliance, Virginia, the NC Coastal Atlas, EPA's EnviroAtlas. Is there a model framework on which APNEP is really focused? Lindsey noted that the Puget Sound atlas is the one they keep returning to as a good model. APNEP's CCMP was based in part on the Puget Sound CCMP. People who will be using it are likely to be one-step removed from technical users. She noted that any APNEP atlas developed will not just be a data dump. There are existing tools out there that can do that, using publically-accessible data. APNEP will use a more targeted approach, which will align with ecological indicators. She asked whether there is an atlas already out there that satisfies APNEP's needs. Does APNEP really need their own initiative? Etc. Does any atlas fully fit our needs? Lindsey noted that to help us answer these questions APNEP is creating a implementation work group entitled "decision support tools". APNEP staff has been investigating several options if the partnership wants to develop a web map application. NC-DENR can host the site using their ArcGIS Server, or ArcGIS online, etc.

Lindsey reviewed the various options. The current NC-DENR information technology infrastructure is not in place to support deploying web map applications at the scale APNEP is requesting, and there is no estimated date for implementation. APNEP has started developing an ArcGIS online web map. They do have an organizational account through that site. Using this site could support some data, but users can be directed elsewhere. Other options included

a trial arrangement using the ECU server. That infrastructure is already in place. This would also help provide support for the NC Coastal Atlas. APNEP staff would be responsible for creating and maintaining the web map. This would be potentially a win/win scenario in the near term, until NC-DENR is able to support it.

Lindsey noted that she had just given us an introduction. The Decision Support Tools sub-group, within the broader Policy and Economics Workgroup will be making these decisions. Tom Allen will be convening that group. Lindsey noted that was just in introduction to the issues, and STAC can discuss this later in the meeting.

Reide asked if APNEP is represented on the NC Coastal Atlas group. Yes, Lindsey is the representative.

Kirk noted that there already is a web site, which APNEP can access. Kirk noted that was set up by Chesapeake Environmental Communications staff. The individual who set it up, David Jasinski, had given a presentation to the STAC.

Coordinating Department of Interior Inventory and Monitoring Programs along the South Atlantic Coast, Laurel Barnhill

Wilson introduced Laurel Barnhill, the USFWS Inventory & Monitoring (I&M) Coordinator, who will give a presentation on the USFWS National Wildlife Refuge (NWR) I&M Program. While Laurel supervises the program region-wide, the program has staff currently in only two of the six Landscape Conservation Cooperatives (LCCs) within the Southeast region: the SALCC and the Gulf Coast Prairie LCC. Laurel noted that the impetus for the I&M Program came from the 1999 Fulfilling the Promises report, and the 2011 Conserving the Future report, Recommendation 7. That latter recommendation mandated the institutionalization of a purpose-driven nationally coordinated effort to inventory and monitor wildlife and habitats. Laurel noted that she has been in this position for three years.

Guidance for the program was approved last year. These are contained in Series 701-709, Wildlife-General. These mandate population management at the field stations, and in the Southeast they are considering survey design. They are also thinking about what other data needs there are for the Refuges themselves.

Laurel shared the program guidance and vision.

- A nationally coordinated program of inventory and monitoring on the NWRS
- Collaboration with other Service programs and State, Federal and private partners
- Document the status, assess the condition of, and detect changes in the Refuge's System's diverse fish, wildlife and plant communities, physical resources
- Support scientific-based conservation planning and management at multiple spatial scales.
- The information generated is scientifically credible, relevant, and valued
- Protocols, and standards provide the basis for consistent data collection and data

management Refuge System-wide

Laurel noted that she has a counterpart in each of the USFWS Regions. They all work closely together to ensure that coordination and collaboration take place. They also coordinate with the state and private partners. They work very closely with the LCC technical teams. Another aspect of I&M is to consider scientifically-based planning for Refuges, but also to make sure that the LCC scale, and even the national scale, is considered. Protocols must undergo both external and internal review.

