

Invasive Species Program Review: NCCOS Response to the Final Report

Prepared by
NOAA's National Centers for Coastal Ocean Science
June 2008

In Response to the NCCOS Invasive Species Program Review
September 11 & 12, 2007

Introduction

On September 11-12, 2007, NCCOS conducted a formal, external review of its Invasive Species Program. Six reviewers were tapped to evaluate the program, including:

- 1) Dr. Britta Bierwagen
U.S. Environmental Protection Agency
Office of Research and Development
National Center for Environmental Assessment
- 2) Mr. Seth Blich
Florida Department of Environmental Protection
Apalachicola National Estuarine Research Reserve
- 3) Dr. James T. Carlton
Williams College
Mystic Seaport Maritime Studies Program
- 4) Ms. Pam Fuller
U.S. Geological Survey
Florida Integrated Science Center
- 5) Mr. Stephen Phillips
Pacific States Marine Fisheries Commission
Aquatic Nuisance Species & Invasive Species
- 6) Dr. Ellen Woodley
Liana Environmental Consulting

The scope of the review included multiple aspects of NCCOS' research activities related to aquatic invasive species:

- Legislative guidance and mandates
- Goals and objectives of research efforts
- Design and components of projects
- Scientific contributions and leadership
- Usefulness of data and information products
- Interactions and collaborations
- Adequacy of funding and staffing
- Data management, dissemination and assimilation
- Direction of future research programming

Reviewers were asked to consider a range of topics including, but not limited to, the quality of research projects, the effectiveness of program structure and leadership (including the setting of research and programmatic priorities) and the adequacy of internal and external collaborations. Most importantly, reviewers were asked to provide recommendations about where the program might go in the future based on present goals, objectives and capabilities. While given guidance on the focus of the evaluation, reviewers were also encouraged to comment on any aspect of the program they believed was important. The reviewers examined written materials and heard oral presentations on past, present and future research and programming efforts related to aquatic invasive species. They also interacted with NCCOS researchers and staff both formally and informally over the course of the one and one-half day period.

Each reviewer drafted his or her own critiques, comments and recommendations, which were submitted to staff in NCCOS Headquarters and compiled into a final report. The final report was submitted to NCCOS leadership in November 2007.

Below is the NCCOS response to the questions, suggestions and recommendations made by reviewers, as reflected in the final review report. Broadly, our reviewers' observations and recommendations centered on the unfocused and ad hoc nature of NCCOS' Invasive Species Program. We agree with this assessment and acknowledge that much work must be done to coordinate and direct our invasive species research and related activities. In response to our reviewers' recommendations, NCCOS will undertake an NCCOS-wide, collaborative planning activity to consider future directions. Moreover, we will strive to better connect our invasive species research program to stakeholders within NOAA and beyond.

NCCOS would like to extend its sincere gratitude to the reviewers for their careful consideration, and thoughtful comments and recommendations. Your comments and suggestions will be invaluable to us as we embark on the planning process.

1.0 Response to Action-Specific Recommendations--Summary

1.1 Reviewer Recommendation:

- Organize and integrate NCCOS' capabilities into a unified program

NCCOS Response:

NCCOS agrees that it has not yet reached a point in its programming where the detection and assessment of invasive species is fully integrated, and that it should better organize and integrate its invasive species (IS) program. Strategies for organization and integration include: 1) identifying the NCCOS niche in invasive species research; 2) strategic invasive species planning; and 3) improving communication among Centers.

NCCOS does employ Topical Activity Planning as a way to document interoffice planning in particular research areas, that is, to track research activities across the five centers and Headquarters. One to three people author Topical Activity Plans (TAPs) by collecting and consolidating information from the NCCOS National Projects Database (NPD), the NCCOS Weekly Report Database and by contacting individual principal investigators/scientists. TAPs are used to document program plans and progress for the current fiscal year and plan for the upcoming fiscal year while looking back one fiscal year prior. In the past, TAPs have been predominately a reflection of already planned programs within its Centers. NCCOS has not used TAPs as a mechanism to undertake coordinated, cross-center planning. To improve inter-office planning, NCCOS will conduct a more coordinated TAP exercise for FY2009 in the area of invasive species. This exercise will actively engage each Center to accomplish visioning and strategic planning in this research area.

NCCOS coordinates its programming within NOAA generally by participating in the NOAA-wide Planning, Programming, Budgeting and Execution System (PPBES). Specifically, NCCOS is an active participant and coordinates research programming closely with the NOAA Aquatic Invasive Species Program (NOAA AISP). In this way, NCCOS leadership can be certain that NCCOS does not overlap or duplicate other activities within NOAA. Moreover, within the PPBES process, NOAA conducts planning three to eight years in advance. This allows for long-term and adaptive program planning at the NOAA-level.

