

NOAA Response to:

FINAL REPORT

The External Review of NOAA's Ecosystem Research and
Science Enterprise

A Report to the NOAA Science Advisory Board

**Evolving an Ecosystem Approach to
Science and Management Throughout
NOAA and its Partners**

July 25, 2006

by the
NOAA Internal Ecosystem Task Team

31 October, 2007

Introduction

As a result of an external review of NOAA's research programs¹, the Agency was encouraged by its Science Advisory Board (SAB) to undertake further parallel reviews of its ecological and physical science portfolios. Based on this recommendation, terms of reference were developed for an External Ecosystem Research Task Team (EERTT), an external panel selected via Federal Register call, and the final EERTT report submitted to NOAA in July, 2006. Their report "*Evolving an Ecosystem Approach to Science and Management Throughout NOAA and its Partners*"² provides a comprehensive set of 17 recommendations to NOAA for addressing its future scientific products and services and internal organization and collaborations in meeting its living marine resource and coastal program mandates. The report calls for affirmative NOAA leadership in the transition to ecosystem approaches to the management of ocean and coastal resources and human activities that influence them.

This document provides an overview of efforts undertaken to date to address the EERTT recommendations and a path forward to achieving the end state envisioned by the external review. It includes notional timelines and recommended structures for addressing outstanding recommendations, particularly where legislative or resource (financial) constraints preclude immediate adoption. While the Internal Ecosystem Task Team (IETT³) was formed primarily to provide an implementation plan for the EERTT recommendations, NOAA has since undertaken a series of decisions that essentially adopted some and furthermore has formed internal structures to implement them. Therefore, this report represents a combination of recommendations to NOAA regarding the eventual implementation of some EERTT recommendations, and a progress review of ongoing implementation of others.

Agency leadership and its internal institutions (e.g., boards, committees, mission goals and line offices) have been sorting through the various recommendations of the EERTT to develop approaches to implementing those that are consistent with its internal goals (especially considering the interests of its stakeholders and partners) and abilities given finite resources available to accomplish all of its diverse missions. Based on the ongoing dialog between the SAB and NOAA, there have been a variety of activities undertaken since the completion of the EERTT report that address, either entirely or partially, some of the key recommendations. Progress on implementing some of the policy and product oriented recommendations has been substantial, and is described herein. While many of the planning and visioning activities sought in some of the recommendations have been completed, a number of the recommendations involve reprogrammed or new resources to

¹ NOAA Research Review. 2004. (<http://www.sab.noaa.gov/Reports/Reports.html>): "...NOAA should establish an external Task Team to evaluate and strengthen the structure and function of ecosystem research in, and sponsored by, NMFS, NOS and OAR."

² External Ecosystem Research Task Team Report: *Evolving an Ecosystem Approach to Science and Management Throughout NOAA and its Partners*
http://www.sab.noaa.gov/Reports/eETT_Final_1006.pdf

³ Internal Ecosystem Task Team members: S. Murawski, (chair) P. Ortner (vice-chair), G. Matlock, K. Koch, M. Holliday, M. Gelman, E. Cornellier, M. Ford

achieve them. In a number of cases, NOAA's planning structure (e.g., its Planning, Programming, Budgeting and Execution System, or PPBES) has adopted EERTT recommendations which will be executed beginning in FY-2008 and beyond. Thus, NOAA is transitioning from planning for, to realizing a number of the key outcomes raised by the Team. Other recommendations, particularly those involving changes in organization or structure, require specific decisions by the Line Offices Boards and Councils, including NOAA's Executive Committee (NEC), comprised of its most senior leadership.

Over the last year, NOAA has provided several updates to the SAB on progress in implementing these recommendations, and SAB feedback has been helpful in prioritizing these efforts. For example, at the August 2007 SAB meeting, members encouraged NOAA to increase the level of dialog with stakeholders, clients and partners on the implementation of these recommendations to achieve shared goals and complementary approaches to achieving them. In reaction to this dialog, outreach efforts have been increased.

Implementing the recommendations of the EERTT requires, in some cases, substantial change in NOAA's programs, and closer integration between its entities (for example the production of integrated ecosystem assessments by multiple line offices working together towards a common set of products). **In order to assist NOAA leadership in moving to a more holistic ecosystem focus for its ocean and coastal mandates, NOAA proposes, within its FACA authority that the SAB form an external Ecosystem Science Working Group to provide ongoing dialog, enhance communication with external partners and stakeholders and to provide a sounding board for proposals to enhance the delivery of science supporting ecosystem approaches to management.**

Below we provide a synopsis of the recommendations of the EERTT, progress to date in NOAA's response to each, and comments and recommendations on the path forward and timing associated with recommendations not yet fully considered. In all cases recommendations on appropriate entities within NOAA are identified as appropriate to respond.

NOAA leadership is committed to harmonizing its statutory missions across its Line Offices, Goal Teams and internal coordination mechanisms to meet the rapidly evolving need for more integrated, timely and responsive information and decision support tools to meet its strategic goal to "*Protect, Restore, and Manage the Use of Coastal and Ocean Resources through an Ecosystem Approach to Management*". The EERTT has recommended an important set of milestones, products and approaches to achieve that goal.

