

**60th Meeting of the NOAA Science Advisory Board
October 30-31, 2017**

Location: Sheraton Silver Spring Hotel
8777 Georgia Avenue
Silver Spring, Md.

Presentations for this meeting have been posted on the Science Advisory Board (SAB) website:
<http://www.sab.noaa.gov/SABMeetings.aspx>

SAB members in attendance:

Ms. P. Lynn Scarlett, Co-Chief External Affairs Officer, The Nature Conservancy (Chair); Dr. Susan Avery, President Emeritus, Woods Hole Oceanographic Institution; Dr. Michael Donahue, Vice President and Director, Water Resources and Environmental Sciences, AECOM Corporation; Mr. J. Walter Faulconer, President, Faulconer Consulting Group; Dr. Everette Joseph, Director, Atmospheric Science Research Center, University at Albany, State University of New York (SUNY); Ms. Jean May- Brett, STEM Partnership Coordinator, Louisiana Department of Education (ret.); Dr. Richard Moss, Senior Scientist, Joint Global Change Research Institute, Pacific Northwest National Laboratory;; Dr. Denise Reed, University of New Orleans; and Mr. Robert S. Winokur, Consultant (ret. NOAA, Navy)

NOAA senior management and Line Office representatives in attendance:

RDML (ret.USN) Timothy Gallaudet, PhD, Assistant Secretary of Commerce for Oceans and Atmosphere and Acting NOAA Administrator; Mr. Ben Friedman, Deputy Under Secretary for Operations; Mr. Craig McLean, Performing the duties of Chief Scientist and Assistant Administrator, NOAA Office of Oceanic and Atmospheric Research (OAR); Dr. Russell Callender, Assistant Administrator; NOAA National Ocean Service (NOS); Dr. Stephen Volz, Assistant Administrator, National Environmental Satellite, Data and Information Service (NESDIS) Mr. Harry Cikanek, Director, Center for Satellite Applications and Research, NESDIS; Dr. David Detlor, Deputy Director, Office of Science and Technology, NOAA National Marine Fisheries Service (NMFS); Ms. Mary Erickson, Deputy Assistant Administrator,, National Weather Service (NWS); Ms. Nicole LeBoeuf, Deputy Assistant Administrator, National Ocean Service (NOS); Dr. Gary Matlock, Deputy Assistant Administrator for Science, OAR; RADM Michael Silah, Director, Commissioned Officer Corps and Office of Marine and Aviation Operations (OMAO);

Staff for the Science Advisory Board in attendance:

Dr. Cynthia Decker, Executive Director and Designated Federal Officer; Ms. Lynne Mersfelder-Lewis, Acting Designated Federal Officer; Elizabeth Akede; and Ms. Mary Anne Whitcomb

October 30, 2017

Opening Statement of the Chair and Self-Introductions by Science Advisory Board (SAB) Members

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

Lynn Scarlett welcomed everyone to the meeting and recognized the members of the NOAA leadership team that were present. Their presence at the meeting was a testament to both their commitment and the value of work done in SAB meetings. Minor adjustments were made to the meeting's agenda due to a speaker's inability to attend.

SAB Consent Calendar

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

- August 2017 SAB Meeting Minutes
- Working Group Status Reports

Jean May-Brett made a motion to accept the items on the consent calendar; Susan Avery seconded the motion and it passed unanimously.

NOAA Update

RDML Timothy Gallaudet (USN, ret), Assistant Secretary of Commerce for Oceans and Atmosphere and Acting NOAA Administrator

Tim Gallaudet presented on NOAA's current activities and how he envisions the agency moving forward under the current administration. He briefly recounted his recent confirmation hearing and his work with the Senate, which deeply appreciates the important work that NOAA is doing.

21st Century Trends

Technological advancement has been moving at an exponential rate over the past 20 years and will continue to do so over the coming decade. Maritime trade, which NOAA is responsible for supporting, has increased by over 400%. Today, NOAA impacts about one-third of America's Gross Domestic Product (GDP). Much of the information technology aspect of this is supported by undersea infrastructure and by NOAA's mapping mission.

The current administration is heavily focused on America's competitive advantage, which is being challenged across the world. The Department of Commerce's proposed FY2019 budget is a billion dollars less than the FY2018 budget. This is a challenge and Congress is looking to reverse some of the cuts. The administration's priorities are clear: growing the Department of Defense's capability, with offsetting budget cuts at the expense of other departments. This national security imperative must be met. NOAA is a huge contributor to national security and natural resource security, and the agency must explore how to leverage this, such as through partnerships with the Navy. The agency must adapt to this nonlinear change.

Ocean Security Imperatives

In addition to the national security element of NOAA's mission, there is an economic security piece that presents many opportunities. The total ocean industry added-value is expected to double by 2030. NOAA's homeland security mission includes disaster response and support for U.S. Coast Guard partners, who utilize its ocean information to operate safely and effectively. RDML Gallaudet is very proud of what NOAA has accomplished over the last few decades in regard to natural resource security and will continue to work with international partners to promote this. Fish stocks have rebounded significantly since 1990, compared with the rest of the world where around 90% of fish stocks are in some state of degradation or depletion. Many of NOAA's efforts are focused on trying to get the international community to be better stewards of

this resource. Cyber security is another critical element of national security. America's federal networks continue to be under attack and maintaining resilience is necessary to successful operations. NIST has developed the federal government's Cyber Security Framework that serves as the guide for cyber security practices.

NOAA Priorities for 2017-2022

RDML Gallaudet presented the three priorities focusing NOAA's efforts going forward. These priorities will guide decision making around prioritizing budget issues.

1. **Lead the world in earth system observation and weather prediction.** NOAA will maintain its lead in earth observation and will continue to work with other agencies to achieve the world's best weather model.
2. **Minimize impacts from severe weather.** NOAA will attempt to find ways to innovate everything it does. The Weather Research and Forecasting Innovation Act that was signed this year has a number of provisions concerning satellite data and simulation experiments to optimize data collections, research into modeling and observation. The reporting requirements are extensive but it is a great step towards having the best model in the world.
3. **Increase the sustainable economic contributions of our fisheries and oceans.** NOAA will advance all it does in coastal zone management, fisheries management, ocean mapping and exploration, with specific considerations for sustainable contributions to the economy. The Secretary of Commerce is very interested in reducing the approximately \$13 billion seafood trade deficit. Despite the U.S. having one of the world's largest Exclusive Economic Zones, we import about 90% of our seafood. NOAA is currently working to develop a conservation-based aquaculture initiative to address this deficit. NOAA will utilize its capabilities to support the "Blue Economy," specifically towards trade, transportation, offshore energy, and other opportunities.