In response to this review, NCCOS undertook preliminary consultation with the NOAA AISP to re-evaluate its priorities. NOAA AISP suggested that research attention is needed to develop and test control and management tools. For instance, attendees of the Seaweed Control Workshop, held at Pacific Grove, CA in 2008, identified the need to examine freshwater herbicides on marine algae. There are a number of herbicides presently approved by the Environmental Protection Agency (EPA) for use in freshwater systems. However, EPA has not approved any of these herbicides for use in marine systems or tested their efficacy in controlling marine algae. Consequently, there is need to investigate the effectiveness of this control strategy, as well as to assess impacts to non-target species and systems. In general, the AISP suggested that NCCOS focus research capabilities and resources on developing and testing control techniques like this one.

Another area identified by the AISP was ecosystem forecasting, similar to NCCOS' existing vision for Integrated Ecosystem Assessments in the invasive species context. According to the AISP, there is a need to provide resource managers with forecasts on:

- which non-native species are likely to be introduced,
- what are the probable environmental or human health impacts from invasions,
- what extent of harm (e.g., economic, ecological, etc.) can be expected from the presence of non-native species,
- how will changing patterns in trade and climate affect these variables, and
- what are the most probable outcomes of different management strategies?

Given guidance from AISP, NCCOS will ascertain if it can better contribute to NOAA's wider mission in the invasive species arena.

1.2 Reviewer Recommendation:

- Abandon the Early Warning System (EWS) concept and redirect program resources to areas more relevant to management needs and NCCOS capabilities

NCCOS Response:

As recommended by program reviewers, NCCOS has abandoned the EWS and redirected program resources. NCCOS discontinued two contract positions focused specifically on the EWS, as project funding expired in October 2007. Subsequently, NCCOS recruited a fulltime federal employee to incorporate invasive species work into the Center for Coastal Monitoring and Assessment's ongoing biogeographic assessments. As recommended, NCCOS is already attempting to support expansion of the U.S. Geological Survey's Nonindigenous Aquatic Species (NAS) Alert System with information compiled for the EWS.

1.3 Reviewer Recommendations:

- Request input on invasive species programming from this panel as well as other groups in the public and private sector
- Connect program priorities, projects and products to NCCOS stakeholders, clients and resource user-groups--actively engage these groups

NCCOS Response:

NCCOS makes significant effort to connect its research programs to stakeholders in a variety of different ways. First, NCCOS interacts regularly with those offices in NOAA that are the customers of its research products and services, such as the National Marine Sanctuary Program (NMSP) and the National Estuarine Research Reserve System (NERRS). In addition, NCCOS coordinates with the NOAA AISP, a crosscutting program joining line offices that investigate invasive species issues. In an effort to involve these groups more closely, NCCOS is contemplating the incorporation of invasive species planning into its strategic planning process, which is now underway.

NCCOS routinely seeks guidance on stakeholder needs and priorities through direct and indirect sources. For example, NCCOS interacts with non-government organizations, such as the Southeastern Fisheries Association and The Pacific States Marine Fisheries Commission. Further, NCCOS makes use of secondary resources, such as technical reports, regional assessments, workshop reports, conference proceedings, social and stakeholder surveys, etc., which enumerate research and management priorities, as well as stakeholder values and perceptions. For instance, research recommendations and priorities developed annually by the Aquatic Nuisance Species Task Force (ANSTF) regional panels are an excellent source of stakeholder input. Stakeholders develop these research priorities to assist state and federal agencies with programmatic planning. NCCOS plans to use this resource more effectively in the future for cross-center planning in invasive species by improving the distribution of ANSTF information and products across the Centers.

NCCOS will continue to seek better ways to connect invasive species programming to stakeholder needs in a more systematic way. For example, through the efforts of the Center for Sponsored Coastal Ocean Research (CSCOR), NCCOS brought more structure to determining regional research priorities for its FY08 Regional Ecosystem Prediction Program, an extramural funding competition for place-based research, by conducting extensive reviews of existing assessments and reports. In total, NCCOS drafted nine "regional ecosystem research prospectuses" for specific areas in the United States, describing the priority issues for each. NCCOS plans to revise regularly these documents, keeping abreast of changes in priorities and needs.

While it is not currently within the scope of NCCOS' mission to engage directly in social research to assess stakeholder needs and priorities, NCCOS does acknowledge that in some cases existing sources of information do not sufficiently capture the needs of resource users and other stakeholders. In such cases, NCCOS recognizes the importance of engaging in social research itself. For example, through work at Center for Coastal Fisheries and Habitat Research (CCFHR), NCCOS is presently conducting a survey of fisheries managers and public health

professionals in 28 island nations in the Caribbean and bordering mainland countries to learn about their perceptions, practices, and needs related to ciguatera fish poisoning. Survey results will guide NCCOS' research program on the subject. Similarly, through CSCOR, NCCOS periodically conducts workshops populated with researchers, resource managers and other stakeholders, to ascertain stakeholder needs and priorities.

