

# NOAA NCCOS Biogeography Branch Program Review

---

*July 23–35, 2019*

## Panel Members

- Captain Rick Brennan, Chief
  - National Oceanic and Atmospheric Administration (NOAA), Office of Coast Survey, Hydrographic Survey Division
- Dr. Caroline Rogers, Marine Ecologist
  - US Geological Survey (USGS), Wetland and Aquatic Research Center
- Dr. Brad J. Blythe, Chief
  - Bureau of Ocean Energy Management (BOEM), Biological and Social Sciences Branch
- Katrina Lassiter, Asst. Division Manager
  - Washington State Department of Natural Resources, Aquatic Resources Division
- Jeff Donze, Team Lead
  - Environmental Systems Research Institute (ESRI), National Government Sciences Atmospheric & Environment

## Purpose of the Review

NOAA requires external peer reviews of its research and development programs on a periodic basis. Such reviews can play a key role in program planning, management, and oversight by providing feedback on both program design and execution. NCCOS is further interested in evaluation of its information products and their delivery to users, and engagement with stakeholders. For this review, the review panel:

1. Assessed NCCOS' role as a Federal entity to analyze and improve ecological and biogeographic assessments, apply new mapping and modeling technologies, and develop information products for prudent and time-sensitive decisionmaking
2. Evaluated NCCOS' role in engaging stakeholders and delivering practicable research products, data, and information
3. Appraised NCCOS management for funding pre-eminent research and fostering interagency partnerships that produce actionable results, engaging stakeholders and transitioning its products and services for the management of coastal and marine resources
4. Offered observations and made recommendations to better position NCCOS for improving its habitat mapping and biogeographic assessments, including modeling

## Program Evaluation Criteria

Following enactment of the Government Performance and Results Act (GPRA) in 1993, the National Academies' Committee on Science, Engineering, and Public Policy produced a report on the unique purpose of Federal research programs and inherent challenges in their evaluation. The committee concluded that Federal research programs could be evaluated using three criteria—quality, relevance,

and leadership—and noted that such evaluations should consider factors beyond peer review of research publications by scholars in the field (National Academy of Sciences, 2001).

In its 2008 *Guide to the Program Assessment Rating Tool (PART)* and citing the National Academies report, the US Office of Management and Budget (OMB) identified relevance, performance, and quality as criteria that can be used to assess the effectiveness of Federal research and development (R&D) programs. This approach was further endorsed in a 2008 National Research Council (NRC) report, which stated that research program efficiency must be evaluated in the context of relevance, effectiveness, and quality.

NOAA, through Administrative Order NAO 216-115A, dated October 3, 2016, and its previous editions, has adopted Quality, Relevance, and Performance as core evaluation criteria. The NAO also calls for a periodic evaluation of research, development, and transition activities, as well as outreach efforts and stakeholder engagement.

In the context of this review, these criteria may be described in the following terms:

**Quality** is a measure of soundness, accuracy, and reproducibility of a specific body of research. It is the most widely and traditionally used criterion evaluated by peer review committees. In general, it refers to the merits of R&D within the scientific community—research publications, awards, innovations, and patents—and implies adherence to values of objectivity, fairness, and accountability. It also requires evidence of established procedures for competitive, merit-based research funding and scientific integrity.

**Relevance** refers to the value and significance of the NCCOS / MSE portfolio to NOAA’s mission, and the benefits of related products and services to stakeholders and broader society. OMB refers to relevance as the “impact” of a program, i.e., the measurable analysis of how NCCOS products and services accrued societal benefits, and who uses the products and how. In essence, relevance asks, “What would not have happened if NCCOS did not exist, and how much would society have missed?” During a review, program personnel identify public benefits of the program, including added benefits beyond those of any similar effort that has been by others.

Benefits include increasingly more skillful and reliable program output, technology, or methodology that satisfies legal mandates and user needs, and provides effective expert counsel and technology transfer, as well as new options for the future.

**Performance** refers to an ability to manage in a manner that produces identifiable results effectively (achieving desired results) and efficiently (with maximum productivity and minimum wasted effort or money). This criterion is evaluated by program management structures that produce the desired results, guidance, or framework for tracking progress toward the agency’s strategic goals and objectives, flexibility to address events or changing priorities, interaction with stakeholders, and extramural collaboration.

## Reviewers' Responsibility

NCCOS presented information relevant to its biogeographic and mapping portfolio during the course of the review, primarily as lecture presentations and in the Briefing Book. Each member of the Review Panel used that information and any ensuing discussion to come up with independent observations, evaluation, and recommendations on different aspects of the portfolio. NCCOS provided the following questions to guide the review and to conform to the three core evaluation criteria:

### Quality

1. How effective are NCCOS studies in developing (a) new and validated analytical methods and technologies in wide use, and (b) advanced tools and techniques to map, validate, deploy, and distribute geospatial products (e.g., predictive models, new sensors and acquisition vehicles, and map services)?
2. How well are NCCOS scientists recognized as leaders in their scientific disciplines for the quality of their contributions (e.g., authors of peer-reviewed publications; external requests for assistance; invited lectures; awards and recognition; and national and international leadership positions in the scientific community)?