Laurel reviewed the program guidance and goals. They must meet the Refuge System's legal mandate; advance fish and wildlife conservation at the Refuge scale and broader landscape scales; implement monitoring to reduce uncertainty, provide early warning, and guide management actions; document the contributions of the Refuge System within the contact of the larger conservation scale.

Laurel moved to the staffing slide. Laurel noted that when the SALCC was formed, there was a desire to make sure that each LCC was closely integrated with Refuges. This is evident from the map. Laurel and the Southeast I&M data manager are both co-located with the USNPS in Athens, Georgia. Vegetation monitoring was done up and down the coast last summer. Because of budget cuts in hiring, all of USFWS staff are also helping out in Florida.

There is a desire to be consistent at the national level. To that end, they have developed a seven-year plan, covering 2013-2020. There will be an Annual Work Plan, and it has a Southeast Region component. The Southeast plan is tiered off the national plan, and addresses the 19 operational goals or focus areas.

Laurel noted that in the Southeast they are trying to implement consistent protocols. Wendy Stanton has the lead for amphibian monitoring. They decided that they didn't want to reinvent the wheel, so they are using an USNPS protocol, and did a 2013 pilot project to see if it will work well on Roanoke River NWR and Mattamuskeet NWR. The preliminary results look good, having detected 16 amphibian species, two lizards, six snake species and three turtle species. Using an existing protocol can save time. Also, this will enable the merging of USNPS and USFWS data, which hopefully can then be used by the SALCC for their Conservation Blueprint.

Laurel addressed the water resources inventory and monitoring component. The goal here is to provide innovative, relevant, and timely water resources information, assessments, and guidance to refuge staff, regional and national management, and partners to inform refuge management decisions and help meet refuge legal requirements. The task is to develop a coordinated water quality and quantity monitoring system. Laurel noted a dialog has been initiated with the USFWS Ecological Services and Fisheries Programs. They hope to eventually develop a shared database.

Laurel shared information about the implementation of the Southeast Water Resource Inventory and Assessment for the NWR System. This will inventory a standardized set of existing baseline information, including geospatial information. The assessment will identify station-specific water resource needs and issues, and make recommendations for addressing any issues. Laurel noted specific Refuges and other facilities which are being inventoried. She noted that stakeholders will also be involved in this process.

Laurel briefly addressed how all of the resultant data will be stored. She skipped to the presentation slide on data management. The ServCat protocol database for reports is up and running. The Service Catalog is also coordinated with USNPS. Some of the documents that have sensitive information will have restricted access.

Laurel turned to Coastal Marine Systems. The program at the national level has not spent a lot of time on this aspect. The goal here is to collect baseline ecological and environmental data to evaluate potential impacts of climate changes and other stressors on wildlife and their habitats within coastal and marine systems. The focus of this effort is to be able to assess sea-level-rise impacts. She noted that one task here is to evaluate surface elevation. USFWS colleague Nicole Ranking is putting in sediment elevation table (SET) stations on Refuges to use data locally to answer critical questions and adjust management. The SALCC will use these data to run and validate landscape-scale models. This is definitely a collaborative project with other partners, including USNPS.

Laurel turned to the implementation of the Coastal Marine Systems, and several specific tasks. She read the tasks that are supposed to be completed by the national I&M team.

Laurel noted that she would stop at this slide, in view of the time. She asked that Wilson facilitate any questions.

Questions: Reide asked about funding availability. Laurel noted that USFWS headquarters has been good about shielding the designated I&M funding from any cuts. Wilson asked if the I&M Program would welcome involvement and participation by academics, since there are a fair number of them sitting around the table. She indicated that would be very positively received, especially with regard to protocol development.

APNEP Ecosystem Indicators, Dean Carpenter and Wilson Laney

Dean reviewed the APNEP indicator topics he planned to cover. There are three sections: ecological indicator development pre-CCMP, role of indicators to support CCMP, proposed process of indicator refinement and integrated monitoring network and design.