Recommendations of the EERTT and Summary of Progress to Date

The 17 recommendations of the EERTT focus primarily in broad three areas: (1) integration of NOAA's ecosystem sciences across its structure and mission themes, (2)

organization of NOAA's capabilities for effective and efficient delivery, and (3) expansion of resources and capabilities necessary to meet the expanded mission envisioned in the report. Of course, all of these areas are linked, and, taken together, provide a vision for NOAA substantially different from what exists today. NOAA's challenge is then to provide a path forward to accomplishing the mission areas it currently has and those outlined in the report, while building the organizational structure that supports better integration among the entities responsible for various functions. In some cases, the expansion of mission, the development of additional resources, and better integration are underway. This section provides a synthesis of the recommendations and NOAA's responses regarding work underway and additional resources and tasking to evaluate them.

The EERTT recommendations are as follows (in some cases context setting text is included for clarity):

RECOMMENDATION 1. NOAA should develop an explicit description, based on current knowledge, of what it sees as adequately "ecosystem rich" assessments and advice for the current products of its ecosystem science enterprise.

RECOMMENDATION 2. NOAA should prepare an "ecosystem development plan" for its assessment and advisory activities within each Region. These plans would lay out the major incremental steps foreseen for increasing the ecosystem content of these activities, and the expected timelines, in a proactive but not proscriptive manner.

RECOMMENDATION 3: When the regional "ecosystem development plans" are completed, they should be assembled into an overall vision of where NOAA ecosystem services and science are going nationally. This consolidated plan should be an informative basis for analysis of gaps, redundancies, and synergies and provide insights into the similarities and differences in what the LOs see as "the ecosystem approach". There is little cause to expect that incremental but independent development of component specific assessments and sector-specific advice will converge on a consistent view of ecosystem status and dynamics, and provide all the information that each management sector needs to know about the activities and effects of the others. Some form of integrated priority setting and Integrated Ecosystem Assessment at regional scales will be a necessary step as NOAA and its partners move to an ecosystem basis. They will not emerge from separate LO activities; they have to be planned and produced as an activity in themselves.

RECOMMENDATION 4: NOAA's Ecosystem Goal Team should lead and participate in the development of Integrated Ecosystem Assessments (IEAs) for all ecosystems in which NOAA has a statutory or trust responsibility. Where possible, NOAA should use multi-agency venues, including its participation in the Integrated Ocean Observing System (IOOS), to foster the production of IEAs. Integrated Ecosystem Assessments and Integrated Management approaches are inherently spatially based. This will require some re-orientation of classical fisheries assessments, which usually gave little attention to spatial pattern within the range of the stock being assessed. IEAs must work from the spatial area of interest, assessing the populations, physical/chemical systems, human activities, and the corresponding interactions among these at the specified scale. An assessment may still estimate the status and trends of selected ecosystem components, such as exploited populations, but the integrating aspect of the assessment is the area wherein the ecosystem components interact. Not only must IEAs consider relationships

and patterns of ecosystem components on region scales, but they must be designed so finer-(and occasionally larger-) scale resolution of trends and interactions can be extracted when needed to address issues such as local depletion of fish populations, effects of human activities on corals, interactions of fisheries with protected species, and coastal or estuarine effects of human activities.

RECOMMENDATION 5: NOAA leadership should commit to supplying ecosystem-science support on a regional basis. This will require collaboration between LOs and other agencies to coordinate science and management activities in several sectors. As a preliminary step, NOAA should organize a forum for all LOs, federal, state and local agencies concerned with, or able to support, coastal and marine management, regulation and policy, as described in Section VI.D. Objectives would be sharing information and plans, developing a common scientific basis for management, and building cooperation between organizations.

RECOMMENDATION 6: NOAA should specify that the eight regional ecosystems it has defined should be the starting points for coordinating regional ecosystem science and assessments. These ecosystems have direct correspondence to the Fishery Management Council activities, which NOAA must continue to support as one of its primary responsibilities, and have adjacent NOAA facilities that can provide centers for coordinating preparation and dissemination of IEAs.

RECOMMENDATION 7: NOAA must formally structure those partnerships that are important to the science capability to perform regional integrated ecosystem assessments, in order to ensure that all partners are accountable for their contributions to the assessments, and that the integrity of the science content is assured.

RECOMMENDATION 8: The Ecosystem Goal Team should lead all LOs and Goal Teams in developing a national plan for an expanded regional ecosystem monitoring capability. For example, expertise within the Climate Observing System should be exploited to develop improved sustained observations of ocean climate variability that affects ecosystems.

RECOMMENDATION 9: The NOAA social science plan should specify more comprehensively what social science monitoring data are required for managing human activities that affect, or depend on, the use of marine ecosystems, and develop a strategy to ensure such data are available.

RECOMMENDATION 10: NOAA should develop a national plan to archive, organize, and distribute all the types of data needed to track, forecast and understand change in regional ecosystems. Starting from now-separate managed-species and climate data, effort should be made to gather and organize existing socio-economic data collected by all sources, observations of unmanaged species and inter-species interactions made by NOAA and others, and all available descriptions of habitat.

RECOMMENDATION 11: The capabilities to analyze status and trends in populations, habitats, and human activities need to be sustained and expanded at the regional scale.

RECOMMENDATION 12: NOAA should expand capacity in forecasting trajectories of ecosystem components under different hypotheses for environmental and anthropogenic forcing and in linking these forecasts to potential consequences for resource users, coastal residents, and management options.

RECOMMENDATION 13. NOAA and its partners in the ecosystem science enterprise should develop or designate Centers of Specialized Expertise to:

1. build new tools for modeling and forecasting, and new observation instruments;
2. develop social science capacity for linking with ecosystems governance;
3. develop an understanding of society and its response to changing ecosystem components;
4. identify changes in ecosystem structure and function;
5. quantify effects of human activities on the ecosystem.