### Relevance

1. How well has the portfolio supported noteworthy achievements in improving coastal and ocean mapping and/or conservation?
2. How effective have NCCOS products been in informing Federal guidance and decision making?
3. Is there evidence of the application of NCCOS-produced scientific knowledge for improving preparedness, management and/or response to events, and issues handled by other Federal, local, state, tribal, and regional governments?
4. How effective is the NCCOS biogeographic portfolio in assisting Federal partners to meet statutory requirements (e.g., Essential Fish Habitat, Endangered Species Act, the National Marine Sanctuaries Act, Coral Reef Conservation Act, Federal Partners' mandates, etc.)?

### Performance

1. How does NCCOS assure—and does it have procedures for—funding preeminent research and impactful science?
2. How well does NCCOS execute its research and related studies in an efficient and effective manner given appropriated resources?
3. How effectively does NCCOS utilize collaboration and partnerships to achieve desired outcomes?

## Panel Member Reviews

### Brad Blythe, BOEM (Review Chair)

---

Overall, it was a pleasure to participate in the review of NOAA's Biogeography Branch. The sessions were well organized and provided high-quality information to the panel, allowing us to effectively review the work, personnel, and other aspects of the program. Having worked with the program on a "second level" as a program manager, it was very valuable to see more of the day-to-day work and the scope and breadth of expertise within the Biogeography Branch. As panel chair, I will limit my comments to more general observations at a programmatic level in most cases and allow the specific observations and comments from the rest of the panel to speak for themselves.

#### **Program Quality**

In terms of program quality, it was clear that the program is widely regarded for high-quality research and is well respected within the United States Government oceanographic research community. We were presented with multiple examples of the Biogeography Branch being sought out by Federal and state partners to perform research and analysis. This speaks volumes about how the program itself is perceived. Of additional interest to me, in light of recent announcements from the current administration, was how the Biogeography Branch is in many cases on the cutting edge of the science and analyses, and is only limited by time and funding to pursue many of its ideas. Staff are clearly chosen for their ability to push the envelope and are encouraged to do so by management.

#### **Program Relevance**

As we are in a moment in time when we are seeing large changes to coastal and oceanographic ecosystems, it is clear that programs like this are incredibly important and relevant. The panel heard from multiple clients and collaborators who presented examples of specific-use cases and decisions made that were supported by Biogeography data products and studies. These "Partner Attestations" were very enlightening and clearly showed the real, tangible, on-the-ground results. Over the course of the review we were shown many examples at the state, local, and Federal level, where the Biogeography Branch helped partners and collaborators meet statutory and regulatory requirements.

#### **Program Performance**

From the perspective of program performance, I think that the only thing that could be seen as holding this group back is budget and staffing levels. Current staff in both programs are not limited by talent or inspiration, but rather time and funds available to take on additional work, so much so that they have to turn down some projects. Clearly, the Branch works very well with partners and collaborators, who routinely come back asking for more work to be done by the Biogeography Branch. We were shown several instances, explicitly and in passing, of the development and improvement of general and standard operating procedures, which appear overall to be well documented and available to staff. Again, as other NOAA and NCCOS offices and staff continue to seek out your expertise, it is abundantly clear that your work is highly relevant to NCCOS and NOAA goals and missions.

#### **General Comments**

It was quite clear that both the Habitat Mapping and Biogeographic Assessment programs are very strong and are being driven by excellent staff and managers from top to bottom. The crystal-clear mission focus and support given by management create a good work environment where staff can thrive and choose to spend their careers. Thoughtful consideration is given to all of the work undertaken to ensure it meets mission requirements and supports science-informed decisions at all levels.

It was clear that management is thinking about how to improve the program and help staff perform at even higher levels. It is also clear that they are doing quite a lot to ensure staff are valued and supported. It would be a wise decision to continue to value and promote the program and staff's entrepreneurial spirit as the strength that it is.

### **General Recommendations**

As a manager of another small program, I am always concerned about staff "depth," and I think that the Biogeography Branch has some similar concerns to contend with. Small organizations need good succession planning, and while the current hiring climate in the Federal government is limiting, identifying key staff capabilities and planning for turnover early is critical. There are some current vulnerabilities within the branch (GIS Application developer, data management) that should be monitored.

The presentations were very high quality and gave an amazing overview of great work that is being done. I would recommend looking into a "mini-symposium" for the rest of NOAA and potential outside collaborators to help "get the word out". One reviewer suggested they be tied to the program reviews itself, if appropriate and possible. The "OneNOAA" webinars may be an appropriate venue as well to highlight specific efforts if you are not already utilizing this forum.

Regarding data management, I think it is a major concern that there is no in-house data manager for the Biogeography Branch. I would strongly recommend that this position be developed and filled as quickly as possible. This position would fill major gaps and allow for the development of an overall data management strategy and geospatial data management strategy.

I would also recommend that some thought be put into how to "value" the support that the Biogeography Branch provides to local, state, and Federal decision-makers. Being able to show a direct line to the resources spent (in time, money, and effort) and a decision can only make future requests for increased funding more likely to succeed.

I think that this is a great example of a program that exists in a "sweet-spot" of Federal research. The work done by this group bridges the gaps between exploration, monitoring, and direct support for restoration efforts and policy development and decisions. That may be a story that you want to find a way to tell more widely.

I think that the Biogeography Branch is also well situated to find ways to truly integrate the social sciences into the work that you do on a regular basis. Because the work ties so closely to real world decision-making, finding ways to think about the sociocultural and economic aspects would continue to add great value to the work that you are doing.