NCCOS will also work more closely with entities whose mandate explicitly includes the conduct of social research to assess stakeholder needs. For instance, NCCOS will strengthen its collaborative partnership with the NOAA Coastal Services Center (CSC) who routinely assesses stakeholder needs, regional issues and management priorities. For more information on how NCCOS plans to include stakeholders, see also the recently released *NCCOS Human Dimensions Strategic Plan* (HDSP) (enclosed). In particular, note:

- Objective 1.3, Societal Consequences of Policy and Management: Help resource managers and other coastal decision-makers anticipate the social, cultural, economic, and public health consequences of alternative actions and evaluate the consequences of actions taken.
- Objective 1.7, Socially Responsible Science: Consult appropriate human dimensions specialists to address societal and ethical questions that arise in the conduct and use of NCCOS science.
- Objective 1.6, Evaluation of Products and Services: Determine the effectiveness of NCCOS' products and services in promoting social, economic, and human health objectives.

1.4 Reviewer Recommendation:

- Conduct ongoing assessments to evaluate the relevance and value of existing projects and programs

NCCOS Response:

NCCOS agrees that relevance evaluations are a critical component of programmatic planning. Routine and increased inclusion of stakeholder recommendations, needs and priorities in program and project planning would force relevance evaluations on a more regular basis.

1.5 Reviewer Recommendation:

- Engage social scientists to develop human dimensions capabilities within NCCOS

NCCOS Response:

NCCOS agrees with this recommendation, as illustrated by Objective 4.1, Organizational Capabilities, of the *NCCOS Human Dimensions Strategic Plan (FY2009-FY2014)*, which reads:

“Build organizational capabilities needed to foster improved support for coastal decision-making by expanding NCCOS' science program to include an integral focus on human dimensions.”

NCCOS is developing specific plans to implement this objective in a *Human Dimensions Implementation Plan (FY2009-2014)*.

1.6 Reviewer Recommendation:

- Do a better job of branding products; highlight products of interest to the scientific community, decision makers and the general public

NCCOS Response:

NCCOS continually strives to effectively brand its products and to make these products more visible to the scientific community, decision makers and the general public. For example, NCCOS scientists regularly publish their research findings in the peer-reviewed literature, in conference proceedings and as NCCOS Technical Memorandums. NCCOS scientists also routinely attend professional conferences where they report on research products and findings. NCCOS also publishes the “Weekly Report”, which is a weekly, electronic newsletter reporting on the activities, products and events ongoing or completed at the NCCOS Centers and Headquarters. The Weekly Report has a wide circulation both within and beyond NOAA.

Despite these substantial efforts, NCCOS is committed to exploring new ways to promote its research products. NCCOS will work in FY09 to improve product branding in the area of invasive species by: 1) improving the content available on NCCOS’ Internet web pages; 2) writing press releases on invasive species issues and research; and 3) developing more effective methods to communicate NCCOS science to customers and other stakeholders. For example, CCFHR will increase the communication of information related to invasions of lionfish and *Didemnum* sp. to coastal managers and the public by increasing its web presence related to these issues, increasing the number of peer-reviewed publications and professional presentations and continuing outreach efforts to applicable user-groups.

1.7 Reviewer Recommendation:

- Regularly brief the ANSTF and the National Invasive Species Council on products and services

NCCOS Response:

NCCOS agrees that this is an important goal and, consequently, has already expanded its existing networks to link more closely with the ANSTF.

NCCOS staff scientist James Morris (CCFHR) serves as the NOAA Regional Representative for the ANSTF Gulf & South Atlantic Regional Panel, while staff scientist Thomas Greig (Center for Coastal Environmental Health & Biomolecular Research or CCEHBR) serves as the NOAA Regional Representative for the Mid-Atlantic Regional Panel. A NOAA Regional Panel Representative provides updates on NOAA research products and services to their panel during bi-annual panel meetings. Representatives of these panels then draft reports based on these meetings, which they provide directly to the ANSTF. Periodically, panel representatives make presentations before the ANSTF in person. For example, Mr. Morris recently provided a detailed report on the status of lionfish research during the FY2008 ANSTF spring meeting, held in Charleston, S.C.

As regional representatives, Mr. Morris and Dr. Greig also participate in quarterly meetings of the NOAA representatives to the ANSTF Regional Panels, convened by the NOAA AISP. During these meetings, they provide similar information to the NOAA AISP Program Management Team.

Mr. Morris was also recently invited to serve on the Research Committee of the ANSTF where he will represent NOAA by making recommendations to update the ANSTF Research Protocol, a requirement of the Non-indigenous Aquatic Nuisance Prevention and Control Act (1990). He will also help the Task Force engage managers, decision-makers and scientists in the identification of research and funding priorities, and opportunities for interagency coordination.