This list is meant to be indicative of some critical areas that occurred to the Committee and is not exhaustive. Other Centers could be developed, should additional needs become apparent as the Recommendations in this Report are implemented.

RECOMMENDATION 14. NOAA should consider whether consolidation of efforts should occur and should develop plans for efficient regional and inter-regional coordination in the following areas:

1. technical analyses on contaminants and toxicology;
2. biodiversity and taxonomy;
3. data archiving and integration.

RECOMMENDATION 15. NOAA should develop a series of Regional Ecosystem Science Boards consistent with the eight national regional ecosystems identified by the EGT plus the Antarctic. Each of these regional boards should be chaired by an SES-level manager, and include formal representation by all LOs providing ecosystem sciences in that regional ecosystem.

RECOMMENDATION 16. The PPBES process, supported by the EGT, should identify and adopt timelines for both annual and multi-year planning, considering particularly the sequencing of timeframes for planning and coordinating of scientific research across LOs within Regions. The timelines should facilitate coordination among NOAA entities and their partners for ecosystem science and research, particularly at the regional scale (IV) and relative to the activities of the national centers (V). The EGT should have a key role, in collaboration with the RESBs, in developing a common set of objectives for all regions, a set of guidelines for the IEAs, and **regional charters** for the operations of the RESBs. These charters would recognize the need to have common approaches to operations for all regions but differences that reflect the regional marine environment, resources, cultures and preferences. The RESB charters would identify the tasks and contributions of each LO and how the regional ecosystem science enterprises would link to other NOAA goals, such as Climate and Weather. Each Charter would also identify partnership arrangements with CI/JI, Regional Associations, IOOS, and federal and state agencies with interests contributing to NOAA's missions. The NOAA EGT, RESB leads, and selected experts would also develop an initial set of guidelines for development of IEAs, outlining common elements in each regional IEA, with the expectation that the RESB would adjust the IEA to regional conditions.

The Ecosystem Goal Team also would serve as a support and coordination mechanism for the RESBs. The EGT would convene regular meeting of the leads from each of the eight RESBs to compare approaches, coordinate needs for expertise and support from the Centers of Expertise and other regions, discuss how to solve common problems, and share lessons learned.

RECOMMENDATION 17: Fund the preparation of the IEAs and other key ecosystem science products through a process that is competitive among teams of LOs and partners.

Cooperation among different LOs and partners in the ecosystem science enterprise will be facilitated by the need to produce IEAs as a common priority, requiring input from the diverse expertise within each Region. The IEAs are the cornerstone for NOAA to maximize efficiencies and synergies in providing a single integrated science product from

which advice and support to different management and policy clients can be derived, and they provide a practical focus for promoting an integrated NOAA ecosystem science enterprise. However, IEAs will demand resources to produce. To succeed as a key activity for integrating across LOs, the work must be perceived as an opportunity for obtaining resources, not as yet another unfunded mandate added onto the LO responsibilities. We envision that each Regional Ecosystem Science Board will develop a program to meet to its regional science and management needs. This program will identify key services that could be provided by various LOs and programs within NOAA, and each Board will solicit LO participation through a competitive proposal process. Each Board will evaluate the responses from LOs and program elements to assemble an integrated program. As the programs are implemented, regular reviews and progress assessments will be conducted for each regional science/management plan.

These 17 recommendations, taken together, fall into four broad areas, roughly: (1) regionalization of NOAA’s ecosystem services and coordination in their delivery, (2) emphasis on Integrated Ecosystem Assessments (IEAs) as a product line for NOAA, (3) expansion and coordination of ecosystem science and monitoring to support IEAs and the ecosystem mission in general, and (4) organizational issues as they relate to the efficiency of service delivery. Below we bin the recommendations into these four categories and provide an overview of progress related to each, to date. Additionally we outline the decisions yet to be made and provide recommendations for further progress in each category:

Regionalization:

Recommendation	Progress to Date	Responsible Parties
<p># 5 Provide ecosystem science support on a regional basis</p> <p><i>Recommendation: Partially Accepted, as NOAA is increasingly collaborating among LOs regionally. More formal mechanisms for regional collaboration are pending decision regarding the most appropriate internal structure for doing so</i></p>	<p>NOAA Executive Oversight Group (EOG) formed and has designated regions (nearly identical to the 8 Large Marine Ecosystems [LMEs]) and regional teams to integrate across LOs to accomplish shared objectives not only in ecosystems but all of NOAA’s mission areas Work of regional teams continues to evolve. Some LOs already have regional structures which may facilitate recommendation</p>	<p>EOG, Ecosystem Goal Team, Line Offices, Regional teams</p>
<p>#6 Specify Eight Large Marine Ecosystems (LMEs) as a starting point for regional ecosystem science and integrated assessments</p> <p><i>Recommendation: Accepted</i></p>	<p>The 8 LMEs were used as a starting point in planning by the EGT, the EOG in establishing NOAA’s regional teams, and by the IEA Priority Area Task Team (PATT) in envisioning a system of integrated ecosystem assessments</p>	<p>EOG, EGT, IEA PATT, Line Offices</p>
<p>#15 Develop regional ecosystem science boards</p> <p><i>Recommendation: Pending the establishment of an</i></p>	<p>Recommendation not yet adopted as formal NOAA structure. Regional-based LOs have mechanisms for regional science integration, but no consistent mechanisms across them,</p>	<p>EOG, Regional teams, LOs</p>