One last note that I wanted to call out is that there is a lot of great work being done by Biogeography Branch staff in methods and technology development and testing on the margins of projects. This work has led to some excellent improvements, and it may be wise to consider a small dedicated funding line that can be used expressly for this purpose and to encourage staff to utilize some time and resources to keep pushing their innovative ideas.

### *Reviewer's Background Note*

- *Primary expertise relevant to this review is with Geospatial Systems implementations in support of science-based programs.*
- *Working relationship with BioGeo program dating from 2003.*

### **Summary Comments**

Participating in the program review for the Biogeography Program was indeed a very informative few days and a pleasure. It was clear from how well organized, and passionate, the staff and management team are that this is an impressive group of scientists and supporting cast members. The evolution of their methods to assess the health of the marine ecosystems provide services for are highly effective. Their capabilities to work in the ocean environment and staff that support these field activities are well targeted towards their mission objective. The partner organizations that shared their experiences of working with BioGeo are indicative of a well-regarded program.

One area to consider is the increasing volume of data that is being collected and how best to deal with it. With technology advancements and new field collection tools that allow staff to collect significantly more data, the staff are dealing with volumes of data that are growing quickly and stressing their capabilities to maintain effective data management. These data which include data from UAVs, remote sensing and other observation platforms provide a means to develop stronger analytics for assessments and monitoring, and are of high value. While the program has a strong foundation of science, investing in a more highly evolved data management with support from IT to better manage the observation data and geospatial data will be important to keep in step with the increasing data and interests in the data. The BioGeo program has been leading the way in NOS in leveraging cloud resources to provide a flexible IT environment. Emphasis on leveraging these cloud resources to support evolving systems and the higher levels of data management can also support the aforementioned increased demands.

### **Habitat Mapping | Capabilities & Case Studies**

#### *Summary Notes*

The Habitat Mapping group provided case studies and summaries of several impressive projects of projects within the US and US Territorial marine environments. The program teams have developed highly evolved best practices over years of experience for collecting data over the coastal zone to better assess conditions of marine ecosystems. The Habitat Mapping group employ a wide range of technologies including Unmanned Vehicles coupled with remotely sensed imagery, as well as investigating new emerging technologies to ensure they employ the most current and cost effective means to collect the data and observations that they use to analyze the habitat areas they are mapping, or for the partner organizations they are collecting the information for. The Spatial Prioritization tool is a very good example of incorporating geospatial tools to assist in prioritizing data collection for areas of interest for project areas. This kind of innovative approach may also be considered for other projects that could also benefit from this kind of spatial analysis.

As stated in the overall comments, this program collects high volumes of data sometimes over repeated field studies and thus time cycles. A review of best practices for data management for the program office given the scale and complexity of data would be recommended.

### *Quality*

The program's work is clearly of the highest quality. The testimonials from several partner organizations provided during the review were evidence of that. Many of these organizations have worked with the BioGeo program repeatedly over many years, evidence of the quality of their work and value put on their products and analysis.

### *Relevance*

From the wide range of presentations provided by BioGeo staff to the panel regarding their work, was how often they are filling gaps in partner organizations ability to collect, manage and analyze data. The BioGeo staff have capabilities beyond the resources of their "customers" to support projects with skills and tools they have developed over many years. A number of examples were presented of BioGeo project teams being brought in to fill a specific niche. Whether it was to assess the effects in the water column of the recurring oil seepage from the *Deepwater Horizon* oil spill or to assist the Office of Coast Survey in near shore mapping with their advanced capabilities with small Unmanned Aircraft Systems (sUAS) as well as other examples presented, the Habitat Mapping group provides valuable expertise that other organizations do not have.

### *Performance*

As indicated above, testimonies from several partner organizations attested to the results and overall high caliber of performance of the BioGeo program.

## **Biogeographic Assessment**

### *Summary*

Through the work of the Biogeographic Assessment program component of the Biogeography Program, the conditions and status of marine life; avian, marine mammal and fish species as well as the habitats that support them, are better understood. With the highly publicized degradation of coral reefs globally through human impact and climate change, it is critical to the future state of these systems that they are closely studied and monitored. The Biogeographic Assessment teams in NCCOS have worked to help map, model and analyze these coral reef and marine ecosystems through seasonal monitoring programs, and other techniques. Their work has resulted in several important and impactful decisions from expansion of marine protected areas to mitigating conflicting uses that ensure minimal impacts of protected species (e.g. the Stellwagen Bank shipping lane adjustment into Boston Harbor).

### *Quality*

BioGeo staff are continuously looking for means to elevate the accuracy of and efficiency of the assessments they conduct. For example, incorporating dive site coordination tools into the Fish and Benthic Visual Surveys that they conduct as part of the Coral Reef Monitoring program is evidence of ensuring that they capture field data efficiently and reduce possible gaps in collection (or overlaps as the case may be). BioGeo staff and management should continue to seek ways to ensure that field surveys that are conducted are as cost effective as possible, and employ spatial analysis and field collection tools that are now available.

### *Relevance*

The BioGeo Program works very closely and in close collaboration with partner organizations. Activities that support the collaboration include workshops with the public prior to projects. This pre-planning activity ensures that they leverage both the local knowledge of the geographic areas where they work, as well as an opportunity to vet the methods they plan to use to conduct assessments, ensuring that the results of their work will be relevant to the local constituents in the project areas.