The APNEP mission: "To identify, restore, and protect the significant resources of the Albemarle-Pamlico estuarine system." APNEP must deal with ALL of the significant resources in the A-P ecosystem. Dean provided a "pre-STAC" timeline, and highlighted some significant milestones. APNEP began in 1987. The initial CCMP was completed in 1994. This NEP has

supported monitoring since the beginning, and there was a Monitoring Conference in 2000. Multiple coordinators served with the program prior to Bill's arrival in 2002.

Turning to that portion of the timeline since the formation of the STAC in 2004, Dean noted that Bill had advised him that indicators were one of Dean's tasks, and since he was the only staff person so charged he needed assistance and worked to create the STAC. There was at the time no coordinated or integrated monitoring program.

Dean observed some of the Chesapeake Bay STAC meetings in order to gain some idea of how APNEP's STAC could function, with the recognition that the former operation has the luxury of having multiple staff members just to serve the STAC. APNEP's STAC had their inaugural meeting in July 2004. A workgroup established by STAC executive board member Dr. Doug Rader and Dean developed an initial response indicator list. The first version of the APNEP Indicator framework was developed In April 2005. Six indicator development teams were developed and populated with STAC members and others. An indicator workshop was convened, at Johnston County Community College in Smithfield, NC during August 2005. Dean shared the APNEP Indicator Flow Diagram, which was developed in 2005. He provided an example of an indicator suite from the Living Aquatic Resources team. The workshop was rather intense and a lot of information was assembled. The STAC really worked intensely on indicators in the 2004-2005 interval.

The next step was to create an Indicator Steering Committee, which met in 2006 (August). The ISC had some suggested indicators. STAC member Steve Smutko had gone through the 1994 CCMP and compiled a list of possible questions; also, candidate questions were pulled from the Heinz State of Ecosystems assessment. By December 2007, APNEP had refined lists of indicators. Dean shared the Heinz Core Indicator Questions as adapted to the A-P geography. He showed a refined ecosystem model. He gave an example for Crop Production of how it would be addressed by the model. Dean shared the spreadsheet of A-P indicators and how they link to the regional ecosystem model. There were several associated indicator processes on which APNEP drew on as well. Dean showed us another "low-resolution" APNEP Regional Ecosystem Conceptual Model. The six sub-areas in the model were used to generate the six APNEP natural resource monitoring teams.

Dean turned to 2008-2009 era and the initial work by the monitoring teams. The first team to meet was the Living Aquatic Resources Monitoring Team in February 2008. The idea was to have the planning component for monitoring working in parallel with CCMP development, the latter providing management objectives to guide indicator monitoring design. The Water Resources Monitoring Workshop was held next (STAC member Tim Spruill as team leader); Wetland (STAC member Mark Brinson as team leader), Terrestrial (STAC member Ken Stolte as team leader), Human Dimensions (no leader at the time); and Air (STAC member Robin Dennis as team leader). Dean noted that he wasn't going to dwell on CCMP development, except to note that APNEP lost a key staff member at the time, which slowed down any momentum. APNEP continued to work on the recommended indicators, however, including recommendations for potential monitoring designs. Once APNEP staff decided that developing

a new CCMP was a top priority, however, monitoring developments were placed on hold. APNEP did provide a forum and held a monitoring workshop in 2011, and did provide a format for indicator monitoring proposals: justification for the indicator; what the goal would be for the sampling/monitoring program; existing sampling/monitoring programs, with associated information; enhancements to the program; key references and contacts. That completed the overview of the indicator/monitoring effort up to the development of the new CCMP.

The CCMP has four questions: (1) What is a healthy Albemarle-Pamlico Estuarine System?, (2) What is the status of Albemarle-Pamlico Estuarine System?, (3) What the the biggest threats to Albemarle-Pamlico Estuarine System?, and (4) What actions should be taken that will move us from where we are today to a healthier sounds by 2022?.