<i>appropriate regional oversight structure</i>	cooperative institutes, Sea Grant, etc. Some cross LO coordination does now occur at the regional level (e.g., between OAR labs and Fisheries Labs, etc.). OAR (Sea Grant) is now conducting a series of regional science needs workshops, and the future of the Ocean Research Priorities Plan may include ongoing regional input in priority setting	
#2 Prepare ecosystem development plans for each region <i>Recommendation: Pending the establishment of accountability mechanisms</i>	Recommendation not yet implemented due to the lack of a consistent regional entity responsible to undertake regional planning. NOAA's regional teams may ultimately be able to undertake such activities or coordinate them, but Regional Teams are essentially unfunded, and are primarily providing coordinating functions	LOs, Regional teams, EGT?
#3 Based on development plans, create vision for ecosystem services and science <i>Recommendation: Partially Accepted, national vision for NOAA ecosystem services articulated in the EGT FY10-14 Program plan</i>	EGT responsibility with LOs and regional entities (regional teams?) to create national vision. EGT has provided corporate vision for ecosystem development, but regional implementation may be substantially varied given the mix of issues. LOs and regional entities need to provide focus and details	EGT, LOs, Regional Teams, PATT
#16 PPBES to adopt timelines for multi-year planning for research across regions <i>Recommendation: Accepted: EGT has provided timelines for the adoption of ecosystem science support in FY-2010-2015 PPBES cycle</i>	The EGT has proposed in the FY-2010-2014 cycle a number of regional efforts requiring multi-year planning for research. These include the IEA pilot activities, the Caribbean initiative, climate and ecosystem issues such as acidification and phenology networks and other issues.	EGT, PPI, PA&E

The EERTT recommendations for a regional focus for progress in ecosystem science are a fundamental consideration for progress in integrated ecosystem science. Ecosystems are inherently geographically based, and thus coordination must be at the appropriate scale and involve the relevant subset of disciplines across NOAA to be relevant. The NOAA regional teams have been developed in concept to bridge the gap between regional distributed capabilities across all of NOAA's mission areas, and the need to coordinate them. Since these regional teams are new, and are not a permanent structure within NOAA, tasking them to undertake such a specific recommendation to develop regional science plans is premature. Nevertheless, if NOAA is to undertake better coordination of ecosystem science regionally, there needs to be in place some structure for doing so.

In the case of the integrated ecosystem assessments (see below) it is vital to coordinate both nationally and regionally (at the scales for which IEAs are being

developed) to avoid duplication and to provide ongoing coordination, tasking and product development. The pilot IEA activities require this coordination among regional entities of NOAA, and in several cases the appropriate entities across line offices have been working together (e.g., PMEL and the Alaska Fisheries Science Center coordinating on regional IEA activities for Alaska waters). Additionally, some of the regional teams have expressed interest in being the focal point for the development of regional IEAs (e.g., the Gulf of Mexico regional Team). Without a responsible regional entity in place, the development of credible NOAA regional ecosystem plans cannot occur, and finding the appropriate mechanism for doing so remains the outstanding challenge to NOAA. Additionally, while different ad hoc mechanisms may be found to prepare these plans, if they are not consistent across regions, then it will be difficult to resource them and provide ongoing syntheses of the gaps and progress relative to performance metrics. The EGT has recognized this in the development of its IEA proposals for 2010-2014 pilot activities.

The key issue to resolve within this area remains the specification of a consistent regional coordinating mechanism for ecosystem research (which may lead to collaboration in ecosystem management, by extension). By doing so, regional plans, coordination of IEAs, and advocacy for regional science needs would potentially be accomplished. In order to make such planning an ongoing activity, some permanent regional ecosystem structure needs to be developed and implemented by NOAA. This may happen as a result of the maturing of NOAA’s regional teams, but more likely will require more specific direction to do so.

Integrated Ecosystem Assessments

Recommendation	Progress to Date	Responsible Parties
<p>#1 Develop an explicit description of an adequate ecosystem assessment</p> <p><i>Recommendation: Accepted/Completed</i> <i>The Integrated Ecosystem Assessment Priority Area Task Team’s white paper and the EGT’s Strategic Investment Question outline the scope and requirements for adequate ecosystem assessments</i></p>	<p>Program Area Task Team (PATT) designated to develop the concept, and coordinate efforts between regional entities and the EGT; Definition of IEAs complete, white paper published by PATT; Strategic Investment Question paper developed as a part of the 2010-2014 program plan development; support in the 2009-2013 NOAA and DOC budgeting</p>	<p>EGT, IEA PATT, LOs</p>
<p>#4 EGT to lead IEA development for all ecosystems for which NOAA has a statutory or trust responsibility</p> <p><i>Recommendation: Partially Accepted:</i> <i>The EGT and the PATT have provided overall vision, as well as priorities for pilot programs with appropriate collaborations. LOs will execute the</i></p>	<p>PATT designated to develop concept of IEAs for a consistent NOAA view, ongoing coordination among PATT, regions and EGT; Progress in implementing IEAs noted above; IEA focus group in EGT developed pilot programs for California Current, Alaska and Northeast; regional ecosystem coordination mechanisms important to ongoing accountability;</p>	<p>PATT on IEAs, EGT,</p>