### *Performance*

The results of the work of the BioGeo staff speaks to the performance of the program efforts. The Salt River Bay National Historical Park and Preserve project is an example of supporting the ongoing protection of the fisheries and ecosystem supporting the fisheries in that Preserve. It also provides an understanding of species migration through advanced telemetry and through designation of the Bay as a Marine Protected area the various species will be better maintained and protected.

### *Outreach, Distribution, Tools, and Technology*

For the size and scale of the resources for outreach and website management, the program has done extremely well. It may be a consideration to look at other examples of outreach and web portals of NOS offices that also have a wide range of projects, data, tutorials and results to convey to both partners and the public. In some cases these portals can be used to connect portal to portal collaboration (for example with Digital Coast, or the NOAA Geoplatform). This may offer a more automated means to sharing of applications and information products.

## Richard Brennan, NOAA

---

I appreciate being able to participate in this program review and the opportunity to more deeply understand the vital work performed in NCCOS. It has been enlightening to see the breadth and depth of the Habitat Mapping and Biogeographic Assessment programs. As a long-time collaborator with the Biogeography Program it was interesting to see how much opportunity for additional synergy and collaboration still exists between NCCOS and Coast Survey, and is the core of multiple recommendations I provided. I look forward to exploring these collaboration options in the coming year.

Overall, I thought the preparation and execution of the review was thoughtful and well organized. There was clear effort to focus the review on those areas critical to the delivery of services and research, and an openness to receive constructive feedback on how these programs could be strengthened.

### **Coastal and Ocean Mapping (Presentations 2-6)**

The quality of the work accomplished by Tim Battista, Chris Taylor, and Bryan Costa is not just at the cutting edge of work within the United States, but also around the world. Their expertise in utilizing modern hydrographic surveying and remote sensing techniques to map maritime habitat and ecology has been reported at conferences around the globe and can be judged by the requests for support they receive from both within NOAA as well as from other agencies. This has been demonstrated within my own organization in the standard procedures for backscatter processing they have helped develop within the Office of Coast Survey to ensure the routine backscatter acquired as a part of our hydrographic surveys is processed in a way that can be utilized more easily for habitat assessment.

The expansion of these ocean mapping techniques to support a larger array of programs, to include fisheries stock assessment, is a clear testament to the relevance of the work they are conducting. In one recent meeting a National Marine Fisheries Service (NMFS) fisheries biologist said “we can increase the effectiveness and efficiency of our stock assessments by more than 50% if we start with an accurate habitat map” in reference to the products NCCOS provides. In addition, the techniques developed for shallow water habitat assessment are directly transferrable to deep-water mineral resource assessments – an area of growing interest now that the Extended Continental Shelf surveys have been completed.

It has been said that “hydrography is the mastery of a million details” and it is clear from the surveys conducted between these three scientists that there is a core ethos that is dedicated to meeting performance metrics and ensuring all the details are addressed. These surveys are well documented in trip reports and metadata, they demonstrate sound calibration techniques and an attention to detail in the editing and processing of these data. In addition, data are systematically delivered for public consumption to National Centers for Environmental Information (NCEI) within less than one year. In addition, the work they have been doing to advance the use of unmanned aerial systems for nearshore, clear water characterization of habitat as well as micro-AUVs to validate segmentation maps places NOAA in a clear leadership position on these techniques.

There are significant synergies that could be realized in the NCCOS Coastal and Ocean Mapping portfolio through a deeper partnership and integration with Coast Survey. There are opportunities for cost sharing of personnel, partnership on base-funded projects, training, hardware and software procurement, as well as research and development. I look forward to exploring these possibilities in the future.

It was exciting to learn about Michael Coyne's work on the Remote Sensing Toolbox. This work is of significant interest outside of NCCOS and it would be good to share in more detail the capabilities this toolbox offers to other programs and partners. There is a growing community within NOAA that is providing their software code on GitHub so that it can be used, improved, and vetted within the open source community. If appropriate, NCCOS should consider posting this code on the NOAA GITHUB page.

## **Observations, Modeling, & Assessment Presentations 7-12**

### *Quality, Relevance, Performance*

Like their Coastal Mapping counterparts, I felt the quality of the work accomplished by Peter Etnoyer, Chris Jeffrey, Matt Kendall, and Arliss Winship was of significant scientific importance. While I cannot speak from personal experience with these four researchers as I can for Tim Battista, Bryan Costa, and Chris Taylor the reach and importance of their work is indicated by the 54 publications (combined) that these four researchers have presented and published in the last five years. In the case of Peter Etnoyer and his discovery of the link between the decline of mesophotic corals and the presence of oil and dispersants I would propose the quality of this research be measured by the additional research and funding (\$7.2M) it spawned and the leadership role it earned NCCOS in the restoration process.

I also found the attestation provided by Jeff Herter from the New York State Department of State very compelling regarding the 2006 New York State ecosystem conservation legislation that required a report on how state agencies would incorporate ecosystem management into state practices. Particularly he indicated how the work NCCOS performed resulted in 17,000 square miles of seafloor being set aside for conservation, the value of the peer review report (2012) regarding sea bird distribution, the 50 NCCOS data sets and their direct contribution to siting offshore wind. He also mentioned that seafloor composition is the biggest value they continually derive from the NCCOS data and data set most commonly utilized.

