

**External review
of the
Cooperative Institute for the North Atlantic Region
Woods Hole Oceanographic Institution (lead), University of Maryland Center for
Environmental Science, Rutgers University, University of Maine, Gulf of Maine Research
Institute
Woods Hole, MA**

**Submitted to the
National Oceanic and Atmospheric Administration
Science Advisory Board
on
1 October 2012**

Summary

An external review of the research, education, and outreach programs of the Cooperative Institute for the North Atlantic Region (CINAR) at the Woods Hole Oceanographic Institution (WHOI) was conducted on 6-7 September 2012 in Woods Hole, MA. Guidelines for conducting the review were provided by the Office of Oceanic and Atmospheric Research (OAR) within the National Oceanic and Atmospheric Administration (NOAA). The review was conducted under the auspices of the NOAA Science Advisory Board (SAB) and, therefore, is subject to the requirements of the Federal Advisory Committee Act (FACA). A list of review panel members is provided in Appendix I. The review panel's on-site agenda is provided in Appendix II.

CINAR is a consortium of geographically distributed institutes and universities in the Northeast US that focuses on a set of important regional issues, while at the same time seeking to improve and integrate our understanding of climate and ecosystems. CINAR is not co-located with a NOAA facility, which poses some challenges. The review panel found that scientific research in each of the five CINAR research themes is progressing quickly and in alignment with three of the four goals stated in NOAA's next generation strategic plan. The review panel also found that the management of CINAR is in capable hands, though the CINAR business plan will need to be responsive to challenging fiscal times.

The review panel noted an overall sense of frustration by the CINAR participants centered on an inability to directly involve colleagues with expertise of value to NOAA and to create new opportunities for partner institutions. This limits the strength of the consortium and hinders its ability to execute and expand upon the vision for CINAR proposed at its inception. Based upon these findings, the Panel issued eight recommendations for CINAR and four for NOAA. The Review Panel concluded that CINAR is a valuable member of the NOAA CI community and assigned an overall rating of **Outstanding**.

I. Overview of CINAR

CINAR was established in July of 2009 and this review is its first 5-year review. CINAR was established as a regional enterprise joining the Woods Hole Oceanographic Institution (WHOI) (lead), University of Maryland Center for Environmental Science, Rutgers University, University of Maine, and the Gulf of Maine Research Institute, with a geographic focus on the Northeast Shelf Large Marine Ecosystem (NES LME). There is also an explicit recognition that effective management of human activities in the NES LME requires an understanding of how these activities interact with each other and with other processes that affect the ecosystems on that shelf and its resources, including climate forcings that originate far from the region's boundaries.

II. Strategic Plan

The overall goal of CINAR is to engage NOAA and academic scientists in cutting-edge research to inform management decisions about sustainable management of the US northeast continental shelf ecosystem. CINAR addresses three of NOAA's four long-term goals in the Next Generation Strategic Plan: (1) Climate adaptation and mitigation; (2) Healthy oceans; and (3) Resilient coastal communities and economies.

CINAR is working on research and education/outreach projects related to six themes: 1) Ecosystem Forecasting; 2) Ecosystem Monitoring; 3) Ecosystem Management; 4) Protection and Restoration of Resources; 5) Sustained Ocean Observations and Climate Research; and 6) Education and Outreach. The first five themes were identified by NOAA (OAR-CIPO-2008-200159), while the sixth theme was added by CINAR to emphasize the importance of incorporating training, education, and outreach efforts into CINAR activities.

Having just completed its third year of a 5-year agreement, CINAR continues to build on strong pre-existing partnerships between NOAA and partner institutions and develop new collaborations.