<i>programs.</i>	IOOS program has provided startup financial support in California Current	
#17 fund the preparation of IEAs through a competitive process <i>Recommendation: Partially accepted</i>	The EGT has proposed the funding of IEAs in outyear budgets for NOAA. The budgeting of IEAs is complex due to the differing regional participation of various NOAA entities. In particular ecosystem research and decision support tool development is amenable to competitive funding, but ongoing monitoring requires sustained investments to a consistent set of NOAA or other regional entities, particularly where trust resources are involved.	EGT, PATT, LOs
#7: Formally structure those science partnerships important to IEAs to ensure accountability <i>Recommendation: Partially accepted, partnerships developed for IEA pilot programs, but final decisions pending FY-09 resources for conducting the IEA program</i>	As noted in the response on regionalization, the key unmet need supporting IEA development and coordination is the specification of responsibilities at the regional level for doing so	EGT, LOs, NOAA Leadership, federal agency ocean science coordinating entities, state partnerships, international coordination (in some cases)

The concept of integrated ecosystem assessments as a focal area for NOAA, originally introduced by the EERTT, has already been embraced by NOAA in a number of venues. The creation of the Priority Area Task Team (PATT) on IEAs explicitly recognized the importance of the concept as a way to organize and integrate NOAA ecosystem science into a product area that can add value to existing science and management efforts. As well, the preparation of IEAs provides an important and concrete venue to collaborate with local, state and other federal partners, and to provide a foundation for the scientific support needed to realize ecosystem-based management. The IEA white paper and strategic investment question responses provide significant details on how IEAs can be implemented within NOAA at various mission specific scales, and addressing the range of ecological, socioeconomic and regulatory support missions relevant to NOAA's ecosystem obligations.

An Integrated Ecosystem Assessment is defined as “a formal synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human factors in relation to specified ecosystem management objectives.” It brings together citizens, industry representatives, scientists, and policy makers through formal processes to evaluate a range of policy and/or management actions on difficult environmental problems. An IEA provides an assessment of baseline conditions and identifies important stressors to the system. It also delivers ecological forecasts and scenario developments under changing ecosystem conditions as well as different management actions. IEAs are an emerging concept under development in the USA, and elsewhere in the world. While our concept shares many attributes with related efforts, NOAA's IEA concept, if implemented as outlined here, will be more comprehensive, complete and useful over a broader constituency than any previous efforts.

The primary objectives of the IEA are to:

- Identify key management or policy questions
- Assess status and trends of the ecosystem
- Assess the environmental, social, and economic causes and consequences of these trends
- Forecast ecosystem responses to climate change
- Forecast likely ecosystem status under a range of policy and/or management actions
- Identify crucial gaps the knowledge of the ecosystem that will guide future research and data acquisition efforts” (source: NOAA’s IEA PATT white paper)

Clearly, various NOAA elements have embraced the IEA concept, and thus the key focus now is to provide a pathway for resources to flow to the executing entities, and to maintain sufficient national to regional coordination to develop the concept so that there is consistency in implementation among regions, local pilots, and the national overview. Importantly, different NOAA entities desire to produce IEAs on scales relevant to their management authorities (e.g., local place-based, regional, basin wide). The hierarchical model developed by the IEA PATT and EGT allow this flexibility while focusing on a consistent set of IEAs for reporting and synthesis purposes. Consistency is important in order for NOAA to develop appropriate performance measures, and particularly so that NOAA and cooperators can provide a hierarchical level of reporting – leading to the ability to provide a national overview on the status of marine and coastal ecosystems of the United States. While there has been consistent support within NOAA and the Department for the production of IEAs, it remains to be seen if new resources can be found to assist in their production. As many entities have noted, simply redirecting resources from high priority data collection activities within particular sectors (e.g., resource surveys) will not allow meaningful progress in the integration among these activities. Some NOAA programs (notably IOOS) have stepped forward to provide temporary funding to support pilot activities (e.g., in the California Current) that show great promise. Other efforts are underway in a variety of areas including Alaska, the Northeast, Chesapeake Bay, and the western governors have identified IEAs and a goal to facilitate ecosystem health initiatives there.

Two key issues remain for NOAA in realizing the goal of producing coordinate and hierarchical IEAs as a mission-oriented product line: (1) sufficient resourcing, and (2) consistent regional to national coordination necessary for accountability and consistency. As noted in the answer to the first set of recommendations on regionalization, the development of a consistent regional ecosystem science structure will serve the latter function. Resourcing the production of IEAs (and their five key elements, see below) will require consistent and sustained vision, advocacy and support from NOAA’s line offices, programs and executing entities.