Finally, Dr. Gary Matlock (NCCOS Headquarters) is presently a member of the NOAA AISP Program Management Team, on behalf of the National Ocean Service, and attends weekly meetings through proxy. One member of the NOAA AISP Program Management is the NOAA liaison to the ANSTF, who reports directly to the ANSTF Co-Chair from NOAA. Thus, NCCOS is indirectly providing information and updates related to NCCOS invasive species to the ANSTF.

Using these established channels of communication, NCCOS will strive to make more direct and frequent briefings to the ANSTF on NCCOS' Center-wide invasive species services and products and will continue to look for new ways of communicating NCCOS science to the ANSTF.

1.8 Reviewer Recommendations:

- Encourage cross-Center, collaborative work; consider offering incentives for collaborations
- Conduct a one day workshop or annual meetings where Centers present their strengths and capacities for invasive species work, how they will collaborate and their central mission
- To bring about a more integrated invasive species program, more effective leadership will be needed at the Headquarters level, although this leadership should “make sense” and be incentive-based, not forcing integration where it is not appropriate
- NCCOS leadership might set aside funding specifically for collaborative science amongst the Centers

NCCOS Response:

NCCOS agrees that it should do more to support collaborative work amongst the Centers. However, NCCOS disagrees that funding incentives are an appropriate mechanism for achieving this synergy. Presently, allocation of money to the Centers is based on corporate planning. Moreover, historically, Congress has directed the allocation of NCCOS funds, which limits NCCOS' ability to create cross-Center pools of funding. Even if NCCOS possessed this flexibility, however, limited appropriations means that creation of such pools of funding at the Headquarters level would necessarily reduce Center budgets, possibly disrupting continuity of ongoing activities. Therefore, it is not in the best interest of NCCOS to embrace this approach to encourage collaboration.

However, NCCOS must do more to improve its internal coordination for both short-term and long-term planning. Presently the NCCOS NPD enables entry of projects only for the upcoming

or current fiscal year. In other words, as one fiscal year is closed, the next is opened. For this reason, principal Investigators do not currently undertake planning for the out-years in the NPD, which means that this information is not available to the person(s) responsible for drafting the Invasive Species TAP. This lack of information limits NCCOS' ability to document program planning within the Centers beyond the upcoming fiscal year.

To address this problem, NCCOS intends to create a mechanism to accomplish long-term planning in invasive species work at the program level, that is, internally, with the ability to adjust program components given short-term realities, such as budget. This activity will better coordinate NCCOS' invasive species program by highlighting potential areas of collaboration across the Centers.

The breakdown in the flow of information internally also makes participation in NOAA-wide planning difficult. Because NCCOS has to date done a poor job of coordinating its invasive species programming, neither has it effectively engaged the NOAA-wide matrix programs in the area of invasive species. With more effective planning internally NCCOS will be better positioned to infuse its coordinated invasive species program priorities into NOAA-wide planning through the PPBES.

1.9 Reviewer Recommendation:

- Revisit the definition of invasive species to make it more clear what does and does not constitute an invasive species [e.g., harmful algal blooms (HABs) and species that are not introduced but become 'invasive' due to other pressures and ecosystem changes]

NCCOS Response:

NCCOS follows a federal convention for use of the term "invasive species." An "aquatic nuisance species" is defined under federal law as "a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters" 16 USC 4701-4751 § 1003(1). Similarly, in Presidential Executive Order 13112 of February 3, 1999, an "invasive species" is defined as: "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (64 FR 6183-6186).

2.0 Program Priorities, Structure & Direction

2.1 Reviewer Recommendation:

- Inventory and mobilize the many capabilities across NCCOS more fully under a coordinated theme or purpose

NCCOS Response:

See Section 1.1, above.

2.2 Reviewer Recommendation:

- Efforts should be made to connect NCCOS program priorities more closely to the needs, priorities and end-points of clients, customers, stakeholders, decision-makers and resource-user groups by creating a systematic process for their inclusion
- Reach out more broadly than the coastal resource management community, to more effectively and productively include local resource users who have an interest in NCCOS research products and services

NCCOS Response:

See Sections 1.1 and 1.3, above.

2.3 Reviewer Recommendation:

- NCCOS should not package programs by species, rather it should use particular species to explore fundamental research questions related to invasive species

NCCOS Response:

NCCOS agrees that its invasive species programs should not be packaged by species, but should instead be organized by fundamental research questions. This is why NCCOS focuses programming in two general areas: monitoring/detection and the assessment of risks associated with the introduction of novel species. For example, since detection of the invasive lionfish, the first invasion of a marine fish in open-ocean, NCCOS has directed its investigations toward assessing the colonization and spread of lionfish, as well as the impact of this invasion on ecosystems and native aquatic communities. However, in light of the reviewers' comment, NCCOS agrees that it must more effectively communicate the relevance of its research projects and products to more fundamental research questions in the area of invasive species.