Dean also reviewed the seven steps to Ecosystem Based Management (EBM) "enlightenment", and he would address several of them in more depth. Dean shared the Drivers-Pressures-State-Ecosystem Services-Response (DPSER) model, developed by USEPA's Ecological Services Program and explained how it works. Human needs drive various pressures ands drivers, which in turn address ecosystem services and so forth.

Dean had taken the candidate indicators and mapped them onto the new goals. The indicators will be passed to the respective APNEP monitoring teams for evaluation. Dean walked us through the "Native Species" category and noted how the goals related to the habitats and species, within the A-P geography. He has been participating in the ENC-SEVA and SALCC indicator development processes as well. Both start as well with general goals and work their way down to specifics. APNEP is about 80% of the ENC-SEVA, and about 33% of the SALCC geography. All have similar conceptual approaches.

EBM Step 5 is developing a monitoring program. APNEP must develop candidate indicators and link them to CCMP outcomes. APNEP must complete the indicator justifications, goals, list the existing programs, and specify enhancements.

Dean shared some activities that he would like to see completed in the near future: collaborate with APNEP engagement staff to convey the importance of indicators and monitoring in the partnership's mission. APNEP needs to be able to track indicators for long periods and undertake high-quality assessment products. Another is to incorporate where feasible indicators developed under larger geographic initiatives of which the A-P region is a portion. These would include the ENC-SEVA and SALCC. APNEP must propose for each CCMP outcome indicators and targets for interim and mid-term (2022), as well as develop an integrated monitoring program.

Dean displayed the APNEP adaptive management cycle and noted that has been a strong component of the NEP philosophy. Dean noted that the focus on this presentation is in the response indicators. At some point in the future he hopes APNEP can begin to conduct projections of indicators. APNEP been forced for capacity reasons to set aside indicator development and develop the CCMP.

Reide asked if the DPSER model had actually been run for the region. Dean noted that Reide could ask Robin (representing USEPA's Office of Research & Development on the STAC), but he thought that it was generated by USEPA-ORD. Peter noted it was a conceptual model. The program that completed it no longer exists. Bill noted that APNEP staff had hoped that USEPA-ORD's former A-P Watershed Study would provide a major contribution to A-P ecosystem modeling.

Peter asked if some of the candidate indicators have already arrived at a metric, but are not yet implemented, at least not by APNEP.

Rhonda asked about a list of the indicators and metrics, and suggested that in order to be successful APNEP needs to work with the agencies to see what they are monitoring, and be able to collaborate. She noted that she had discussed with Peter during the meeting break about the need for them to meet with Laurel (USFWS) and collaborate on collecting data, which will benefit both parties.

Dean agreed that such collaboration is needed. A lot of the specificity needs to be hammered out. Whereas the SALCC is working on a larger geography, APNEP might be able to enhance their data resolution, and also ask them to perhaps cover some things for APNEP when they are doing their own sampling. APNEP needs to refresh all earlier monitoring proposals to make them current.

Bill Crowell noted that while the CCMP goals are pretty broad, the more detailed environmental outcomes should be kept in mind. APNEP staff wants now to set up implementation workgroups. In the future APNEP will be spending funds primarily on those action steps that are generated by the implementation workgroups. APNEP must consult with the implementation groups not just whether something is an appropriate indicator, but also what is the appropriate indicator. While APNEP staff do not want cooperators to change their programs, they hope that the partners can develop a program to answer the pressing questions.

Reide asked for the time frame on the implementation workgroups, plus whether those groups will develop the indicators. Bill noted the original schedule had workgroup activities commencing in September 2013. Yet maintaining core APNEP staff has been a challenge. When APNEP loses a staff member the loss of capacity means difficulty in keeping activities on track. Bill would like all implementation workgroups designated by this fall. While several of the workgroups are based on existing initiatives, like SAV and Oysters, there isn't existing initiatives to jump start other workgroups.