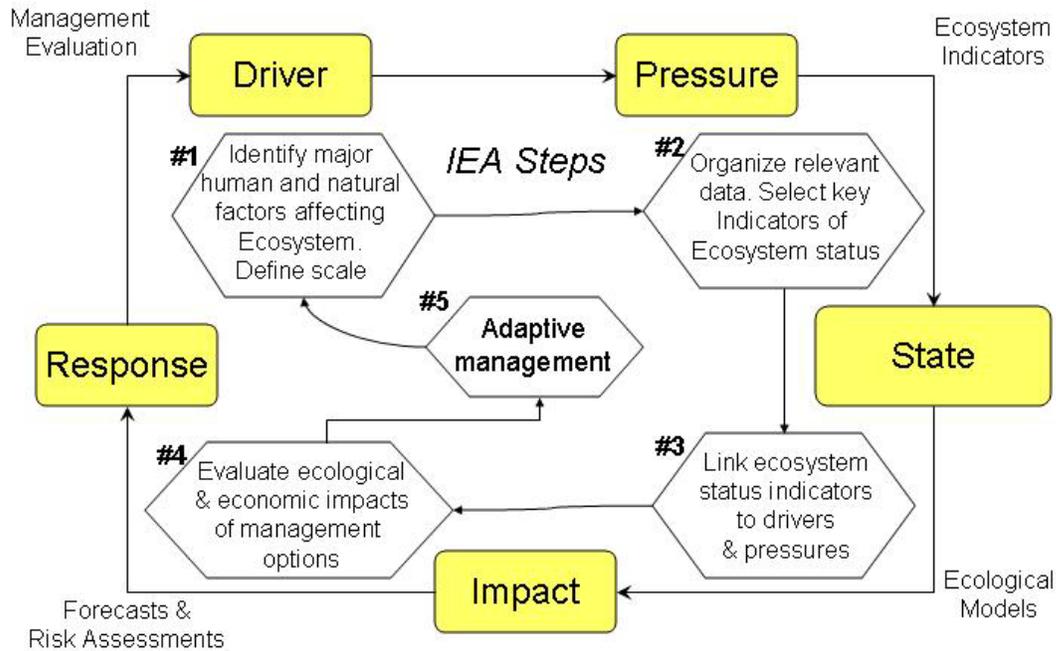


Figure 1. NOAA's Model for Integrated Ecosystem Assessments:

Drivers are considered large-scale anthropogenic and earth system phenomena that act through specific pressures to influence ecosystems. Examples of drivers include the increasing demand for seafood, increased human populations and their disproportionate migration to coasts, and long-term climate change affecting the atmosphere and oceans.

Pressures are the specific agents acting as a result of the drivers that affect ecosystems. For example, increase demand for seafood drives fishing effort, prices and imports. Increasing human populations at the coasts generate higher levels of pollution and result in lower habitat quality, and global change may result in warmer temperatures and less sea ice.

States are various measures of current ecosystem conditions, such as the number of fishery stocks that are overfished, the average nutrient loads in coastal waters and the average water temperatures. Often these state variables are measured relative to some management imposed standards (e.g., through various laws).

Impacts are the consequences of the observed state of the system usually expressed in human terms such as total net benefits (or those foregone when ecosystems are degraded). They can also be expressed in other currency such as jobs, recreational opportunities and other impacts humans care about. We envision IEAs to incorporate a risk assessment module to evaluate the risks and consequences of not meeting prescribed management targets as articulated in the selected set of state variables.

Last, the *response* part of DPSIR evaluates how the ecosystem state variables respond to the various management actions implemented. By iterating this model it is possible to build an empirical and modeling-based understanding of how the ecosystem responds to human pressures and to support adaptive learning and management schemes that achieve ecosystem objectives. (source, NOAA's IEA Strategic Investment Question paper)

Ecosystem Science & Monitoring

Recommendation	Progress to Date	Responsible Parties
<p># 8: Develop a national plan for expanded regional ecosystem monitoring</p> <p><i>Recommendation: Partially accepted. The IOOS strategic plan is developing in stages concentrating on 5 key variables. The IEA program focuses on observations relevant to key indicators for policy-relevant questions. Taken together they form a consistent plan for ecosystem monitoring</i></p>	<p>The full implementation of the IOOS strategic plan considering its 21 key variables envisions a consistent strategy for NOAAs integrated ocean observing investments. The plan includes requirements from the various NOAA mission goals (such as EGT and Climate), and NOAA's line office priorities. The production of consistent regional IEAs will identify observing gaps, as will conformance with NOAA's statutory responsibilities (e.g., fish and protected species monitoring, incorporation of nearshore, offshore and appropriate watershed data, and appropriate onshore and climate variables). Additionally, regional ecosystem science committees and LOs, as appropriate, should prioritize broad-scale oceans observations for some near-term assessments/demonstrations of the impact of ocean climate variability on ecosystems, in conjunction with the Climate Program Office.</p>	<p>IOOS program office, EGT, Line Offices</p>
<p>#11: Sustain and expand regional capabilities to analyze status and trends in populations, habitats and human activities</p> <p><i>Recommendation: Partially accepted. The FY-12010-2014 program plans for EGT provide strategies to maintain and in some cases expand regional capabilities to provide relevant biological and socioeconomic data required for ecosystem management</i></p>	<p>Individual capabilities are primarily now the responsibilities of individual line offices. In the future, IEAs at regional levels will identify gaps. NOAA PPBES will prioritize investments</p>	<p>EGT, LOs, Regional Teams</p>
<p>#9: Specify in NOAA's Social Science Plan which data are required and develop a strategy to use them</p> <p><i>Recommendation: Accepted: NOAA's Research Council maintains a Social Sciences Committee which provides, on an ongoing basis, input in the development of NOAA's data and analysis capabilities for social sciences.</i></p>	<p>Social Science WG of SAB and NOAA's research Council have identified recommendations for these investments. Strategies for social science data acquisition lie with EGT Program managers</p>	<p>EGT Programs, LOs, Research Council, Social Science Team in RC</p>
<p>#12: Expand capacity in ecosystem</p>	<p>Under NOAA's IEA proposals,</p>	<p>EGT, LOs,</p>