Critical Ocean Security Enablers

Partnerships will be key in implementing the agency's priorities and achieving its goals. NOAA must accept that the private sector is outpacing the government in innovation and technology. Better research and science will require collaboration with the private sector. There is also potential for revitalizing existing partnerships, such as with the National Oceanographic Partnership Program. In addition to innovating technology, NOAA needs to innovate in its processes and could benefit in this by looking to examples in the private sector. NOAA is going to work on being more responsive in hiring, recruiting, training, and retaining their people.

Transition/Personnel Update

RDML Gallaudet noted there has been concern in the press that this administration does not appreciate science. This is certainly untrue within the Department of Commerce. The Secretary is very keen on data, facts, and science, and knows that NOAA is the gold standard in the federal government for this. He then went on to review the following NOAA personnel

- Mr. Barry Myers, Nominee for Undersecretary for Oceans and Atmosphere and NOAA Administrator
- Dr. Neil Jacobs, Nominee for Assistant Secretary for Environmental Observation and Prediction
- Ms. Julie Roberts, Director of NOAA Communications

- NOAA Corps Vice Admiral Michael Silah, Director of NOAA Corps and Office of Marine and Aviation Operations

Operations Update

RDML Gallaudet commended NOAA for its outstanding work saving lives and property from the impacts of hurricanes this year. On November 10, the Joint Polar Satellite System (JPSS)-1 satellite will launch from Vandenberg Air Force Base, CA and the Geostationary Operational Environmental Satellite (GOES)-S will follow in March. The GOES-16 satellite is moving to take the GOES-EAST position in November and GOES-13 will be moved into storage orbit. NOAA Ship Oregon II celebrated its 50th anniversary this year. NOAA is exceeding its service life for all of its fleet, including aircraft. The fleet recapitalization effort is included in the President's budget.

Organizational Updates

James Ott, National Weather Service, was the second recipient of the Department of Commerce Ron Brown Excellence in Innovation Award. This and other awards demonstrate that NOAA is continually being recognized by the Department and external agencies for the great work it is doing.

RDML Gallaudet called for a round of applause for Ben Friedman's work as Acting NOAA Administrator.

Discussion

Lynn Scarlett asked if NOAA is incorporating its role in coastal system management into its thinking on the second priority of minimizing impacts of severe weather or if NOAA sees that priority more focused on observational systems, information flow, etc. Ms. Scarlett noted that there are a lot of objectives under each of the three priorities and asked if they would be matrixed. RDML Gallaudet said that NOAA leadership has not yet filled out each of the priority objectives; the first goal is to put out budget guidance for 2018. RDML Gallaudet's own thinking is that many of the objectives under each of the priorities will be matrixed across all three; coastal zone management will have contributions to each one. Nicole LeBoeuf said she and Russell Callender will be meeting with RDML Gallaudet to discuss further subgoals for each of the priorities.

Lynn Scarlett asked about the amount of research coming out of the private sector, non-governmental organizations (NGOs), and academia; specifically, if there is a breakdown of research by topical area and therefore a corresponding understanding of which areas have less private sector investment. This may show where there are greater or lesser opportunities for partnerships. RDML Gallaudet said that this knowledge exists. Competition with other countries will be a major driver. NOAA could really benefit from the SAB's advice on this situation and where best to invest its resources.

Susan Avery asked about the agency's sense on the implications of the weather's interface with the climate scale and the emerging science of community-based platforms of weather-climate models. RDML Gallaudet said climate is definitely a part of the severe weather priority and the agency will continue its climate mission. Much of the economy and protection of life and property depends upon advancing our understanding of climate, as well as prediction and

modeling capability. This is a huge part of the agency's priorities and RDML Gallaudet acknowledged the interconnection of climate and weather.

Everette Joseph commented on the importance of impact within the scope of extreme weather. The Weather Service has recognized this in its impact-based decision support strategy which is embedding more with emergency managers. Social science and social science research are required to marry impacts with prediction. If we had had better impact-predicting capabilities, instead of evacuating 1.6 million people in Hurricane Harvey, perhaps it might have been a 30,000 person evacuation. RDML Gallaudet said advancing decision support is critical and weaving social science into considerations to help emergency managers and various economic sectors is something with which the agency needs to move forward.

Walter Faulconer asked for an update on the status of the Commercial Weather Data Pilot Project. RDML Gallaudet deferred to Steve Volz, who said they are continuing to go forward with follow-up to the initial data pilot with next steps of looking not just towards the observations but how they can best be utilized. There are few vendors currently able to deliver, so the Request for Proposals (RFP) has been delayed until March 2018. NESDIS expects to see several launches in the next year, getting more candidate operating systems in orbit. There is just one vendor now providing only a fraction of what they expected to do a year ago. However, it is a healthy project and NESDIS is finding that before NOAA can use commercial partners' data, the agency must understand all of the integrity, latency, and data validation that went into it.

NOAA Chief Scientist Update

Craig McLean, Performing the Duties of NOAA Chief Scientist

Summary

NOAA Responds to the 2017 Atlantic Hurricane Season

NOAA's capabilities have advanced enormously since Hurricanes Andrew (1992) and Katrina (2005). It is remarkable that the models refine a ten-mile zone of where a hurricane will hit, but more can be done. NOAA has only gone halfway through the Hurricane Forecast Improvement Project for intensity. Through the Weather Research and Forecast Improvement Act, Congress has directed the agency to get back to it on its progress.

Before the Storms

Products that were launched this year include storm surge forecasts, which were very successful in informing the public on what to expect and how far inland the storm would intrude. They increased the landfall forecast out to five days and released estimated times of arrival with color-coded risk intensities. These tools orient more towards the social understanding of storms rather than classical meteorological interpretations.

During the Storms

NOAA flew its two P-3 Orions into the storms. The U.S. Air Force has ten C-130s to cover 15% of the hurricane season, while NOAA does the rest with two P-3s. While not wishing to take anything away from the USAF, this discrepancy should be part of the national discussion on public resources. The SAB may be helpful in providing its input.

During the Storm: FV3 Update

During Hurricane Harvey, the performance of the operational Global Forecast System was exceeded by several other systems. The Environmental Modeling Center (EMC) and Geophysical Fluid Dynamics Laboratory (GFDL) versions of the Global Finite Volume Cubed-Sphere Dynamical Core (FV3) model both showed improvements over earlier models.