Findings

1. CINAR is conducting high-quality research and education/outreach projects across all six themes and contributing positively to NOAA's management needs, particularly at OAR and the National Marine Fisheries Service (NMFS).
2. Currently CINAR allows academic scientists and NOAA sponsors to work one-on-one to develop proposals that respond to specific management needs. Given current funding levels, however, particularly the lack of discretionary or programmatic funding, CINAR does not have the capacity to operate as an integrated team with the strategic vision that was proposed.
3. There are numerous partnerships between CINAR investigators and OAR and NMFS scientists, many of which were developed before CINAR was established. There are opportunities for CINAR to facilitate new relationships among academic scientists and NOAA.
4. CINAR has facilitated some awareness of the expertise available at the partner institutions and needs of NOAA partners, but there is still not a broad recognition among researchers within CINAR and potential NOAA sponsors of the available expertise and potential collaborations across institutions.
5. CINAR provides a more flexible mechanism for funding research projects than the standard process. In several instances, CINAR investigators have responded rapidly

and successfully to management issues (e.g., Harmful Algal Blooms (HABs), an oil spill, and marine mammal strandings). There is an opportunity for CINAR investigators and NOAA to learn lessons from these projects that have responded rapidly to management issues.

Recommendations:

1. CINAR scientific leadership, in coordination with NOAA, should explore opportunities for generating or capturing additional CINAR discretionary funding. The leadership should also identify critical research gaps and prioritize the scientific research that would be pursued with any discretionary resources that might be identified in the future.
2. NOAA and CINAR should create additional opportunities for sustaining existing partnerships and developing new relationships. Possible opportunities include: 1) co-locating NOAA staff at CINAR institutions (or CINAR investigators at NOAA facilities); 2) hosting additional workshops that encourage face-to-face dialogue among participants (not just scientific presentations); and 3) creating a strategy for sharing information on CINAR expertise and management needs among potential CINAR participants and NOAA sponsors.
3. Drawing from past success of CINAR projects, CINAR investigators should work with NOAA to refine their capability to respond to future crisis events (e.g., HABs, oil spills, and others). NOAA should develop a process to capture the expertise of CINAR investigators effectively and quickly to respond to crisis management situations.

III. Science Review

The science review presented the great breadth of CINAR scientific research activities and accomplishments across time- and space-scales and across climate and ecosystem components. Highlights include:

- Advanced and sustained observations and synthesis to test and initialize global and regional ocean/climate prediction models;
- Detection of significant shelf-water cooling and freshening and development of environmental indices (e.g. stratification, nutrients) at the range limits of species;
- Development and implementation of improved ecosystem survey methods, including novel sensors and instrumentation to inform management, protection, and restoration of resources;
- Development and application of regional models directed towards understanding of climate-driven changes and management of ecosystem resources; and
- Documentation and understanding of coupled economic and social systems focused on fisheries management.

Findings

1. Highlights revealed a strong focus on NOAA's missions, with important research results on regional ecosystem impacts of climate and resource exploitation behavior, and with significant forecasting/management relevance.
2. Significant progress has taken place in designing and developing observational and modeling systems that transmit ocean climate information from global to regional to local scales and in applying this information to ecosystem monitoring, management, and protection/restoration in the NES LME.
3. CINAR science and technology expertise, along with institutional infrastructure, were highly leveraged through productive scientific partnerships with NOAA and other federal and state agencies, with fisheries consortia, and within CINAR.
4. CINAR investigators responded rapidly and successfully to NOAA's critical needs for information (observations, analysis, and understanding) in the Deepwater Horizon oil spill, as well as during extremely anomalous HAB events.

Recommendation

1. We realize that ecosystem research is in many cases a rapidly developing field, and that current CINAR projects were initiated through discussions between NOAA sponsors and individual CINAR investigators. The individual ecosystem research components presented to the review panel are of high quality, but the ecosystem research within CINAR would benefit from greater cohesion. We recommend that CINAR work to integrate its ecosystem research from fundamental observations and modeling through to applications and outreach.

IV. Education/Outreach

CINAR has a broad set of Education and Outreach efforts that span NOAA goals in K-12, undergraduate, and graduate education and for post-doctoral fellowship programs. Efforts include a minority scholars program as well as informal education, technology transfer, and teacher training. The overarching Education and Outreach goals are: 1) to transfer and translate the results of CINAR research in support of responsible stewardship of coastal and marine resources in the region; and 2) to train the next generation NOAA workforce. Two of the major education and outreach initiatives include: 1) education around HABs; and 2) the Marine Resource Education Program (MREP), which is a collaboration between NOAA and industry partners to enable fisheries stakeholders to actively engage in the science and management process.