<p>forecasting under different environmental and anthropogenic forcing scenarios, and link to consequences for resource users</p> <p><i>Recommendation: Accepted. NOAA has committed (pending resources) to increase its capacity to provide modeling and forecasting capabilities supporting IEAs. Increased forecast ability will come from focusing extramural programs, implementation of near-term priorities of the Ocean Research Priorities Plan, and strategic investments proposed by the EGT supporting IEAs.</i></p>	<p>expanded forecasting and modeling capabilities are a key priority. The EGT has identified this in the 2009 and 2010 program plans. Additionally two near term priorities under the Ocean Research Priorities Plan address increased ecosystem modeling and forecasting capability. The Environmental Modeling Program in PPBES is considering expanded support for ecosystem modeling.</p>	<p>EMP</p>
<p>#10: Develop national plan to archive/distribute data</p> <p><i>Recommendation: Accepted</i></p>	<p>The IOOS development plan includes a critical element to develop an overall NOAA set of standards and consistent archival program. Additionally, the regional IEA efforts will benefit from NESDIS' ecosystem data framework which will provide the consistent access and archival model. Increasingly, NOAA's Observing Systems Council (NOSC) has emphasized the unique challenges posed by the ecosystem data archival issues</p>	<p>IOOS Program Office, EGT, LOs, NOSC</p>

The EERTT emphasizes the importance of monitoring marine ecosystems across a consistent suite of variables at sufficient intensity to provide meaningful surveillance and measures of progress in marine ecosystem management. Within NOAA, the adequacy of monitoring of ecosystems has been quite variable, e.g., better for statutory issues such as fish stock management, and poorer for ecosystem parameters of more general interest such as primary productivity and socioeconomic valuation of ecosystem goods and services. A number of NOAA entities advocate for ecosystem science and monitoring consistent with their missions, and new initiatives such as the Ocean Research Priorities Plan and Implementation Strategy (ORPP/IS) produced by the Joint Subcommittee on Ocean Science and Technology will likely fund additional capacity beginning in 2008 (e.g., included in the President's budget). **Importantly, while there is national coordination across NOAA in ecosystem science and monitoring priorities (e.g., through the EGT and IOOS program), there is no consistent regional prioritization across NOAA. The establishment of regional NOAA science entities could be an effective mechanism to fill this gap. Additionally, the production of regional IEAs will identify priority observing, modeling and decision tool gaps and will further strengthen the identification for national priorities. Thus, developing expanded ecosystem science and monitoring, apart from specific sectoral priorities, requires implementation of the IEA regional processes and the establishment of regional science coordination.**

Organizational Issues

Recommendation	Progress to Date	Responsible Parties
<p># 13: Designate Centers of Specialized Expertise for new observation and modeling tools, social science, etc.</p> <p><i>Recommendation: Partially Accepted</i></p>	<p>NOAA has developed collaboration mechanisms to minimize duplication of efforts and to leverage resources on Oceans and Human Health, modeling and a few other areas. Additionally, a new focus on thematic Cooperative Institutes will allow more specialization of expertise. However, no consistent approach has yet been developed</p>	<p>LOs, EGT, Research Council</p>
<p>#14: Consider whether consolidation of efforts within NOAA should occur and develop plans for efficient regional coordination in: contaminants, biodiversity, and data archiving/integration</p> <p><i>Recommendation: Pending coastal visioning and other mechanisms for better coordinating existing programs</i></p>	<p>LOs, EGT and coastal programs considering specific proposals to re-organize and emphasize inter-program collaborations. Additional collaboration opportunities in seafood contamination monitoring and elsewhere. NOAA decided many years ago to consolidate data archiving with its creation of the three National Data Centers. With its recent creation of the IOOS Data Integration Framework (DIF), the Global Earth Observation Integrated Data Environment (GEO-IDE), and the Comprehensive Large Array-data Stewardship System (CLASS), NOAA is well underway in improving their data integration and archiving efforts, which will support regional ecosystem activities.</p>	<p>EGT, LOs, Coastal Program Team</p>

The organizational issues raised in the EERTT plan primarily focus on the designation of specific centers of disciplinary expertise and in the coordination of efforts related to specific issues. However, more generally, the delivery of consistent ecosystem science and management services begs the question regarding the appropriateness of NOAA's line office structure. Many cross-NOAA coordinating bodies (e.g., boards, councils and Goal Teams) have materially improved overall coordination among the executing entities involved in ecosystem services. The EETT report identified the need to consider further organizational consolidation in part to deliver more efficient regional implementation of ecosystem science and management. NOAA's coastal ecosystem programs (Coastal Services Center, National Center for Coastal Ocean Sciences, Sea Grant and the Office of Coastal Resource Management (OCRM)), have developed several options for functional organizations to better meet these mandates. These options are further being considered as part of NOAA's Coastal Visioning activities in preparation for reauthorization of the Coastal Zone Management Act. As part of these activities, some re-alignment of offices is being considered. Whether re-organization of specific functions among the line offices

or more generally the line offices themselves, requires a careful analysis of the objectives, costs, and strategic advantages associated with various models.

The IETT has not taken up the challenge of providing alternative structural alignments for NOAA's ecosystem programs, since it involves considerable thoughtful input from the highest levels of NOAA leadership. Nevertheless, this remains an important issue, and the IETT recommends the formulation of a specific working group to examine issues associated with various alternative models of structural alignment that would provide more consistent, efficient and integrated ecosystem science products and management services.