2.4 Reviewer Recommendation:

- Develop a two-way flow of information between NCCOS and clients, customers, stakeholders, decision-makers and resource-user groups, embrace “adaptive management”

NCCOS Response:

See also Sections 1.3 and 1.4, above.

2.5 Reviewer Recommendation:

- Determine how stakeholders in the field prefer information products to be packaged and delivered

NCCOS Response:

NCCOS agrees that it is important to consider the informational needs of its customers and stakeholders to better link information products to on-the-ground management needs. In all of its research, NCCOS presently strives to be aware and responsive to what information products our stakeholders need in the field, and how best these products should be packaged for maximum

usefulness and value. We will endeavor to improve our ability to better connect to our stakeholders in this regard. See also Sections 1.3 and 1.4, above.

2.6 Reviewer Recommendation:

- Specific recommendations about the direction in which NCCOS might move its research efforts in the future:
 - eradication/control
 - vector management (prevention), beyond ballast water
 - a rapid response capability for invasive species
 - taxonomy/identification of invasive species
 - contribute to the identification of species, donor regions and founder populations
 - focus on biogeographic assessments of invasive species
 - forecasting of “future scenarios” related to invasive species
 - integrate disciplines and stressors via the human dimensions angle

NCCOS Response:

NCCOS will consider these specific recommendations about the direction of its invasive species program as a part of its coordinated planning efforts. See sections 1.1 and 1.8, above.

3.0 Center-Specific Comments

3.1 Headquarters

3.1.1 Reviewer Recommendation:

- Avoid duplicating research and assessments already undertaken by other entities, such as with the “The Compendium of Invasive Aquatic Species in the Coastal and Great Lakes U.S.”

NCCOS Response:

NCCOS agrees, in general terms, that limited resources should not be expended on duplicative activities within or across research entities. This is why, when possible, NCCOS tries to coordinate with its partners and collaborators in the area of invasive species. As indicated previously, NCCOS is an active partner in the NOAA AISP and coordinates research programming closely with this entity. In this way, NCCOS leadership can be certain that research conducted within NCCOS does not overlap or duplicate other activities within NOAA. NCCOS also tries to coordinate and collaborate with outside entities, such as CAB International and the U.S. Department of Agriculture.

Having said the above, NCCOS also recognizes the potential value of using multiple methods to investigate similar issues, as this may provide new perspectives on a problem or solution. In other words, NCCOS endorses a triangulation approach to understanding the complexities of coastal and ocean issues, which may, at first glance, appear to be duplicative of former or existing efforts, but is not.

Addressing the reviewer’s specific example, NCCOS disagrees that the project, “The Compendium of Invasive Aquatic Species in the Coastal and Great Lakes U.S.” was duplicative of ongoing efforts to inventory and compile lists of aquatic species, or that it was intended to be so. Unlike existing efforts to compile lists of invasive species, NCCOS intended this project to focus on the economic and social impacts of such species. While some liken the manuscript to a general invasive species compendium without a substantial human dimensions component, NCCOS did not originally conceptualize the project in this way. The difficulty for project authors, reportedly, was a dearth of existing literature and data related to the social and economic impacts of aquatic invasive species. Admittedly, the lack of requisite information to complete the study as proposed should have been known prior to initiation of the project. Consequently, NCCOS agrees that it needs increased clarity when communicating its product needs to collaborators and vendors, and to pay more careful attention to the proposals and progress of external research that it is funding. In the future, NCCOS will require that Statements of Work include detailed research proposals, including surveys of applicable literature and discussions of project methods, and will request routine project reports and updates.

3.1.2 Reviewer Recommendation:

- When available, use staff within NCCOS to produce products and services, rather than contracting to outside entities

NCCOS Response:

NCCOS disagrees that all work produced by NCCOS should be completed by internal staff only. Very often, full-time staff people are not able to undertake new projects because of time or other constraints. Similarly, NCCOS may need a research question answered for which it lacks staff with the requisite knowledge, skills or expertise. In such cases, NCCOS relies on a variety of entities to enhance and augment its capabilities. It will continue to use a mix of resources, such as federal employees, contractors, university scientists, etc to expand its capabilities to meet the research needs of NOAA and the nation

3.1.3 Reviewer Recommendation:

- “The Integrated Assessment of the Potential for Further Invasion of the Marine Tunicate, *Didemnum Sp*” was a good idea and needed information, but it appears from the documentation and discussions that it was not the right way to go about getting the information. This document will need further revision prior to use as a model for future integrated assessments.

NCCOS Response:

The manuscript, “An Integrated Assessment of the Continued Spread and Potential Impacts of the Colonial Ascidian, *Didemnum sp. A*, in U.S. Waters”, was peer reviewed by persons working in invasive species research and programming within NOAA. The authors addressed the reviewer’s comments and recommendations to the satisfaction of the NCCOS leadership in Headquarters. NCCOS will publish the manuscript as an NCCOS Technical Memorandum.