Dean noted that Bill had mentioned that the implementation actions will be important, yet the ecological response side can be considered independently. Mitigation activities may be considered as part of the steps that can be taken over the near term (next two-to-three years). For example, if there is a CCMP action step to double implementation of best management

practices (BMPs) in a certain watershed, how are they likely to manifest in terms of ecological response? APNEP then needs to monitor and track to see what happens. Dean reviewed the potential outcomes that could result and possible interpretations.

Kirk noted that this is a vitally important concept. Often action is decoupled from monitoring. STAC members must battle to keep monitoring coupled with any actions taken. If there is not some way to monitor to determine whether an outcome is achieved, then there will be problems. Managers can help to guide the process by specifying risk levels. Once APNEP gets down the implementation road and targets aren't being achieved, a reevaluation is in order.

Bill noted that they have tried to make APNEP as politically neutral as possible, and are trying to continue that during the appointment of the implementation teams. Some of the indicators will be dependent on stable funding. NCDMF had been hit by a funding reduction that affects their ability to monitor water quality near coastal recreational areas.

Tim Spruill asked if most of the monitoring to be relied upon is already in place. Some of them are. APNEP eventually will develop a monitoring plan: what is the time frame? Should a monitoring document be expected from each of the natural resource monitoring & assessment groups? Yes. Tim asked what the target is. Bill indicated the goal is to have an integrated monitoring plan within the next three years. Tim noted that someone has to design monitoring sites and was just trying to grasp all of the ramifications.

Dean noted that they will be trying harder to get senior management input on what their objectives are, and then emphasize the importance of monitoring to track progress.

Tim noted that within the A-P region, if impact zones and management goals are identified, then many discussions, with many people should be precipitated. Shouldn't such discussions be done sooner rather than later? There are a whole variety of things which require such deliberation. Dean noted that he too wished to see such discussions transpire sooner rather than later.

Dean noted that where establishing species population objectives are appropriate for evaluating whether an ecosystem is healthy, the scientists will take the first cut at an estimate then seek feedback from managers. Tim noted that APNEP may not get a very good answer.

Bill noted that for beach closure days, clearly fewer are desirable. The monitoring plan, however, would be an APNEP plan, not just a single partner (e.g., NC-DWR) monitoring plan.

Dean noted that Bill will be visiting the Puget Sound Partnership later this year as a member of an NEP review team, and will investigate how they meet these challenges.

Tim noted that the task is going to be daunting for sure. He asked Kirk to share with the STAC what is needed, and what has been the Chesapeake Bay STAC's experience in working with managers. He asked if the Chesapeake Bay Program has ever received anything definitive.

Kirk noted that the original effort was to bring management together and develop the goals. They originally wanted to be able to de-list impaired waters, and also determine their original priorities. The Chesapeake Bay staff has tried to get them to move away from numbers as indicators. This will also help to dissuade the stakeholders that when they reach a certain goal, they are finished. Rather, they want to realize that numbers are not the accountability, but rather the healthy ecosystem. They want to move toward outcomes that are adaptive.

Tim noted that it sounds like the Chesapeake Bay is not adopting numeric endpoints. Kirk stated that they do have some numeric management strategies, to get to the outcomes they want. This approach recognizes the uncertainties in the numbers. Tim stated that it sounds like then numeric endpoints may be established. Monitoring designers must know what it is to be achieved, so some of the existing monitoring networks may not be able to accomplish what is sought by APNEP. Yet APNEP must rely largely on existing monitoring. APNEP will be somewhat constrained by what is needed. The bottom line is that you have to have some fairly specific, quantitative planning to succeed.

Reide noted that Laurel's presentation was encouraging. It is not often that you hear about an agency that is adding capacity. It was also encouraging to hear that USFWS will embrace any ideas regarding how to monitor coastal marine resources. Some of that could ultimately happen through the SALCC as well.