As with all NCCOS research, its true value is in the decisions it supports to help the nation balance preservation against exploitation. We heard multiple examples of how this science supported decisions on the boundaries for marine protected areas capitals preferred, local area land use regulations, and offshore renewable energy site selection as well as regional conservation plans. These real world examples build a solid foundation of support for this work and point to the demand for an expanded and coordinated initiative to map larger quantities of the U.S. territorial waters.

There seemed to be a clear driver between much of the work all the Habitat Mapping and Biogeographic Assessment programs perform and the National Coral Reef Monitoring Program (NCRMP). While this work complements local efforts, it was not immediately clear how these efforts were either coordinated or integrated with these local efforts. Establishing a more integrated connection with the local research and conservation communities could significantly strengthen all the work accomplished by this team, particularly in the area of employing social science to crystalize the value of these resources to the communities they support. In addition, there seems to be a significant opportunity to utilize unmanned systems and artificial intelligence to speed the processing of this work and expand the area of coverage possible per day at sea. There are multiple areas of research both inside and outside NOAA working on this subject – coordinating these for maximum community benefit is critical and offers NCCOS the opportunity for a leadership position in this arena.

## **Programmatic Materials Presentations 13-14**

I appreciate the introspection shared with the review team regarding the NCCOS budget and how it is allocated across the Habitat Mapping and Biogeographic Assessment programs. Based on the information presented to the review team and my understanding of the current fiscal climate within the

federal government, I believe NCCOS is making sound budgeting decisions to support the long-range viability of the program. While I am sure it is not perceived as a benefit, the lack of base funding and the entrepreneurial spirit engendered by the need to secure reimbursable projects has formed a tight, lean, and productive team. It was clear through this review that this team is very agile and able to respond rapidly to changes and new opportunities. This is a real asset and should be preserved as a cultural asset within the organization.

The director of NCCOS, Steve Thur, asked the following questions of the review team. I will answer each in kind below:

**1. How will the growth of unmanned systems (UxS) effect mission, staffing, and how we do our business?**

**2. How does automation change how we do our business**

I will answer number 1 & 2 together because I think they are related. In Coast Surveys work with unmanned systems over the last 15 years, it is clear that they do not reduce staffing. At best, they simply change the skills required of the staff you have and in many cases may require more staff to operate. The benefit is in the additional territory that can be mapped or environmental parameters that can be measured as compared with traditional methods. However, this can create a bottleneck in the processing of these data if there is not a simultaneous change in the systems used to process and analyze the data, and deliver the necessary products derived from it. I see automation of these processes as the key to enabling the increased production achieved through the unmanned systems and hence these two must necessarily go hand in hand. I think it changes how NCCOS does business only in that it will require significant thought to determine where a human actually delivers value. All other parts of the process should be considered for automation and training developed to support the humans in those areas of the process in which you intend to utilize them exclusively.

**3. Advice on how we can better tell our story.**

Honestly, I think NCCOS does a very good job of telling their story. Perhaps a more robust social media presence could help. I think the work that Tracy Gill does is persistent and outstanding to spread all of our science work internally within NOAA.

**4. Advice on funding stream and reliance on external funding.**

As stated in my comments above I think the reliance on external funding has created a very resourceful work force within NCCOS. I think there is a growing demand for the data and skills NCCOS delivers as the nation begins to realize the opportunity our ocean presents for critical minerals and the new challenge this will present on both the conservation as well as the exploitation mandates we have within the Department of Commerce.

**5. What is the obvious set of things we should continue doing?**

I think all of it is valuable. I think the opportunity may be in the better integration of the various disciplines into a single unified product. So creating a product package that delivers the mapping, modelling, and social science as a cohesive set of products that

are all inter-related and build off each other.

**6. What should we stop doing?**

Questioning your decisions. You have a great team! Move forward!

## Caroline S. Rogers, USGS

---

It was a pleasure to participate in the review of NOAA's Biogeography Program, July 23 to July 25, 2019, in Silver Spring, Maryland.

The Biogeography team has accomplished a huge amount over a sustained time period, and they have much to be proud of. In my opinion, the focus should be on "keeping up the good work" (a significant task) rather than any large-scale changes. Thanks to careful and effective management of the Marine Spatial Ecology Division by Dr. Mark Monaco, the NOAA Biogeography Program scientists are able to spend more time doing science and far less time writing proposals and trying to identify funding sources. In other words, they know what they are doing, and they have the support and freedom to do it. (With fewer funds available and increasing overhead costs, some agencies such as my own (the US Geological Survey) have requested that permanent employees attempt to bring in several pay periods of their own salaries.)

Dr. John Christensen did a terrific job organizing this review. Although Death by PowerPoint is a real phenomenon, the presentations were so varied and professional that this was not a problem. I thought perhaps it would be wasteful to print out the briefing books, but I ended up finding the hard copy very useful.

Here I offer my comments while acknowledging that if there were major areas in need of improvement or substantial funds just lying around to support even more activities, this thoughtful group would already know of them. I think that the staff are of the highest quality (some people have made some excellent hiring decisions!) and working at full capacity. Certainly, asking them to "do more with less" would be inappropriate.

I think that the Biogeography Program is excelling in all three major areas of Quality, Relevance, and Performance.