After the Storm

Immediately after the hurricane, the Sea Grant program launched its network of advisers who were able to locate and recover approximately 10,000 lobster pots that were relocated by the storms, returning the fishing community to work and removing the impact of unattended pots. The Texas Sea Grant Extension donated a crane to pick up boats that had been washed up onto dry land and put them back in the bayou.

After Hurricane Maria, the NOAA Ship Thomas Jefferson went to Puerto Rico to survey and open harbors. NOAA's confidence with their weather forecasts enabled them to send the ship down as the storm passed by. The National Coast and Geodetic Survey flew an OMAO aircraft over the coast taking georeferenced photographs to allow people to see remotely the state of their homes before they had access to the area.

Sea surface temperature gives the signatures that tell us whether there is more heat waiting for the hurricane engine to assume and amplify. NOAA has been able to deploy gliders in and around hurricane environments. The agency should move towards maintaining a line of gliders on constant watch during hurricane season. A Glider Workshop will be held in November to evaluate the 2017 operations and plan for the future.

NOAA Forecast Smoke Transport During Active 2017 Fire Season in the West

A key product that has come out of the delivery of images from the GOES-16 satellite is the ability to monitor the West Coast fire season, forecasting where the chemical products of the fire and firefighting efforts may be distributed downstream. The tools in the hands of forecasters and on-site responders are greatly enhanced, as is their safety, by what is detectable from the satellite imagery. The Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) tool is also used for many other applications around the world, including atmospheric forecasting after the Fukushima event. Due to budget constraints, there is concern about the ability to sustain HYSPLIT as it is part of a lab that would be closed under the proposed budget. The High-Resolution Rapid Refresh (HRRR) Model is able to forecast downstream effect of where smoke may be found and has proven to be very effective.

Climate Adaptation and Mitigation Update

The 29th annual gathering for the Montreal Protocol is coming up, commemorating the successful cooperation of industry and science to find alternatives to Chlorofluorocarbons (CFCs).

The World Health Organization's Greenhouse Gas Release Index is scheduled to be issued November 1. The global average increase from 400 parts per million (ppm) to 403.3 ppm is the most dramatic increase that has been measured.

2017 is on track to be the second warmest year on record. The compression of the first and second warmest years is a trend that continues and is scientifically indisputable.

Health Oceans Update & Resilient Coastal Communities and Economies Update

NOAA partners with the XL Catlin company as a reinsurer. They believe that if the agency could teach people about the sensitivity of the environment, they will be more responsible, which will result in fewer claims. To achieve this end, they have conducted 360 degree photo surveys of the National Marine Sanctuaries to enable virtual sanctuary tours via cell phones.

The Galway Statement, which formulates collaboration between the U.S., Canada, and the European Union (EU), categorizes and defines the areas of the North Atlantic that warrant further mapping. Mapping the world's oceans is something the international community has agreed they should be doing and there is now a prioritization scheme.

The 2017 Our Ocean Conference included significant commitments by governments and private sector interests to protect and improve the state of the ocean. The U.S. is clearly a leader in the commitments and demonstrations/implementations it has made.

New stock status and overfishing limits have been set for 27 Hawaiian reef and bottom fish species as a result of more developed measurement techniques. This provides relief to the fishers as well as a higher degree of confidence on what those forecasts will look like. They have used new autonomous technologies for assessing fish stocks in untrawlable bottoms.

The Campaign to Address Pacific monument Science, Technology and Ocean Needs (CAPSTONE) Project that the Ocean Exploration Program has run for 3.5 years has produced many discoveries and has shown the scale and scope of potential overreliance on satellite measurements.

CSAR: Chief Scientist Annual Report

The report offers several vignettes that describe to the public in understandable ways what NOAA is doing. The latest report should be available in December.

Bibliometrics: Meteorology and Atmosphere

NOAA continues to perform strongly. They are proud of both the number of articles (4044 between 2011-2016) and the quality of the papers (24% of articles in the top 10% of their work from 2011-2016). In the areas of Oceanography and Meteorology for the years 2011-2016, NOAA has the largest number of articles.

Discussion

Susan Avery asked if things like the Oceans Conference or Galway Statement are going to supplant the global discussions that would have otherwise been had at the Intergovernmental Oceanographic Commission (IOC) now that the U.S. is removing itself from the United Nations Environmental, Scientific and Cultural Organization (UNESCO). Craig McLean said that the U.S. withdrawal from UNESCO will not affect NOAA participation with or impact on the IOC. The U.S. needs the IOC as the forum to implement our global ocean observing program, tsunami program, and many others.

Framing the Discussion of “Value of Information” Topic

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

Ben Friedman, Deputy Under Secretary for Operations

A subcommittee met and narrowed the focus of the broader topic of value of information for the purposes of this meeting. A key part of value of information is thinking about valuation and return on investment. Lynn Scarlett noted RDML Gallaudet’s comments regarding the agency’s thinking about value of information in terms of its economic impact, but there are also linkages to national security, relevance and use. In the future, Chair Scarlett hopes to discuss the interface between science and decision-making and the emerging body of work around the sociology of science and how people learn. This is relevant to NOAA in how they work with the communities that are dependent on the agency’s information. Steve Volz said that value of information is the capacity to absorb it and understand it as well. He added that NOAA can do that more effectively and would like to follow up on this topic with the SAB because that is a significant area of improvement that NOAA can gain from if the agency can be more effective in our capacity-building.

Ben Friedman said that communicating the value of what NOAA provides to the public will start with the value of information. NOAA has an enormous impact on the economy, on national security, and on the quality of life, but these are difficult to quantify.

Session 1. Qualification and Documentation of the Value of Information Gathered by NOAA

Overview – *Monica Grasso, NOAA Chief Economist*

Monica Grasso discussed the economic valuation of NOAA products and services to both private and public sectors. Valuation of these products and services is important in order to justify government funding, aligning mission and operations to public value, providing information for the decision-making process, and helping to prioritize investments in observing systems and information policy. The biggest benefit of going through the process of valuation is finding out who you are impacting and how. The Social Science Committee developed three priorities which mirror the SAB’s short-term priorities.

- Priority #1: Economic impact and return on investment
- Priority #2: Decision science and risk communication
- Priority #3: Integrated assessment approach

Dr. Grasso focused her discussion on Priority #1, though they are all linked. The Social Science Committee has a strategic plan that seeks to improve how NOAA communicates the value of what they do, ensuring that the various line offices are working together to collect and manage the information, increasing the quality and consistency of estimates of the economic impact of NOAA’s products and services. The Office of the NOAA Chief Economist is working on the NOAA Economic Impact Report showcasing NOAA’s role in transforming livelihoods, operationalizing businesses, public safety, and boosting the national economy. Draft language will be circulated for clearance soon.