The types of educational activities/opportunities for K-12, undergraduate, and graduate students that the institute offers on an ongoing basis include:

- The Cohen Center for Interactive Learning (K-12) at the Gulf of Maine Research Institute, working with Maine 5th and 6th graders to experience hands-on, inquiry-based science;
- Undergraduate summer intern funding;
- A Minority Summer Student Fellows Program that will begin in 2013;
- A partnership with the University of Massachusetts School for Marine Science and Technology (SMAST) and the NMFS's Northeast Fisheries Science Center to address issues related to Massachusetts and regional fishing communities. Two components include: 1) a series of rotating, competitive Fellow awards for WHOI scientists working in areas relevant to the central theme of quantitative fisheries science; and 2) faculty support at SMAST; and
- Support at WHOI for one 18-month CINAR Postdoctoral Scholar per year.

Current and planned outreach efforts include:

- The Ocean Reference Station (ORS) program, which makes space available on its cruises to the NOAA Teacher at Sea program each year;
- Teacher training using HabCams; and
- CINAR science educators meeting with members of the NOAA Education Council in September 2012

Findings

1. CICOR (previous CI) responded predominantly to OAR and focused on climate and ocean observations. CINAR added Education and Outreach (E&O) as a sixth theme because it is viewed as an important topic deserving of its own emphasis (although funding is limited).
2. The review panel was impressed by the fact that CINAR considers E&O so important that it supports E&O through both individual grants as well as the allocation of roughly one-third of its Task I funding.
3. The review panel was also impressed by the broad array of E&O efforts; however, the panel suggests that as the program moves forward there be a greater focus on integration of outreach activities among institutions.

Recommendations

1. The review panel encourages CINAR to continue working with Sea Grant partners to ensure appropriate coordination of outreach efforts.
2. The review panel encourages outreach efforts aimed at leveraging the already ongoing outreach efforts as a way to better inform partner institutions and CINAR scientists about CINAR activities.

V. Science Management

Science management is supported under Task I of the Memorandum of Understanding, with funding support provided by both OAR and NMFS on roughly a 1/3 to 2/3 basis. Activities that fall under Task I include administrative oversight of CINAR, coordination among the member institutions, as well as general education, outreach, and transition activities. The CINAR directorate noted that Task I funding has not always arrived in a timely fashion making it difficult to adequately plan workshops and other activities as well as to be assured that sufficient funds will be provided to support the administrative staff. In addition, the amount of Task I funding is barely adequate to cover the significant administrative costs associated with a five-partner consortium, with the small amount of remaining funds reserved for travel, outreach, and other minor activities. There is thus not sufficient Task I funding to broaden education and outreach activities, support visiting NOAA scholars, or for other activities envisioned at the time of proposal submission.

Findings

1. The management that CINAR has been able to accomplish under this task is laudable, but the review panel is concerned that the current funding level does not allow for regular meetings among senior staff, broad-scale visioning, integration of work among the participating institutions, or for fostering collaboration between CINAR and NOAA scientists that would lead to future projects. Some topic-oriented planning workshops have been conducted by CINAR, and more are on hold until funding becomes available.
2. Integration of work across the member institutions of CINAR is difficult, and there appears to be a lack of knowledge by NOAA scientists about the range of scientific capabilities and expertise that resides in the member institutions, and vice versa.
3. Arrival of funds from OAR for Task I has occurred on a regular basis at approximately the same time each year. The NMFS support for Task I, however, has arrived in a piecemeal basis extending late into the fiscal year with no strong assurance that it will even arrive at all. This has hindered efforts to spend Task I funds efficiently and effectively.

Recommendations

1. It is important that CINAR provide discretionary funding to support development of collaborations between and among CINAR and NOAA scientists, either through topic-based workshops and/or pilot studies that would lead to future project proposals. Without this type of support, CINAR is essentially functioning as nothing more than a clearinghouse for NOAA funds. Discretionary funding should also be used to support

competitive, theme-based solicitations of proposals across the CINAR member institutions.