3.2 Center for Coastal Environmental Health and Biomolecular Research (CCEHBR)

3.2.1 Reviewer Recommendation:

- Ensure availability of the National Benthic Inventory (NBI) and the genetic work that addressed tracking the source population of a species to coastal resource managers

NCCOS Response:

NCCOS agrees that the NBI should continue to be available to coastal resource managers. Presently, the NBI is an interactive web-based database on the diversity, abundance and distribution of benthic invertebrate species obtained from various ecological assessment surveys conducted in estuaries and coastal-ocean waters around the country by NCCOS and its partners. Coastal resource managers and the public may access this data at <www.nbi.noaa.gov>. NCCOS CCEHBR staff has begun coordination with Pam Fuller of the USGS NAS and Greg Ruiz of the Smithsonian Environmental Research Center (SERC) to initiate plans for linking the NBI with the online Non-indigenous Species Database Network (NISbase.org), which USGS and SERC operation jointly with support from the ANSTF. Successful implementation of database linkage will likely increase the availability and exposure of the NBI to coastal resource managers.

NCCOS agrees that genetic work tracking source population of invasive species is important and a potential capability of its Centers. While NCCOS currently has no formal program addressing genetic issues of aquatic nuisance species, NCCOS researchers have assisted coastal resource managers and scientists on a case-by-case basis to identify source populations of invasive species. NCCOS will continue to offer this service to its customers, and will consider this recommendation during the NCCOS-wide planning activity related to invasive species.

3.2.2 Reviewer Recommendation:

- Any tools that can be developed to assist law enforcement in making cases against illegal introductions or spread of invasive species would be of great merit

NCCOS Response:

NCCOS agrees that there is a need for genetic tools to support law enforcement in the context of invasive species. NCCOS will consider this recommendation during the NCCOS-wide planning activity related to invasive species.

3.2.3 Reviewer Recommendation:

- Is there coordination between CCEHBR and the Coastal Services Center (CSC) on the remote sensing of *Phragmites*?

NCCOS Response:

Yes, NCCOS' CCEHBR did coordinate with CSC and the University of South Carolina on research on *Phragmites*. Researchers successfully developed two models using remotely sensed data on habitat and water quality to predict colonization and probability for spread of the plant, once colonization occurs. An NCCOS CCEHBR staff member served as a committee member

for the graduate student conducting the research. NCCOS distributed the findings of this research throughout NOAA. CSC partially funded this research, along with the NERRS Program and Sea Grant. The graduate student, Dr. Sam Walker, and his USC faculty advisor, Dr. Dwayne Porter, who conducted the research are both actively involved in the U.S. Integrated Ocean Observing System (IOOS) with CSC (e.g. the Southeast Atlantic Coastal Ocean Observing System). Dr. Walker has made numerous presentations at national and international meetings on these findings, including presentations to NERRS site managers.

3.2.4 Reviewer Recommendation:

- Use existing capabilities in genetic and microbiological research for detection and to develop control tools

NCCOS Response:

NCCOS agrees that its Centers have capabilities in the area of genetic and microbiological research, and that these capabilities could be brought to bear on the development of tools for the detection and control of invasive species. NCCOS will consider this recommendation during the NCCOS-wide planning activity related to invasive species.

3.2.5 Reviewer Recommendation:

- Use existing capabilities to develop chemical control tools for coastal managers

NCCOS Response:

NCCOS agrees that it has the capability to develop chemical control tools for coastal managers in the area of invasive species. Presently, NCCOS responds to regional issues on invasive species control on an “as requested” basis when the management community feels it needs our marine ecotoxicological expertise. This approach ensures that NCCOS is responding directly to the management community and undertakes research on the highest priority issues for environmental managers. In addition, this ensures that our efforts have the greatest relevancy related to control methodologies, their safety and efficacy. However, NCCOS will consider this recommendation during the NCCOS-wide planning activity related to invasive species.

3.2.6 Reviewer Recommendation:

- Related to CCEHBR’s research into the reproduction and escape of the Asian oyster *Crassostrea ariakensis*, the Virginia Seafood Council, The Virginia Institute of Marine Science (VIMS) and others involved in this introduction should provide a substantial portion of the funding to develop the genetic and other techniques to permit independent monitoring of reproduction and spread

NCCOS Response:

NCCOS has no control over the funding allocations and budgetary priorities of either the Virginia Seafood Council or VIMS. Therefore, we cannot comment on how these entities should or could allocate their monies.

3.3 Center for Coastal Fisheries and Habitat Research (CCFHR)

3.3.1 Reviewer Recommendation:

- Do you have a plan for communicating lionfish dangers to fishers, SCUBA divers and the medical community?