One general comment that I have is that I think it would be good to set aside a specific session within the review where the NOAA scientists can present their thoughts on the Biogeography Program, including obstacles and opportunities, what is working and what is not. Most federal government scientists that I know work extremely hard and do not often have time to stop and talk even with their colleagues one cubicle over. The BioGeo scientists are actually in a better position to assess ongoing activities and find opportunities for integration in some respects than those of us on the review panel.

It is great to hear that the BioGeo team (permanent employees) will be on a retreat this month where they can exchange their ideas on the program. (Might be good, if feasible, to get input from contractors as well.)

My observations are based on the formal presentations, informal conversations with NOAA scientists, conversations with scientists outside NOAA that have been collaborators, and my personal observations while based in St John where the BioGeo team has conducted work for several decades. I want to preface this report by clearly stating that my impressions are just that—impressions that I hope reflect an accurate understanding of the program but which may be based on incomplete or inaccurate information.

It is my opinion that having more base-funded employees and activities would be preferable (another example of "easier said than done"). The innovation and new blood that arrives with short-term contract employees can provide flexibility, but these employees will often leave even very fulfilling jobs for the security of a permanent position elsewhere. It can take a very long time to hire their

replacements, and that can be disruptive. Also, some of the long-time employees are certainly thinking in creative, new ways! (As just one example, Chris Taylor demonstrated the use of fish-finding technology to examine an oil seep.)

Ideally, there would be some discretionary funds to support new ideas arising from the employees themselves or from their collaborations with others. One such example is a new 3-d video method that Tim Battista and Jeff Miller (National Park Service) have been discussing. A small amount of funding could support a pilot study that might have a good pay-off over time.

With regard to the question of whether or not some activities should be modified or scaled back, I think that NCRMP should be carefully examined. (Quality, Relevance, and Performance all come into play here.)

There is a need to “monitor the monitoring” wherever long-term monitoring is occurring. NCRMP is a multi-agency collaboration, not solely a NOAA responsibility. I have some concerns about this overall monitoring effort although I am a strong believer in long-term monitoring and certainly do not recommend doing away with this! High-quality, long-term monitoring is very difficult to sustain, and many scientists and agencies are glad to have others do it. Our current understanding of reef trajectories is a direct outcome of the blood, sweat and tears of many people who have monitored reefs over the last several years. With the increasing seawater temperatures linked to changing climate (and extensive bleaching episodes, in turn sometimes followed by disease outbreaks), monitoring is even more important. However, NCRMP is a huge financial and time commitment and some cost savings might be possible without compromising the program.

The expertise of the in-water divers doing the monitoring needs to be evaluated. If it is sufficient for them to be skilled divers who are videotaping the benthic habitat then having interns do this could be sufficient. However, if more expertise is required, for example, in identifying coral diseases (notoriously difficult) then their lack of knowledge could be a factor. I do not know how much of a concern this is, but it was raised by a few of my colleagues from different agencies.

The logistics can be nearly overwhelming and time is always in short supply, but spending more time in overall planning and collaborative discussions could be beneficial.

*Who, exactly, decides what will be monitored, how frequently, and what the protocol will be?*

I know that there have been discussions between the National Park Service (NPS) and NOAA scientists regarding this, but I do not know who makes the final decision.

If the objectives are to document change over time (the objectives of all monitoring programs) then permanent sites for benthic and fish monitoring have clear advantages over randomly selected sites.

*Is this program having the desired results?*

Who will decide this?

*Who, exactly, are the managers that will use this information?*

They can be easier to identify in some cases than others. Although we use the word “manager” frequently we often do not explicitly state just who we mean. Within the National Park Service, Superintendents and Chiefs of the Division of Resource Management would be in this category. Who else?

It is not always clear just what managers need. Once I directly asked a Superintendent of Virgin Islands National Park what he needed, and he told me that he needed me to tell him what he needed. There can be rapid turnover in management positions as well, just to add to the equation.

(Note that for this and other activities there is a recognized and expressed need by BioGeo to “work backwards” from what managers want.)

#### *How relevant is it?*

Dr. Jim Bohnsack, Director of the Southeast Fisheries Science Center, once made the following (or a similar) comment in a meeting: “You can monitor fish forever, and you will find that Great White Sharks are rare and Bluehead wrasses common”. This gets at the reality that reefs are complicated and inherent characteristics of fish assemblages and benthic systems will present monitoring challenges. Use of permanent, co-located sites should be considered even acknowledging that changing methodology is usually to be avoided. What realistically can be learned and provided to managers?

Some people I spoke to expressed concern that the NCRMP data (and accessible data summaries) for the Caribbean are not being made available in a timely fashion. I do not know if this is the case or whether the people I talked with had just not been aware of where the data summaries are.

Coral diseases are presenting a considerable challenge not only to NOAA but to all agencies engaged in evaluating the status of coral reefs. Research by NPS, the University of Puerto Rico (UPR), the University of the Virgin Islands (UVI), and others have documented the severe decline in coral cover associated with white plague and other diseases. Currently further declines are linked to something referred to as Stony Coral Tissue Loss Disease (SCTLD) which may or may not be the same as the disease that has been ravaging Florida reefs for the last 4 years. My perception is that the distinction between white plague and SCTLD is not conclusive at least in some US Virgin Island locations, and decisions need to be made as to how to document diseased corals effectively.