Dr. Grasso then briefly discussed three projects under way: the Cooperative Research and Development Agreements (CRADA) Economic Impact Study, the Economic Value of Marine Vessel Observations, and the Economic Impact of Space Weather. A value of information community of practice was started in 2016, consisting of government agencies with observation programs that generate data. The community of practice has expanded to include the private sector and academia and has been very successful. In October, the Group on Earth Observations (GEO) held a plenary side event, a two-day workshop discussing methodologies for Earth observation and emerging issues. The discussions were very productive. The major outcomes of the workshop include: (1) draft value chain models for Earth observation applications to flooding, harmful algal blooms, extreme temperatures, energy and mineral supply, and transportation; (2) increased visibility of value of information effort with GEO; and (3) the initiation of an international best practices community. Major challenges identified by the workshop include:

- Complexity: multiplicity of timescales, actors, and uses
- Non-linear relationships
- Human behavior
- Establish counterfactuals
- Communicating in basic terms

Discussion

Michael Donahue asked if their valuation processes include evaluating the performance or effectiveness of individual programs and projects to help in the prioritization process. Dr. Grasso said she believed some programs did this at some level and that would be ideal.

Robert Winokur asked how extensive the CRADA database is. He also requested the report on the economic value of the marine vessel observations, which is an issue he grappled with as Co-Chair of the Independent Review Team on the fleet recapitalization plan. Monica Grasso said the CRADA database has information on all agreements concerning who was in agreement and what they developed on the project. It is not extensive but they intend to expand it further to include users and beneficiaries.

Richard Moss asked for clarification on the basic methodology and said it may be helpful to articulate more explicitly that this partly lies in the area of evaluation research.

NMFS Management Strategy Evaluations-*Doug Lipton, NMFS Senior Research Economist*

Doug Lipton presented an example of management strategy evaluation (MSE) and valuing at NOAA using fishery stock assessments. The framework for MSEs includes incorporating the input of the stakeholder community and co-learning as key elements. Mr. Lipton walked through the steps of the MSE for the summer flounder harvest, answering the question of whether updating stock assessments every three years or every seven years would be optimal. The economics of the assessment included revenues, discounting, demand, production costs, producer and consumer welfare, and recreational value. Coming to a valid economic assessment is a very complicated process. The MSE demonstrated a positive net benefit to society from conducting a stock assessment every three years compared to seven years of about \$32 million and that most benefits accrue to commercial downstream firms, final consumers, and recreational fishermen.

MSEs are complex, data-intensive, and time-consuming to build but, once built, scenario analysis is relatively simple and adaptable to answer multiple questions. Because of fishery regulations, the value chain for stock assessments is very tight. In another domain, MSEs may be more difficult.

Discussion

Tim Gallaudet commented that more frequent and better stock assessments will lead to better management decisions and strategies. Dr. Lipton said having more precision in their estimates could result in a greater allowable catch for commercial and recreational fishermen.

Robert Winokur asked how or if the economic models are validated. Dr. Lipton said there are many ways to validate, including withholding data and blindly running simulations to see how well they predict. There is also a peer review process to confirm the best models available.

Michael Donahue asked if there is any consistency in stock assessment evaluation approaches globally. Dr. Lipton said MSEs are being adopted globally. The stock assessment world has several model toolboxes that are used internationally.

Session 2. Better Understanding of the Use of NOAA Information

Donald Boesch, Professor, University of Maryland Center for Environmental Science
H. Eddie Hicks, Director, Morgan County (AL) Emergency Management Agency

Speakers were provided with three guiding questions to help structure their discussions with the SAB: (1) How does NOAA information benefit you in your work? (2) How do you access NOAA information? and (3) What other information streams do you use and why?

Discussion of Better Understanding of the Use and Communication of NOAA Information
Donald Boesch, Professor, University of Maryland Center for Environmental Science

Donald Boesch said that, after conferring with some of his colleagues who work on the cutting edge of fishery science, he gained a very positive view of the essential nature of NOAA's information and what it provides on living resources of the oceans. Long-term missions, however, can lead to an inertia that is difficult to disrupt. New technologies are coming out that help us better understand stocks and the dynamics of things that could be brought in to modernize the information that's provided. Personal relationships are sometimes necessary in order to get the information that scientists want. There is great respect and support for the broader-scale survey work NOAA Fisheries does and some concern that there may be some reduction of investment in those areas. They do find that there is less information on extraction itself than is needed. In general, there is good information sharing between NOAA and the states but state clients often want more specificity. Important interfaces to making information valuable locally are public universities and programs such as Sea Grant. Retirements of experts in federal service is going to be a major staffing challenge in the next decade. This is also an opportunity to work with universities to think about training.

Managing coastal zone areas such as the Gulf of Mexico is not just a challenge for NOAA but for the whole federal government. This has been handled in a piecemeal way, cobbling together resources to make environmental observations. The Chesapeake Bay has been a more positive

story with better coordination, perhaps because of the smaller scale, so it may offer valuable lessons.

People are very dependent on NOAA information for weather and coastal hazards, and NOAA forecasts are critical to preparation. Weather is a small part of climate and many are concerned that NOAA will be under pressure to lower its emphasis on the longer-term picture, one that is changing and will need to be incorporated. The capabilities of the National Climate Data Center need to be protected and enhanced – it is a precious international resource and politics should not interfere with that. Considering who the end users of NOAA’s products are would be useful for scale and functionality, as some local governments have more technical capabilities than others. Overestimating the dangers of climate change is also a problem and NOAA needs to get better at giving people a realistic idea of what to expect. As part of its mission in the National Climate Assessment, NOAA has developed and refined scenario projections for sea level rise. The ranges given for these projections are so broad that the public may get the message that NOAA really does not have a clue. They also neglect to couple sources adequately as to how the agency arrives at the forecasted scenarios. The assessments do not make clear that the high ends of the projections are not a matter of fact, but of choice. Adaptation and mitigation scenarios should be included.

Bringing the long-term view into restoration efforts is critical. One NOAA-specific issue is the conflict between responsibilities. A more rational approach to responsibility and information is needed.

Dr. Boesch recounted his experiences working on the Deepwater Horizon oil spill response. NOAA should be looking at lessons learned from the spill and how to respond in a better way in case of future events.