NCCOS Response:

Yes, NCCOS developed the “Lionfish Coordinated Outreach Project” in partnership with Essential Image Source Foundation (EISF). This plan guides NCCOS’ efforts related to communicating the dangers of lionfish to at-risk communities, such as fishers and SCUBA divers in the Gulf and southeastern United States, Bahamas and the Caribbean. These communications are made using webpages, email and print publications issued to organizations and businesses. More recently, EISF is developing public service announcements (PSAs) and podcasts aimed at educating the medical community in the treatment of lionfish stings. NCCOS also educates the public generally by participating in interviews with journalists from magazines, newspapers and television. In addition, NCCOS CCFHR works directly with the Reef Environmental Education Foundation (REEF) Exotic Species program to educate REEF divers working in the South Atlantic and Caribbean about lionfish. Finally, through the efforts of NCCOS staff in CCFHR, information about the lionfish is available for inclusion in the South Atlantic Fishery Management Council’s first fishery ecosystem plan.

3.3.2 Reviewer Recommendation:

- Question about temperature tolerance –was this research accomplished with lionfish purchased from a store? You might want to do it again with wild fish to see if they are any different – as invasives often are

NCCOS Response:

This work was accomplished at NCCOS CCFHR using native (Indo-Pacific) lionfish purchased from the aquarium trade. NCCOS intends to continue laboratory and field studies of lionfish temperature tolerance in the Atlantic. It is likely that lionfish will adapt (via epigenesis or adaptive evolution) and that physical tolerances i.e., the critical minimum temperature, may change over time. NCCOS is currently engaged in research to describe the bioenergetic demands of Atlantic lionfish at temperatures of the South Atlantic and Caribbean and is assessing how these processes impact the biology and ecology of lionfish. This project will re-evaluate lionfish biology in regards to temperature limits and is scheduled for completion in FY09.

3.3.3 Reviewer Recommendation:

- A pilot removal project for lion fish is encouraged

NCCOS Response:

NCCOS scientists with CCFHR are investigating the movement (i.e., site fidelity) of lionfish off North Carolina and in the Caribbean. Preliminary results obtained by tagging lionfish in the Bahamas indicate that lionfish exhibit high site fidelity and are therefore susceptible to removal

techniques. NCCOS CCFHR is also obtaining estimates of lionfish recruitment rates to coral reef communities to determine the effort that would be required for effective control.

3.4 Center for Coastal Monitoring and Assessment (CCMA) & the Early Warning System (EWS)

3.4.1 Reviewer Recommendations:

- Discontinue or put on hold the EWS project until the “inherent problems with the program design” can be rectified
- Rather than directing additional funds to the EWS project (alternatives):
 - support expansion of USGS’ Nonindigenous Aquatic Species Alert System
 - build a geo-referenced baseline of information
 - do more monitoring for and detection of invasive species
 - partner much more strongly with others who do biological monitoring (such as the NERRS, NMSP, NBI, State of Texas, and the Southeast Area Monitoring and Assessment Program or SEAMAP) to consolidate existing data
 - redirect funds toward research on prevention and eradication
 - realign the EWS effort toward forecasting

NCCOS Response:

See section 1.2 for comments concerning EWS. NCCOS will consider recommendations about the direction of its invasive species research program during planning NCCOS-wide.

Center for Sponsored Coastal Ocean Research (CSCOR)

None

Center for Human Health Risk (formerly Hollings Marine Laboratory)

None

4.0 Comments and Recommendations on General Programmatic Components

4.1 Qualifications of Scientific Staff

4.1.1 Reviewer Recommendation:

- The only gaps in personnel and expertise noted by the reviewers were social scientists

NCCOS Response:

See HDSP Objective 4.1, Organizational Capabilities:

- Objective 4.1, Organizational Capabilities: Build organizational capabilities needed to foster improved support for coastal decision-making by expanding NCCOS' science program to include an integral focus on human dimensions.

4.2 Program Funding

4.2.1 Reviewer Recommendation:

- Because of resource limitations NCCOS should consider its programmatic priorities carefully

NCCOS Response:

NCCOS agrees that it should consider programmatic priorities carefully and will undertake planning. NCCOS will articulate a process whereby it will establish priorities and employ this process in future planning efforts.

4.3 Collaboration & Partnership

4.3.1 Reviewer Recommendation:

- NCCOS should undertake more cooperative interaction with USGS
- In the context of the EWS, NCCOS should dispense with territoriality and adopt a more collaborative stance with external entities

NCCOS Response:

As stated in the NCCOS Strategic Plan, Section 4.4, "NCCOS will expand reliance on effective partnerships." Therefore, NCCOS agrees that it should engage in collaborative interactions and partnerships with external entities, including the USGS, in the area of invasive species. NCCOS works to initiate, cultivate and sustain collaborative interactions with external partners, and will continue to do so. In the case of USGS, NCCOS is already attempting to support expansion of the Nonindigenous Aquatic Species Alert System with information compiled for the EWS.