Several years ago I submitted a proposal on coral diseases to an NPS/USGS RFP. My supervisor at the time expressed misgivings about this because diseases were something that managers apparently could not do anything about. In other words, why study them? Also, NPS held a workshop to identify the greatest stressors to national park resources and omitted any discussion of coral diseases for the same reason. Those of us scientists who were attempting to find funding to study diseases therefore could not turn to the workshop report to document the concern of NPS managers. Fortunately, people now better understand the need to consider coral diseases, although this is partly an outcome of the sheer impossibility of ignoring their effects.

NOAA websites are generally very well-designed (and far superior to those of many other federal agencies). During the review I would have liked to see a little more information on just which sites are available. With regard to how NOAA can better “get the word out” regarding their activities and products, I think that they are a victim of their own success—they are accomplishing so much that it is hard to let people know all they are doing.

The fact that some of what NOAA is doing is not known may simply reflect that people are too busy with their own work and not making an extra effort to dig into what is available. NOAA can make an effort to invite school children and others to the R/V Nancy Foster but they can’t make people take advantage of these great opportunities. (One inexpensive but high impact program that was brought to my attention by someone in the audience was the Teacher in the Sea program. I hope that is not cut!)

I am sure that this is already occurring but I think it is very valuable for the public and for scientists to provide clear, specific case studies (some of which we saw in the presentations) that demonstrate how managers use information that BioGeo provides (on websites, etc.)

Many of the scientists in the BioGeo program have been working there for decades—something must be going right! Clearly, someone made some excellent hiring decisions.

It was very refreshing to see the map indicating where BioGeo staff are located—including several where just one or two people had fairly remote offices, partly a reflection of accommodating the personal lives of some of the staff. Clearly a concern for the well-being of the employees.

There was an interest in closer integration, but I am not sure exactly what that refers to—perhaps integration within NOAA or possibly integration of the social and natural sciences—I have no expertise in the social sciences and would have liked to have heard more about specific case studies of how social and natural science could be integrated. There might be instances where such studies could enhance each other for a more integrated whole rather than just be simultaneous.

Most of my direct experience with the BioGeo scientists has been through their efforts to map and monitor US Caribbean coral reefs, particularly in the Virgin Islands. In these cases, some on site monitoring was already in place, and, while support of NOAA's efforts and collaboration were considered worthwhile, this differed from other situations where specific products were requested. For example, it was especially interesting for me to hear of cases where NOAA did a fantastic job of providing exactly what a manager requested—one such case was the benthic maps off of Washington State. I think that there is a need for more discussion and advance planning when NOAA is expecting a large contribution from local partners for less well-defined objectives.

There is clear evidence and no doubt that the BioGeo program has done a stellar job of working and collaborating with many different partners. This works both ways and it is not just BioGeo's responsibility to make the best of these partnerships. In some cases, scientists with the partner agencies have not taken the time to do this. Major NOAA reports are sometimes not even read by NPS resource managers, for example. I myself admit to being "NOAA weary" at times even outside formal partnerships because of the seemingly endless bombardment of NOAA requests. This partly just reflects that there are a small (and declining) number of people here in the US Virgin Islands available to review or contribute to NOAA's efforts.

Thanks for the opportunity to learn more about all that the Biogeography Program is accomplishing. I appreciate being invited to be on this review panel, and wish everyone continued success.

### *Introduction*

Participating in this program review was an honor and I left with a deeper understanding of the Biogeography Program and the passion behind all of the work that the staff does. I am a manager and policy expert at a state natural resources agency, so that is the perspective from which I provide my comments.

### *Habitat Mapping*

#### ***Overview***

It was clear from staff presentations that the habitat mapping arm of the Biogeography Program is highly collaborative and that they are always seeking efficiencies and multiples uses of their data.

#### ***Quality***

The projects that staff discussed had a very strong customer service component, which makes them well respected amongst their “clients” and colleagues and results in new or repeat project requests. These staff are innovating by not only testing new technologies, but by testing and designing new applications of these technologies. They are developing applications for UAVs that can increase efficiency of data collection and improve human safety. Staff are using the expertise of technical advisory teams to help design research questions and how to measure them. A consistent theme among the projects was the clear effort to improve their methods and usefulness of the data through creating new analytical and data collection methods that are quantitative and repeatable, validating data in the field, automating analysis tools, and processing and normalizing data for consistent use.

#### ***Relevance***

The Biogeography Program’s clear effort to conduct highly relevant work is unique among government agencies and stands out as a strength of both components of the Program. It is clear that the habitat mapping staff develop projects to address client questions and work with the client to disseminate, digest, and make the data useful for decision-making, and the clients do actually use the data to inform management actions.

While the habitat mapping team is not a response organization, it has demonstrated that it can provide support in response to events handled by other agencies. For example, the team helped BOEM identify the source and patterns of an oil and gas plume based on acoustic signature of bubbles using sonar on a ROV. The habitat mapping team also provides practical services that benefit communities, like documentation and removal of marine debris and nautical charting in nearshore areas that are difficult to access.

It seemed as though everything this team does has raised the bar on habitat mapping and that their work has led to meaningful results for their clients. The mapping prioritization process that they undertook with coastal managers in Washington resulted in NOAA and other organizations conducting mapping in the priority areas. They are documenting their procedures, testing new technologies and documenting how to use them, and sharing data and procedures to allow others to repeat their projects. The team is calibrating their systems so that

they can compare data across ecosystems and now many of their techniques have been adopted worldwide.