2. All Task I funding provided by NMFS should arrive at approximately the same date as the OAR funds arrive each year in order to facilitate planning for its expenditure.
3. To enhance awareness of related non-CINAR research, and to show how CINAR research is synergistic, it would be helpful for CINAR investigators, CINAR PIs, and NOAA to maintain a catalog of CINAR-related scientific research that is funded by other agencies or by NOAA through other mechanisms.

VI. Summary and Conclusions

In summary, the Review Panel concluded that CINAR is a valuable member of the NOAA CI community and assigned an overall rating of **Outstanding**. The CI community is clearly beneficial to NOAA's strategic plan, but given the limitations of the CI framework, there exists an opportunity for NOAA and the SAB to reassess the official review guidelines to ensure realistic expectations.

Appendix I

List of External Reviewers

[1] Heidi Cullen, Ph.D., Chairperson (Member of NOAA's Science Advisory Board)

Chief Climatologist
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In addition to her responsibilities as Vice President for External Communications, Dr. Heidi Cullen serves as Chief Climatologist for Climate Central — a non-profit science journalism organization headquartered in Princeton, NJ. Before joining Climate Central, where she reports on climate and energy issues, Dr. Cullen served as The Weather Channel's first on-air climate expert and helped create Forecast Earth, a weekly television series focused on issues related to climate change and the environment. Prior to that Dr. Cullen worked as a research scientist at the National Center for Atmospheric Research (NCAR) in Boulder, CO. She received the NOAA Climate & Global Change Fellowship and spent two years at Columbia University's International Research Institute for Climate and Society working to apply long-range climate forecasts to the water resources sector in Brazil and Paraguay. She is a member of the American Geophysical Union, the American Meteorological Society and the Society of Environmental Journalists. Dr. Cullen also serves as a member of the NOAA Science Advisory Board. She received a Bachelor of Science degree in Industrial Engineering from Columbia University and went on to receive a Ph.D. in climatology and ocean-atmosphere dynamics at the Lamont-Doherty Earth Observatory of Columbia University. Dr. Cullen is the author of *The Weather of the Future* published in August of 2010 by Harper Collins and is a Visiting Lecturer at Princeton University.

[2] Tom Ackerman, Ph.D. (Ex-Officio, cooperative institute representative)

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Dr. Thomas Ackerman received a B. A. in Physics from Calvin College in 1970, a M. Sc. in Physics in 1971 and a Ph. D. in Atmospheric Sciences in 1976, both from the University of Washington. He is currently a Professor of Atmospheric Sciences and the Director of the Joint Institute for the Study of the Atmosphere and Ocean (JISAO) at the University of Washington.

He teaches undergraduate and graduate courses in the area of climate processes and climate change. His research is primarily concerned with the role of clouds and aerosol in regulating climate and uses both high resolution data from satellite and the ground and output from global climate models. He previously served for seven years as the Chief Scientist of the Department of Energy's Atmospheric Radiation Measurement Program. He is a Fellow of both the American Association for the Advancement of Science and the American Geophysical Union and served as the Chair of the GEWEX International Science Steering Committee. He is the recipient of the NASA Distinguished Public Service Medal and the Leo Szilard Award for Science in the Public Interest awarded by the American Physical Society.

[3] John Boreman, Ph.D.

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Dr. Boreman holds Masters and PhD degrees from Cornell University. He is currently CEO of Boreman Consulting, specializing in advising natural resource agencies on science and policy issues. He is also advising graduate students and teaching a course on marine science and policy at NC State. His previous positions include Director of the NMFS Northeast Fisheries Science Center and Director of the NMFS Office of Science and Technology. He is President-elect of the American Fisheries Society.

[4] Tracey Dalton, Ph.D.

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Dr. Tracey Dalton is an Associate Professor of Marine Affairs at the University of Rhode Island. Her primary areas of research include public participation, spatial planning & management, and governance of social and ecological systems. Recent projects include an examination of the social and ecological factors influencing marine protected area performance in the Caribbean, a study of spatial patterns of use in Narragansett Bay RI, development of an integrated economic-ecological model for fisheries management, and an investigation of recreational boaters' perceptions of scenic quality. She teaches undergraduate and graduate courses on human use

and management of the marine environment, management of marine protected areas, and coastal zone management, and has served as major advisor to over twenty graduate students. Dr. Dalton holds a BS in Chemistry from Boston College and a PhD in Environmental Science from the University of Massachusetts Boston.