Discussion

Lynn Scarlett asked for more information on the challenges of the piecemeal effort in information gathering in the Gulf of Mexico and what better agency coordination would look like. Dr. Boesch said task forces have been established for specific areas, such as hypoxia, using collaborative voluntary efforts rather than mandates. There is an objective that the states agree to do but, if you can’t measure the end-point metric, it is a problem. They need to get to the point of allocating load reductions by state or by tributary in the upper river. NOAA’s responsibility does not extend to Iowa’s farm policy, but they do have a stewardship responsibility for the Gulf of Mexico. There has not been much support on addressing these inland questions.

Mary Erickson said the Hypoxia Task Force has been doing great work connecting the issues of middle America to Gulf water quality issues. Stakeholders are more willing to sacrifice if they see a return, which is why data is so critical.

Craig McLean asked about the completeness of data and if it is of sufficient resolution for inshore needs versus offshore. He also said that the computability problems go beyond the interpretation of the uncoordinated regulations because the laws are drafted to address specific issues. In Alaska, the federal community works together very well because they have to in order to survive. This could be modeled as a preferred practice. Interagency constructs in the federal government also have the challenge that no one is in charge. From an ocean policy perspective,

somewhere along the line there has to be a jurisdictional basis rather than confusing, overlapping laws. Dr. Boesch thought that might be correct. Given the size and complexity of our government, it falls on senior leadership through a National Oceans Council mechanism to work towards that ideal, in lieu of one responsible agency.

Tim Gallaudet responded to some of the points Dr. Boesch raised in his presentation. He said the Secretary values climate data immensely and this is rolled into the second NOAA priority. Addressing the mix of onerous regulations that sometimes contradict one another is a top priority for the NOAA leadership team. Paul Doremus has put together a Draft National Aquaculture Plan in which NOAA seeks to oversee and streamline the whole regulatory framework. RDML Gallaudet appreciates the need to think about user needs at various levels.

Lynn Scarlett commented on the role of precursor analysis, looking at event trees wherein minor events could lead to a much larger problem if they occur in a certain sequence. The problem is often not just data access but whether the question is framed appropriately. She also commented that this presentation may offer insights on where changes in governance and regulation could yield greater efficiency and effectiveness. RDML Gallaudet encouraged the SAB to make recommendations about how NOAA leadership can make the most effective decisions.

Discussion of Better Understanding of the Use and Communication of NOAA Information *H. Eddie Hicks, Director, Morgan County (AL) Emergency Management Agency*

Eddie Hicks focused his presentation on event response at the local level, state emergency management offices and the information they have access to and how it is utilized. None of the emergency management offices around the country are created equal. Emergency managers are also assessing the value of information because Congress always wants to know the return on investment from the allocations they give to state emergency management. They have had to use anecdotal evidence to justify their allocations and many would like to work it out numerically.

The forecast is one of the most crucial pieces of information emergency managers need. They don't need to know why a weather event is happening, but they need to understand what is happening and what the threats are. The National Weather Service's IDSS (Information and Decision Support Service) is very important because it is the interface between the local emergency management office and the Weather Service on interpreting changeable conditions.

Information is accessed through websites primarily. Alabama has a radio network that allows emergency managers to access forecasters directly, which is a very useful way to communicate. When more information is needed than what is available, NOAA has been a great partner in providing it. There is a lot of information that NOAA offers that may be useful, but emergency managers do not have time to look for it. Most emergency management offices do not depend entirely on information from NOAA. They pay for other sources in order to get a second opinion or clarification on the information that is coming through. But the National Weather Service has to be the official source of information.

Discussion

Everette Joseph asked where Mr. Hicks thought IDSS should go in the future. Mr. Hicks said he doesn't need an NWS meteorologist embedded in his office, but he does need the ability to

converse with and get information from them. More nuanced tools that predict impact would be helpful, as would incorporating social science into messaging.

Mary Erickson asked for thoughts on the agency's effort to make its products fit a flexible timetable. Mr. Hicks said it is hard to predetermine what IDSS actions you need for unexpected situations. Emergency managers need to be flexible, based on the needs out in the field. Dynamic interfaces and direct communication are more useful in this respect than schedules.

Susan Avery asked if NOAA spends too much time on processes instead of system science. Dr. Boesch said we need programs of science that are more directed to needs, outcomes, and solutions, but that allow for some investments in creativity for breaking open new ground - getting scientists trained to work in an environment where they can provide useful information but not be so prescriptive that you lose creativity. The current generation of graduate students is much more attuned to thinking and working in this way.

Lynn Scarlett said the work of Rick Spinrad on the research portfolio was in part about this balancing act and she asked about NOAA's current approach to this. Craig McLean said the CI21 (Cooperative Institute 21st Century) review was left as a prospectus and is now in need of application. NOAA has not yet mastered when, where, and how to use the best tools as opposed to the most convenient tools. Because NOAA is treated as though it doesn't have a two-year appropriation, there is an incentive to move money quickly which doesn't provide the agency with the time and latitude to do the fullest and richest degree of work it would like program managers to do. Tim Gallaudet said he looks forward to discussions on research policy with respect to the division of labor and percentage of dedicated resources toward foundational research versus practical application of the science. They both have merit and NOAA needs to be deliberate about applying its resources. Dr. Boesch said that the Navy's Office of Naval Research (ONR) had frameworks for this; its investments for practical use in defense of the nation have led to broad latitude for program managers to investigate fundamental questions.

Mary Erickson said the Weather Service is working on a strategic human capital plan. They want to see a demonstration of interdisciplinary understanding in future workforce. Denise Reed added that being able to understand and communicate is an essential quality for future scientists.

Next Steps on "Value of Information" Topic

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

Lynn Scarlett opened the floor for additional thoughts on the topic of the value of information and potential next steps. She added as a caveat that "value of information" is being used as a label for some very disparate elements. There have been emergent efforts around scientists working with communities to co-frame problem sets which then inform the information and tools generated, as well as how the information is communicated. Members generally agreed that decision-making is a very rich area to pursue.

Tim Gallaudet said one other thread is not just promoting various sectors of the economy but potentially creating or expanding specific industries.

Ben Friedman noted that value of information was an interim topic while NOAA leadership was put in place and would defer to RDML Gallaudet as to where the SAB should go with it in attempting to be most useful to NOAA.