### ***Performance***

The funding and management structure of the Biogeography Program allows them to be nimble and still meet their goals. The habitat mapping team seems to meet or exceed all of its goals while also consistently finding efficiencies. They are trying to collect data that can serve multiple functions and to find out how to extract more information from their data to make it most useful. Staff are identifying projects in geographies that will be the most beneficial to the most people and then improving the usefulness of their data for the modelers on their team. They participate in highly collaborative project development with coastal managers and stakeholders and then solicit input throughout the project. It is clear that the team is not only highly responsive to stakeholders, but that they make a significant effort to communicate with and educate a diversity of stakeholders from children to VIPs.

### ***Conclusions/Recommendations***

The habitat mapping team does an excellent job of recognizing the need to standardize data formats and collection standards for data accessibility. Given how innovative this team is, it would be helpful to build research and development into the job descriptions of key staff working on and with innovative technology and data integration. To enhance the useful life of mapping projects, in the project development phase, the team may consider identifying a return frequency and work that into the project plan. While each habitat mapping project has an associated project web page, projects may be reach a wider audience and be more broadly beneficial with an associated information dissemination plan.

## **Biogeographic Assessment**

### ***Overview***

The biogeographic assessment team demonstrated efficient use of data, capitalization of cross-cutting partnerships, plans for cutting edge science, application of science to contribute to restoration, and production of comprehensive social and biological science products for communities.

### ***Quality***

Biogeographic assessment staff have spent decades conducting, documenting, and refining biogeographic assessments. They have standardized data collection protocols that allow for comparison and tracking of systems, like coral reefs, across the country. The team finds efficiencies by drawing upon existing NOAA and other data for models and developing data collection and validation methods that can lead to streamlining of coral reef data collection across NOAA programs. Maps created by assessments are available on a public portal and through regional ocean data portals, while other entities can also re-create the models when staff share their model codes.

To enhance success of future projects, the biogeographic assessment team is identifying and mapping data uncertainties and developing baselines for future research and assessment.

Clients are using products to help with decision making and planning including marine spatial planning, permitting, and identifying socioeconomic impacts of potential decisions.

### ***Relevance***

Staff from the biogeographic assessment team effectively demonstrated that their work supports other agencies, communities, ecosystem health. For example, their coral data models have led to the designation of new habitat areas of particular concern and analyses of baseline data have identified a causal relationship between Deepwater Horizon and coral damage. The team is developing models that can illustrate regional biological connectivity and that use data at the spatial scale of decision making, which help tell the story of why a place is special in order to inform management decisions, like the designation of the Frank R Lautenberg Deep See Coral Protection Area.

Models developed by the biogeographic assessment team are increasingly relevant and useful to the local communities. For example, local partners help determine the project direction, participatory research gives a voice to the people who use the waters, and social scientists on the team compare socioeconomic conditions in surrounding communities to coral health.

### ***Performance***

The biogeographic assessment team leverages dollars and produces positive results by identifying local partner needs during project planning, using existing local data, and relying on partners to understand data and limitations and to review products. Products from these projects often catalyze partnerships and future collaborative studies. Furthermore, rather than collecting new data, the team relies heavily on partnerships with other organizations for data to input in models.

The team has been using a coral reef report card to report to local communities, NOAA, and Congress on the status of coral reef health in various jurisdictions. Data collected by the team can also be used to evaluate effectiveness of marine protected areas.

### ***Conclusions/Recommendations***

The biogeographic assessment team is in the early stages of developing a stronger social science team. There is potential to better align the scales of biological assessments with those of socioeconomic surveys. Given the growing interest in socioeconomic studies, it may be useful to develop a plan to monitor the useful life and actual application of socioeconomic products.

While it is clear that the coral propagation project to restore Gulf coral communities is in its nascent stages, it seemed as if it could benefit from additional sideboards and outside collaboration. Understanding that this is part of NOAA's Open Ocean Restoration Plan, coral propagation seems to push the boundaries of the current responsibilities of the Biogeography Program.

## **General Recommendations**

One of the greatest strengths of the Biogeography Program is their ability to develop collaborative partnerships inside and outside of NOAA. However, it was unclear whether there

is deliberate planning at the management level for internal partnerships. One recommendation would be to introduce discussion of these types of partnerships at management meetings.

It was clear from the presentations and conversations with program managers that they are thinking about how to handle data into the future and moving data to the cloud. At this time, however, the program does not have a clear data management strategy nor more than one staff person to manage data. The program should also be thinking about long term stable funding for data management as well as the feasibility of developing a single portal for accessing all of the program's data.

The Biogeography Program is comprised of staff who primarily have advanced degrees. However, due to NOAA's current structure, these staff are responsible for handling all of the administrative matters related to their work, from travel to contracts. This seems to add significant workload to these staff. An administrative staff person assigned to the Biogeography Program would streamline administrative duties and remove the burden of those duties from the program staff.

An excellent reputation and successful dissemination of project information has driven an ever-increasing demand for the Biogeography Program to lead projects across the country. The program seems to be at a crossroads where they could take on more work and grow their project staff, or strategically accept projects that will be conducted by existing staff. It may be beneficial for the program to improve partnerships across line offices in NOAA to find funding efficiencies, avoid duplication, and broaden geographic reach; plan to meet with NOAA program management to engage and integrate; consider a more robust strategy for incorporating social science into projects where appropriate; and develop a strategy for shared goal setting with partner agencies.