Bob Miller asked if APNEP wants to be in a position to request that the agriculture or forestry sectors to increase BMPs by a certain amount, or to just ask them to increase and let us see if we can detect the changes. How is APNEP going to derive specific amounts?

Tim stated that it almost appears to him as though APNEP will need to do monitoring after-the-fact. APNEP won't be in a position to conduct experiments. Seems to him that APNEP will just be able to identify watersheds where they are putting management measures in place, and then evaluate them later. APNEP must work with what is there, and what is being done.

Dean stated that he views the challenge a little differently, suggesting that APNEP determine ecological targets, whose indicators are co-monitored with significant stressors (e.g., point and non-point resources). With an established baseline a management action is implemented and then the system response is monitored.

Tim suggested that a specific watershed could be selected and then a response could be monitored.

Dean agreed that one must specify what part of the A-P geography should be measured.

Tim noted that many people go from the specific to the general in their planning. Or, you simply monitor, you know what land use practices are in each watershed, then you can compare. It doesn't take a lot of input information.

John McLeod noted that all states don't do things exactly the same. Some jurisdictions may actually be able to run an experiment.

Kirk agreed and noted that APNEP may be able to say what is expected, and if not achieved, then reevaluation follows.

Peter Kalla noted that APNEP should be careful about what is promised to stakeholders.

Tim noted that you really must know the design in advance. You can't accommodate the goal, unless you know your expectations.

Dean agreed and noted that the Monitoring Networks workgroup will be developing some guidelines. Members not a part of that group will be able to comment on their draft product.

Rhonda noted that she has some marching orders from the water quality group at EPA Region IV. Their water quality division chief has suggested some appropriate questions for the group. One of these is whether there are water quality facets that need improvement. If there are, then APNEP needs endpoints. Rhonda noted that one such endpoint for the Tampa Bay NEP was seagrass. Reaching their objective (coverage equal to that in 1947) required them to investigate all factors that are required for seagrass coverage to be improved. They pulled in all of the stakeholders and worked with them to address the objective. In that case, the state of Florida developed nutrient criteria and developed TMDLs, all designed to reach the desired endpoint. She noted that Tampa Bay is much smaller geographically and politically, so they may have had an easier time to address the issue. Rhonda suggested that discussions shouldn't get too wrapped around the axle. The committees should perhaps look at a rough charge for the endpoint, and then see if APNEP has the system that will allow us to measure our progress. Whether APNEP can politically achieve this or not remains to be seen.

Tim assumed that in Tampa Bay there was some sort of turbidity problem. That was the case: clarity was a major factor. Tim noted that end points must be defined. Rhonda agreed and noted that there is an opportunity there as well.

Kirk noted from a cautionary perspective that 20 years from now things can be different, as a consequence of climate change. Rhonda agreed that you do have to have some idea of what conditions are. Tim noted that in actuality it is very complicated. Rhonda noted that even when you have some good things in place other factors can complicate matters, such as in Indian River Lagoon.

Rhonda noted that once a baseline is set, one can begin to investigate what things drive the response.

Tim noted that APNEP should strive to achieve the average level for what stakeholders agree should be the target, rather than shifting the target up and down regularly. This is achievable if

you have an understanding of the target. Rhonda suggested APNEP discuss what the endpoint should be, and how it will be achieved, and bring that back to the STAC. The APNEP Citizens Advisory Committee could be helpful in that regard. Bill and Dean noted that the CEC no longer exists.

Tim noted that some people consider that catching carp is NOT fishing.

Rhonda stated that there is a whole history.

Michael asked if it would be valuable to look at the proposed membership rosters of the implementation workgroups. Dean noted that he didn't have the rosters on hand.