[5] Roger Lukas, Ph.D.

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Roger Lukas received his Ph.D. in Oceanography in 1981 from the University of Hawaii (UH), a Master's degree in Oceanography from UH in 1977, and the A.B. in Mathematics from the University of Southern California in 1973. Lukas is a professor of Oceanography in the School of Ocean and Earth Science and Technology at the University of Hawaii – Manoa, teaching graduate courses in physical oceanography and air-sea interaction. He conducts ocean and climate research on topics including ocean currents and turbulence, thermohaline distributions and variations, sea level variability, air-sea interaction, El Niño, and decadal climate variability. He helped lead the TOGA Coupled Ocean-Atmosphere Response Experiment from 1987-1998. Lukas and colleagues have conducted the Hawaii Ocean Time-series observational program at Station ALOHA, north of Oahu, documenting changes of ocean physics, chemistry and biology since 1988. He is part of a team that in 2011 successfully deployed (and continues to operate) the deepest cabled ocean observatory in the world. Lukas is a member of the Board on Atmospheric Research and Climate of the National Academy of Science. He is the co-author of the book, "The Near-Surface Layer of the Ocean".

Appendix II

CINAR 5-year Review Agenda September 6-7, 2012

September 6th, 2012

Time	Agenda Item	Presenters
8:00	Shuttle pick up from hotel – transport to WHOI	Sci. Review Panel
8:15	Sci. Review panel closed session - continental breakfast provided	Closed session – review panel only – <i>Clark 509</i>
8:45	Welcome	Susan Avery, WHOI President and Director (via Skype)
9:00	CINAR introduction and overview	Don Anderson, CINAR Director
9:30	Theme V: Sustained Ocean Observations and Climate Research Theme Overview and Highlights	Bob Weller (WHOI)
10:15	Coffee break	
10:30	Theme I: Ecosystem Forecasting Theme Overview and Highlights	Andrew Pershing (U Maine / GMRI)
11:15	Theme II: Ecosystem Monitoring Theme Overview and Highlights	Josh Kohut, Rutgers
12:00	Lunch – panel plus selected CINAR investigators and students (buffet lunch)	<i>Clark 507 Foyer</i>
1:00	Theme III: Ecosystem Management	John Annala (GMRI)
1:45	Theme IV: Protection and Restoration of Resources Theme Overview and Highlights	Mark Baumgartner (WHOI)
2:30	Theme VI: Education and Outreach Theme Overview and Highlights	Alexa Dayton (GMRI)

3:15	Break	
3:30	NOAA program managers and sponsors – conference call / meeting	Closed session – NOAA and review panel only (see page 2 for list of attendees) – <i>Clark 509</i>
4:30	Brief recap meeting – review panel only	Closed session – review panel only – <i>Clark 509</i>
4:45	Poster session and glider demo	<i>Clark 507 Foyer</i>
5:30	Reception	<i>Clark 507 Foyer</i>
7:00	Option for informal dinner at local restaurant - not subsidized	Review panel, CINAR Director, CINAR Consortium PIs

September 7th, 2012

Time	Agenda Item	Presenters
8:00	Shuttle pick up from hotel – transport to WHOI	WHOI van picks up Sci. Review Panel
8:15	Sci. Review panel closed session - continental breakfast provided.	Closed session – review panel only - <i>Clark 509</i>
9:15	Tours: Ocean Reference Station (Bob Weller); HabCam (Scott Gallager/Amber York)	Bob Weller – <i>LOSOS</i> ; Scott Gallager / Amber York - <i>ESL</i>
11:00	Closed session with CINAR Director, Administrator and CINAR Consortium PIs Coffee provided	Science Review Panel - <i>Clark 507</i>
12:00	Lunch with CINAR Consortium PIs	<i>Clark 507 - Foyer</i>
1:00	Science Review Panel executive session	Closed session - review panel only - <i>Clark 509</i>
4:00	Initial report back to CINAR – preliminary findings and tentative recommendations	Review panel - <i>Clark 507</i>
5:00	Adjourn	