Richard Moss said the SAB may want to continue this discussion in the broader context of emerging scientific advice for NOAA. Economic valuation is only part of a much broader field of evaluation of environmental programs. If the SAB continues with this topic, it should be reframed in a way that is not focused solely on economics. The question of diffusion of innovation is a valuable idea that ties into several threads the SAB discussed.

Denise Reed said this was not meant to be a long-term effort and was not sure it should be continued just because they have more ideas. An unanswered question for her was how the agency learns as an agency and reflecting on whether NOAA is doing the right kind of science to inform what is needed.

The conversation may have set up some important issues that may be helpful in formulating a SAB two-year work plan.

Lynn Scarlett intends to meet with NOAA leadership to further discuss the NOAA priorities and will report back to the SAB with themes of interest. RDML Gallaudet thought that would be a great way to move forward and encouraged the SAB to focus its efforts on the priorities he presented.

Craig McLean said the value of information discussion has been a useful exercise and something to take away from the presentations is a series of directions that could give a renewed way of looking at the value of NOAA's research. He asked why it takes so long to amend the way NOAA communicates its forecasts, quotas, or information products when it is clear that it is not what the public is looking for. NOAA needs to remind itself that it is a public-serving agency.

Discussion with RDML Tim Gallaudet

Since RDML Gallaudet would not be available to attend the next morning's presentations, Lynn Scarlett asked if he had any thoughts to share or if any members had further questions for him.

Tim Gallaudet said the CAPSTONE project is an area with wide-open potential for applications to the economy and benefit to the nation.

Mike Donahue noted that the three priorities did not list subtopics and asked if that is something NOAA will fill in or if the agency would like ideas from the SAB. RDML Gallaudet said they are open to ideas. Items the SAB has considered before may need to now be examined further or refocused under these lenses. He mentioned the report on data science as something that could be expanded.

Walter Faulconer asked if there is still a focus on international partnerships and how important they are in NOAA's plans. RDML Gallaudet said it is very important but they have to be partnerships where the U.S. gains. Sometimes it is okay to give more than we get in order to build capacity, but the current administration is keen on gaining competitive advantage. In his experience in the Navy, he got the most out of his bilateral relationships, while multilateral relationships were less rewarding.

Robert Winokur observed that there is a lot that NOAA can do to minimize impacts from severe weather, but there is a lot here for which NOAA is not responsible. Those variables have to be separated into what NOAA can control within its budget and domain. RDML Gallaudet understood this, but optimizing what the agency can do is very important. Using the Weather Act as the template can help focus the effort.

Susan Avery asked about the Space Weather bill moving through Congress and if severe weather includes severe space weather. RDML Gallaudet said space weather is not a part of the Weather Act but he is attuned to the need to advance NOAA's space weather capability. Mary Erickson said significant progress has been made in the area of space weather and it would be unfortunate to pull back now.

Harry Cikanek said useful lines of inquiry for SAB may be how to extract useful information from sensors and observing systems that are collecting much larger volumes of data than ever before. He added the importance of the intersection across multiple disciplines so that information is useful to other applications and systems.

Nicole LeBoeuf said she met with the Integrated Ocean Observing System (IOOS) Advisory Committee and asked them how they would advise NOAA to take advantage of big data and new intersections of knowledge. They are writing up recommendations to NOAA now. Bodies such as this can be very helpful in advising on what end users want. Lynn Scarlett said a presentation on this topic might be useful for the SAB.

Mary Erickson commented that NOAA had excellent forecasts for the April 2011 storms that Mr. Hicks mentioned but hundreds of people still died. NOAA's mission is to save lives and property and the agency needs to reconsider how it builds relationships in order to communicate better and to develop products that achieve that mission.

Richard Moss commented on how far decision support has come since the 2014 National Climate Assessment. NOAA is among the leaders in thinking about decision support. Looking at the kinds of products that are now available on the Climate Resilience Toolkit, for example, there are some really innovative things that are there but he does not think there is full understanding of how well they work. It needs to be made clearer which tools are appropriate for which kinds of problems. Evaluation of the tools might be interesting to hear more about. Everette Joseph said NOAA needs fundamental research on how emergency managers make decisions before they build tools.

Public Comment

There was no public comment.

October 31, 2017

Welcome

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

Lynn Scarlett welcomed everyone to the second day of the meeting.

Discussion of SAB Next Steps on Short-Term Topics

Lynn Scarlett, The Nature Conservancy and Chair, NOAA SAB

Lynn Scarlett led off this discussion with some initial thoughts to get the group thinking. With new NOAA leadership coming on board, the SAB is well-positioned to develop its two-year work plan. There are two questions for the SAB to consider while developing the plan: (1) what will be the content of SAB's focus and (2) what will be the process to develop the plan? There are several sub elements under content: one is whether, how, and with what focus the SAB should, or might continue some of that "blue sky" exercise, the looking ahead for NOAA, drawing in external expertise. The experts may not be specifically linked to NOAA's universe but may be engaged in technological or other scientific innovations that might be relevant to NOAA's thinking about its own ways of operating the technologies. This includes things like emergent technologies, issues of translating data into knowledge, and useable knowledge. Other areas of interest for this expertise include big data and all of the observing system information that's being generated.

There may also be some insight and expertise that give the SAB a look at newly identified global changes that may be highly relevant to NOAA and NOAA's ability to fulfill its mission. The second is really more the centerpiece of a work plan, that is, what is it the SAB should do, can do, would provide knowledge to inform and assist the top three priorities that RDML Gallaudet laid out yesterday for NOAA?

Ms. Scarlett then went on to mention a few topics that came up in that discussion or from RDML Gallaudet.

Some examples of topics:

- Blue Economy, both in terms of sustainable aquaculture and growing knowledge bases
- Earth observing systems and observations-linkages across observing systems and usefulness of data-
- Intersection between weather and climate—how well are they interlinked and is there something that could be done in a better way..?
- Risk reduction and high intensity storms and natural disasters could be considered as well as the corresponding restoration activities.
- Sustainable restoration—what is it?

The third sub-element includes "enablers":

Is there any role for the SAB in helping NOAA think about and consider those enablers? In the course of our discussion several were mentioned including workforce planning. At one level workforce planning can be an extraordinarily administrative-like effort; however at another level, workforce planning that has a look ahead is an extraordinarily strategic enterprise. Given what the world looks like, and given NOAA's mission, what is the kind of expertise we need? Do we have it internally or do we contract and buy the expertise from others.

Doing that kind of exercise does involve really understanding big trends. What does the world look like and how do those trends interface with NOAA? Some trends to examine may include:

- Workforce Planning- What are other science agencies doing in this field and how could NOAA benefit?