4.4 Information Products

4.4.1 Reviewer Recommendation:

- Increase education and outreach components of invasive species research

NCCOS Response:

NCCOS agrees that education and outreach should be a component of its invasive species research whenever appropriate and practical. There is a NOAA-wide goal addressing the employment of outreach and education to achieve a well-informed public that will steward coastal and marine ecosystems. Within NOAA, NCCOS participates in the Ecosystem Research Program, one of whose goals is to strengthen the stewardship of NOAA-jurisdictional resources through outreach and education. Therefore, outreach and education is certainly within the scope of NCCOS' mission. Moreover, according to the NCCOS Strategic Plan FY2005-2009, Section 2.3, one goal of NCCOS is to strengthen the ability of coastal decision-makers to manage

resources through the “transfer of knowledge and tools from NCCOS research projects.” Therefore, NCCOS will endeavor to increase the number of invasive species research projects having an outreach and education component. However, NCCOS does have budgetary limitations that necessarily affect the nature and extent of its outreach and education. NCCOS is always searching for partners to help it develop outreach products and materials.

4.5 Human Dimensions

4.5.1 Reviewer Recommendations:

- To meet gaps in expertise in the social sciences, NCCOS should partner with NOAA’s CSC, the EPA or the Centers for Disease Control
- NCCOS should rely on the input of qualified staff who are versed in the social or anthropological sciences to assist researchers in the process of incorporating the human dimensions strategy into their work
- NCCOS should retain someone with anthropological experience to help NCCOS with its long term goal of integrating Traditional and Ecological Knowledge into research and management programs

NCCOS Response:

NCCOS agrees with these recommendations, as illustrated by the following objectives of the *Human Dimensions Strategic Plan (FY2009-FY2014)*:

- Objective 1.4, Traditional and Local Ecological Knowledge: Conduct community-based research documenting traditional and local ecological knowledge, facilitate its application to enhance coastal and ocean science and management, and equitably share benefits with local communities.
- Objective 4.1, Organizational Capabilities: Build organizational capabilities needed to foster improved support for coastal decision-making by expanding NCCOS’ science program to include an integral focus on human dimensions.

NCCOS is developing specific plans to implement these objectives in a *Human Dimensions Implementation Plan (FY2009-2014)*.

4.5.2 Reviewer Recommendations:

- Come to a consensus about what constitutes an Integrated Ecosystem Assessment, particularly as it relates to the conceptualization of the role of humans as both a driver of ecosystem change and a benefactor/victim of such changes—consider adoption of the conceptual framework used by the Millennium Ecosystem Assessment
- Consider critical aspects of the human dimensions of ecological change when setting research priorities and program goals, as well as in the articulation of individual research

NCCOS Response:

NCCOS agrees with these recommendations, as illustrated by the following objectives of the *Human Dimensions Strategic Plan (FY2009-FY2014)*:

- Objective 2.2, Integrated Ecosystem Assessments: Provide leadership among scientific, management, and other stakeholder partners to define, produce, and

facilitate the use of Integrated Ecosystem Assessments incorporating critical human dimensions information.

NCCOS is developing specific plans to implement this objective in a *Human Dimensions Implementation Plan (FY2009-2014)*.

4.5.3 Reviewer Recommendation:

- People should be incorporated into NCCOS' programs by including stakeholders, resource users and coastal managers in all aspects of NCCOS' research efforts, from the setting of priorities to, where possible, data collection

NCCOS Response:

See Sections 1.1 and 1.3, above.

4.5.4 Reviewer Recommendation:

- With limited financial and human resources, is it feasible to draw on the broader implications of the link between ecosystem change and humans? There should be clarity in developing and understanding this important link, broadening the scope of what NCCOS implies and considering what NCCOS can feasibly undertake

NCCOS Response:

NOAA recognizes the link between humans and ecosystems, as evidenced by its definition of the term ecosystem, which reads: "An ecosystem is a geographically specified system of organisms, the environment, and the processes that control its dynamics. Humans are an integral part of an ecosystem" (NOAA's Strategic Plan FY 2006-FY 2011, p.3). NCCOS recognizes this linkage as well, as demonstrated by the *Human Dimensions Strategic Plan (FY2009-FY2014)*.

4.5.5 Reviewer Recommendation:

- Is the NCCOS mission statement too broad and inclusive? How does the mission for each center fit into the NCCOS overall mission – are these goals too dispersed and not cohesive enough? NCCOS' four strategic goals address the natural and social aspects of ecosystem management

NCCOS Response:

NCCOS has just completed a reorganization, which includes new mission statements for each of the Centers. NCCOS is also in the process of revising its strategic plan. NCCOS will consider this recommendation in the context of that revision process.