Michael noted that he agreed that APNEP should select a reduced set of activities and try to accomplish them first. It will take a lot more effort to move the entire framework. It is difficult to take a look at something that will fit the entire geography. Furthermore, we need to know what we don't know.

Rhonda noted that in Florida they have different sets of standards in place, both geographically and for different habitats. For example, USEPA gave them a grant to establish tidal creek standards.

Michael noted that tidal creeks are a priority in North Carolina as well.

Bill noted that he had the current list of groups: Policy and Economic, Freshwater Habitats & Fish Passage, Decision Support Tools, Education & Engagement, Water Quality Improvements, Shorelines, Contaminant Management, Invasives, Restoration Strategies, Monitoring Networks, Oysters, Hydrological Flows, SAVs.

Michael noted that for some of these, there are actions that can be addressed readily.

Bill noted that CCMP actions address different points in the adaptive management cycle. APNEP will not begin at the same starting point for all of the groups.

Mike Piehler noted that for the SAV workgroup, APNEP has been a key partner and has put a lot of resources into the SAV Partnership.

Reide noted the importance of conveying the importance of monitoring to both stakeholders including legislators. He asked Lindsey, what is the decision point with regard to an APNEP Atlas. Reide has his own ideas regarding how to proceed. Given the state of NC-DENR today, would APNEP be able to say on the web site what should be expressed? Rhonda noted that was a pertinent consideration. Reide noted that for some of the change rates APNEP might develop for shorelines, SAV, or floodplain maps, might APNEP experience resistance to posting these trends on the site? The Coastal Atlas doesn't cover the entire state, although he would steer the product in that direction, and they seem to be headed in the direction of where

APNEP wants to head. There could be static maps and the ability to put some of these data in a geospatial framework. Also, given the staff issues at APNEP it might be difficult do develop a separate IT staff.

Dean noted that almost as important as what APNEP can't say, is what APNEP can say. Through the atlas layers stakeholders can be provided with current status of metrics. A spatial layer would be a good complement to the indicator/monitoring proposal.

Reide stated that the atlas is important for getting information out there.

Bill stated that so far, the Coastal Atlas is the best atlas. Lindsey noted that NC-DCM is currently funding the coastal atlas. While the atlas is hosted outside of NC-DENR, much of the data comes from there. Discussions are ongoing now about what data layers will be displayed.

Reide noted that the ECU Coastal Atlas has some data out there now that NC-DENR doesn't want there, because NC-DENR is not going to calculate shoreline change.

John McLeod noted that it is also desirable to have the Virginia portions of the A-P watershed added.

Rhonda noted that at some point it could be that not only the Virginia portion of the watershed would be added, but also add the Cape Fear to make the atlas a statewide product.

Robin asked if there is a concern with NC-DENR's loss of monitoring capabilities via budget cuts, and asked if there is anything STAC can support to address that shortfall.

Reide noted that it isn't just NC-DENR.

Peter Kalla suggested that APNEP needs to be careful, because the NC-DENR data won't necessarily answer APNEP questions.

Bill noted that there are all kinds of different monitoring programs, not just NC-DENR. All of the agencies are currently under stress. For example, APNEP is providing a third year of bridge funding to the continuous water quality stations on the Roanoke.

As the meeting was coming to adjournment, Dean thanked Reide for his two years of service as one of the co-chairs. Reide was given a round of applause. Dean noted that he would welcome any member interest in serving as the new co-chair. This meeting wraps up nearly ten years of STAC operations. Rhonda suggested a ten-year celebration at the next meeting. Dean thanked everyone for coming.

Dean at Bill's request noted that two RFPs will be issued. One RFP will support research on governance to determine where the best place is for APNEP to be housed. A second RFP will be to conduct an economic assessment of the A-P region, to get more information on the

ecosystem services aspect. While there is often talk about the cost of mitigation actions, the value of the ecosystem services that our region provides needs to be added to the conversation. He exhorted all to have a safe trip home and have a good early summer.

The meeting adjourned.