Decision Support Tools- There is an explosion of decision support tools being developed by NOAA and by others including those relevant to NOAA's mission, coastal resilience and risk reduction, What are best practices?

Scenarios and their use in the context of probabilities. This issue was raised by Everette as it related to forecasting and, the value of ensembles, for example.

So, there's that whole realm, and is there a role for the Science Advisory Board? Maybe, maybe not, of looking deeper at what's out there? What's useful? What isn't useful? And not just any old decision support tools, but those that seem particularly relevant, or being generated in the context of NOAA's mission. So, that's a second enabler.

The third enabler that came up in various different ways, but I think Don Boesch mentioned it in particular, was that of data accessibility. But more than just, oh, can I push a button and find it on the Web? Or, you know, is it somewhere?

But really are there scale issues and sort of commensurateness challenges between let's say, local and state information, and federally generated information? And if you need both, how do you bring them together?

Chair Scarlett discussed the process for development of the work plan. One suggestion toward drafting a plan: that she meet with NOAA leadership to get a deeper dive on the priorities, take that information coupled with the discussion the SAB has had here and in earlier contexts, and put together a straw man outline to be circulated to members for feedback. Another option is that a small working group will convene to develop a draft plan with further discussion at a subsequent SAB meeting. On process is a discussion about work products. Some products might be along the lines of blue sky efforts that resulted in a short summary of the issue for NOAA; food for thought

But others, and we didn't do much of this in the last couple of years, may actually merit a bigger product of some sort; not an encyclopedia, but something a little more substantive. There is also the question of roles and responsibilities. One key issue that has been before us is, you know, how to better link to and utilize the working groups?

When we think about products is there some product, perhaps one of a bit greater -- requiring a bit greater inquiry that we could turn to the working group and ask them to take it up and report back to the SAB. So that there's a tighter linkage between what the working groups are doing and what we're doing.

When thinking about the process, it includes thinking about sequence, thinking about products, thinking about potential roles and responsibilities, coordination with the working groups.

Denise Reed discussed the topic of large-scale ecosystem restoration as an area for the SAB to take up. There is dialogue among scientists involved in large-scale ecosystem restoration efforts about how to bring science to bear in a way which is system-level and relevant to the outcomes that society is looking for from those systems. There are many scientific issues that are not

difficult to conceptualize but are very challenging to be quantitative about. Another relevant discussion was raised about coastal flooding, not just as it relates to tropical storms, but as an interface of riverine flooding, sea level rise, or backwater effects. Other issues raised included how to provide sustainable protection for coastal communities and natural and nature-based infrastructure. These are areas where the science is not as mature as we would like it to be, but they are areas central to NOAA's activities. It would be good if the SAB could fertilize the agency's way of thinking and also provide some consensus thoughts on where science might go or how potential discretionary investments could be used.

Michael Donahue agreed with Dr. Reed's remarks and thought the SAB could add value to the notion of doing a scientific, objective analysis on the benefits of large-scale ecosystem restoration. In the case of the Great Lakes Restoration Initiative, there has been very little focus on individual programs and projects and what benefits they provide. Resilience is also an important issue for consideration. He noted that implementing programs and projects that restore coastal ecosystems but are only good until the next big storm are perhaps a waste of money.

Craig McLean pointed out that some of the items mentioned are not in NOAA's jurisdictional domain. The SAB could be very helpful in identifying where interagency bridges could be built at the program manager level.

Russell Callender agreed with Dr. Reed's suggestion as well as Dr. Donahue's about "building smarter" on the coast. NOAA had some restoration efforts in Puerto Rico that were destroyed by Hurricane Maria. The agency has offered to re-restore, what was already restored. So, how can this be done better in a way that supports the economy? How could rebuilding on the coast in a more intelligent way support an infrastructure initiative, if it is ever proposed by the administration?

Susan Avery suggested expanding the discussion of ecosystems to include cities. Also included in the conversation about restoration is the question of what needs to be let go. Consideration should be given to whether an ecosystem can be restored in a cost-effective way that has the benefit that you want to achieve. Denise Reed provided reassurance that such thinking is central with restoration planning. While we use the term "restoration" it rarely means putting something back to its original state.

Lynn Scarlett said large-scale ecosystem restoration cuts across science considerations, significant governance questions, engineering considerations and finance considerations, among others. She asked where the SAB could provide the most value to the conversation. Taking the issue from broad concept into detail and quantification may be one way.

Harry Cikanek suggested some topics to consider:

--The increasing need for cross-discipline coupling, including in models. What are the best ways achieve this goal in terms of how it is best done from a resource, staffing and organization perspectives?

--The need anticipate big changes are coming way down the road in terms of computing technology, data and analytic methods.

--How to best use technologies coming along such as the Internet of Things as well as smart devices that are going to be out there: what kind of data are they going to collect, and what NOAA could do with it.

--Citizen science has become more popular since many people have smart devices. How good are those measurements and how can NOAA use them effectively e.-Other emerging topics are business model revolutions and procuring and using potential commercial sources of satellite data as Steve Volz mentioned yesterday.

Those are some the blue sky topics that the SAB might consider.

Susan Avery said the SAB needs to hear about and weigh in on the Decadal Survey for Earth Science and Applications from Space that will be released soon. The SAB should hear about a an independent review of NESDIS that was completed recently and the implications that this proposed budget has in terms of sustaining weather observations would be useful. Another thing being discussed is a National Academy decadal study for the weather enterprise; Amanda Staudt would be a good person to hear from on that.

Craig McLean noted that the NOAA representatives at the table do not know everything about NOAA programs. He suggested the SAB help NOAA find new ways of answering the same science questions in a new way. The SAB could also help identify earth observation communities whose needs aren't addressed by the current constellation of satellites. As a result, they build from the bottom up as opposed to finding what is already available. Another potentially helpful area would be guiding NOAA to where additional opportunities exist to bring modelers and observers together. Robert Winokur suggested the SAB get briefings from its own working groups at future meetings with the opportunity for one-on-one discussions. The working groups are already addressing a lot of issues of interest to NOAA. He also suggested the SAB can serve as a sounding board for NOAA leadership at whatever level on any topics or studies they would like to move forward. A specific one of particular interest to him is to be a sounding board for the five studies that Monica Grasso's office is undertaking as they move forward. He suggested reviewing what other agencies, such as the Department of Defense (DoD), are doing with respect to innovation offices and decision support systems.

Richard Moss added some specific thoughts to Dr. Reed's suggestion. He also wanted to include incorporating input from working groups into Chair Scarlett's outline. The Board could rely on working group liaisons to share information between the SAB and the working groups.

Whether it is restoration on a large scale, or it is our trying to deal with developing the next harmful algal bloom forecast, there is extreme difficulty in coming to grips with the questions: what does that overlapping intersection and integration look like and how is it accomplished.

Since NOAA is a mission-oriented agency that uses science to accomplish the mission, a suggestion for the SAB would be to focus on forecasts. This is a tool that brings together that many disciplines but about which we know little in terms of accomplishing the societal objectives for which they are done.

Walter Faulconer commented that the priorities listed by RDML Gallaudet needed metrics associated with them. He commented on the importance of being proactive in working with the commercial community. The SAB should consider the national security aspect of NOAA.

David Detlor said that Fisheries is using social demographic and fisheries data to develop community social vulnerability indicators. There is still a long way to go for these communities to use it for large-scale restoration. There is a dearth of social scientists in Fisheries and across NOAA itself. It would be helpful if the SAB could point to trends in restoration projects where NOAA needs indicators of what they hope to achieve in order to get a return on investments. NOAA is also considering support of fellowship programs for training the next generation of social scientists.

Susan Avery expressed concern about the wording of the first priority since NASA thinks it leads the world in earth systems observation and it is not the only agency that does this.

Honoring Past SAB Chair and Current ESMWG Co-Chair David Fluharty

Ben Friedman, Deputy Under Secretary for Operations

Ben Friedman reviewed David Fluharty's accomplishments and the value he brought to the SAB. He highlighted a letter from Dr. Fluharty to then-Administrator Lautenbacher about the need to focus on ocean acidification when it was just an emerging issue. Spotting important trends that NOAA needs to focus on is exactly what the SAB should be doing. Dr. Fluharty's wealth of experience and insight has helped strengthen NOAA's programs and benefitted multiple NOAA Administrators through more than 12 years of service. Mr. Friedman thanked him on behalf of NOAA and looks forward to continued engagement.

David Fluharty made comments on his time served and the importance of making room for younger people. The SAB can make a huge difference in what NOAA does. The SAB has undertaken two studies on social sciences within NOAA and it is probably time to revisit that subject with some new ideas and opportunities in mind.

Discussion of SAB Review of Indigenous and Local Ecological Knowledge

John Armor, Director, Office of National Marine Sanctuaries, NOAA

Summary

John Armor discussed NOAA's response to the SAB's recommendations on indigenous and local ecological knowledge (ILEK). NOAA commended the SAB for taking on this important issue and pointed out the agency could improve how it integrates ILEK into various programs and processes. The most effective way to do this is by encouraging and empowering existing programs to adopt these principles regionally. Mr. Armor reviewed the SAB's recommendations. After discussions with OAR and other parts of the agency, Mr. Armor and Cisco Werner, NMFS Chief Science Advisor, felt a strategy or guidance document implemented regionally through existing NOAA programs would be a more effective approach. They felt the most effective funding mechanism would be through existing funding lines in the NOAA budget. Funding provided by other sources to gather, track, and manage information would be useful for NRDA.

ILEK's integration into resource management can be achieved via Management Strategy Evaluation (MSE). The Sea Grant's network visioning project touches on many of the foundational principles the SAB advised NOAA to explore, taking what is known in indigenous and local communities and infusing them into NOAA's various decision making processes.

NOAA researchers and managers would benefit more from a handbook than a policy and the use of a website may be considered in the future. Regional workshops covering specific programs would also be useful. These would need to be conducted with permission, guidance, and participation of ILEK holders.

Discussion

Russell Callender commented that some of the organizations where ILEK would be a natural fit are programs that are not supported well by the administration. NOAA needs to think creatively about how to get a program like this moving.

David Detlor said that one aspect of ILEK in integration with MSEs is developing a list of contacts of people with regional knowledge in areas that would be helpful in designing surveys. Mary Erickson said NOAA Regional Teams may be a way to infuse or share this database.

Gary Matlock said that one of the strengths of the Sea Grant program is the combination of research, extension, and education. The ability to approach an issue like ILEK from within local communities and bring that information to bear on research, education, and decision making is a power that already exists within NOAA. Russell Callender said PRiMO (Pacific Risk Management 'Ohana) is another avenue for bringing this into the discussion between NOAA and its partners on the challenge of resiliency in the Pacific.

Susan Avery said there are several other place-based programs within NOAA, such as the Regional Integrated Sciences and Assessments (RISAs), where you could really push this idea. Craig McLean said that RISAs are not currently funded to go any farther than where they are today, despite significant potential.

Brooke Carney said that the upcoming regional workshops that Sea Grant is hosting would be a great opportunity for NOAA regional people to participate and let these ideas marinate.

Jean May-Brett suggested encouraging the Bay Watershed Education and Training (B-WET) grant program to include something on ILEK.

Denise Reed asked about next steps for the handbook. Mr. Armor said they would take that up internally and determine who the right person is to draft something.

Michael Donahue asked for a sense of timeline for any of these discussion items and things that NOAA is committing to do to follow-up on the report recommendations. John Armor responded that what NOAA is hoping for is first to have this discussion and then he, Cisco Werner and Gary Matlock would go back as the NOS, NMFS and OAR representatives to the ESMWG to develop a timeline. Dr. Donahue said that would be a good agenda item for a future SAB meeting is to get a report on the implementation of the recommendations and timeline for them.

Craig McLean suggested as part of work plan, to include considerations whether the timeliness of NOAA's response to the SAB's recommendations is appropriate or if there are better ways.

Review of Actions

Cynthia J. Decker, Executive Director, SAB and Designated Federal Official

Cynthia Decker said that she was not aware of any actions from the previous day.

Lynn Scarlett will work with the NOAA leadership and SAB members to develop a straw man outline for a biennial work plan, send it out to the members for comment, and then ask for a small group of members to further refine it.

NMFS and NOS will follow up with the SAB on the ILEK handbook recommendations and next steps with timeline on ILEK at a future meeting.

Cynthia Decker said the documents being discussed will be posted on the SAB website. Denise Reed asked for a review of scheduled meetings and webinars coming up. Cynthia Decker said a winter teleconference will probably be scheduled for late-January/early-February and the next in-person meeting will be April 9-10, 2018. Lynn Scarlett will work with Cynthia Decker to arrange an interim teleconference meeting before the April meeting.

The meeting was adjourned at 11:30 a.m.