Timelines and Considerations in Addressing Remaining Recommendations

As noted above, evaluation and implementation of the various recommendations of the EERTT has progressed at differing rates, partially as a result of decisions to implement parts of the program, and the set up of internal mechanisms and entities responsible for specific tasks. Below is a rough timeline for progress on the remaining issues highlighted above:

(1) The development of consistent regional coordinating mechanisms for ecosystem science is a lynchpin for accomplishing many objectives of the EERTT report. While the new Regional Teams can have considerable input (and in fact ownership) in this process, NOAA needs to develop a mechanism and process to more formally establish regional science and ecosystem management collaborative mechanisms. The IOOS Regional Associations are appropriate mechanisms to seek cooperative arrangements beyond NOAA. The highly integrative nature of ecosystem science goals outlined in the external report and the creation of ecosystem assessments require a coordinating mechanism that is either a modification of NOAA's existing regional team structure or a new approach. **It is proposed that over the next 6 months, the IETT in conjunction with the Research Council and Regional Teams develop recommendations for alternatives for the establishment of such coordinating mechanisms.** As NOAA entities begin to discuss the appropriate roles for the regional teams, this group will be able to better articulate ecosystem requirements to these entities.

(2) Of the EERTT recommendations, most progress has been made in implementing the concept of Integrated Ecosystem Assessments. There is substantial planning and some success in the budgeting process at the national level with coordination with some regional entities. However, in order to provide the IEA vision of consistent coordination, there needs to be designated entities responsible for carrying out these activities. In the California Current ecosystem and Alaska coordinating mechanisms are in place, but these efforts are somewhat ad hoc. The designation of regional entities responsible and accountable for the production of IEAs remains a high priority. This recommendation is related to the need identified in (1) above. **Over the next six months, the EGT, IEA PATT, in coordination with the Regional Teams and the Research Council should work out the appropriate regional entities responsible for IEA implementation.** This proposal seeks to provide cross-line office logistical support for the execution of

integrated ecosystem assessments. Based on ecosystem pilot projects, this coordination function at the operational level is critical to success. In addition, with the clear connection to the EGT and IEA PATT these coordinating entities may provide some corporate consistency to the effort which we believe will add clarity in planning and budgeting for these efforts.

(3) Connecting observing requirements of IOOS with IEAs, is a clear recommendation of the external report. IOOS will be able to assist in the construction of integrated products (IEAs) and IEAs will benefit from IOOS data systems and increased access to regional observations. We see some connections being made in the current programming phase, but believe that a more directed approach is needed to provide a strong, requirements-based foundation for planning and budgeting both ecosystem products and IOOS. **In order to develop a consistent monitoring plan for ecosystem sciences, the IOOS program, in conjunction with the IEA PATT and the EGT should provide a consistent set of requirements for consideration in the PPBES process. This ongoing activity should be coordinated with the regional science coordination entities designated in (1). This activity should take place in time to meet the 2011-2015 program plan activities.**

(4) The EERTT report identified a number of proposed structural changes without a detailed proposal for structural revision. The recommended focus areas continue to be valid considerations for organization solutions like centers of specialized expertise: i.) new tools for modeling, forecasting, and observations, ii.) social science capacity to link science to ecosystem governance, iii.) understanding society's response to changing ecosystem conditions, iv.) identification of ecosystem structure and function, and v.) quantify the effects of human activities on ecosystems. Additionally the external report identified toxicology, biodiversity and taxonomy, and data archiving as capabilities that may benefit from organizational examination (i.e., optimize the organizational structure). PPI supports this proposal to assemble a team as described to address these issues. In the past, structural change discussions used a group of this composition (DAAs) to make final decisions. **The IETT recommends the formulation of a small, strategic group of DAAs and other senior leaders in NOAA to carefully consider structural changes within NOAA to better meet the needs of providing ecosystem services consistent with the objectives outlined in the EERTT report. This activity should be timed with transition opportunities.**

Recommendation to the Science Advisory Board

Implementing the recommendations of the EERTT requires, in some cases, substantial change in NOAA's programs, and closer integration between its entities (for example the production of integrated ecosystem assessments by multiple line offices working together at regional scales towards a common set of products). In order to assist NOAA leadership in moving to a more holistic ecosystem focus for its ocean and coastal mandates, NOAA proposes, within its FACA authority that **the SAB form an external Ecosystem Science Working Group to provide ongoing dialog, enhance communication with external partners and stakeholders and to provide a sounding**

board for proposals to enhance the delivery of science supporting ecosystem approaches to management.

Summary

The EERTT report provides a comprehensive set of recommendations for NOAA to evolve from a primarily sectoral set of ecosystem programs into an integrated program emphasizing excellence in ecosystem management and services. One constraint is clearly the lack of a societal or legislative mandate to move in this direction, although NOAA corporately recognized the importance of such an evolution. The EERTT notes:

“Transition toward EAM is a process already underway (and must continue in the longer term.). Making a transition towards supporting EAM based on investment in NOAA’s ecosystem science enterprise is a process akin to turning a large ship – inertia must be overcome without compromising stability. Absent a crisis or strong legislative mandate and facing limited resources, change can only come by constant pressure applied in the direction of the turn. In NOAA this pressure is being applied by leadership at the top and by experts throughout the Agency. Reprogramming of support for ecosystem science on which to prioritize missions and resources is incrementally turning the NOAA approach. Many things may affect this ability to expand NOAA’s scientific capacities, including future budgets, potential litigation and legislation, and extent of public support”.

“We assume that the form of institutions will follow function, such that in 5-10 years further organizational changes may be required to better implement an ecosystem basis for the NOAA science enterprise. The key here is for NOAA and its EGT to get on with the task of expanding and integrating ecosystem assessments into NOAA’s management approach at the regional level now, rather than waiting for legislation or regulatory changes to make some specific organizational structure necessary”.

“The theme of this report is that a regional organization would best provide the research and applied science support to comprise the scientific basis for ecosystem based management. This approach fits the nature and role of ecosystem science much better than any we can envision, particularly better than disciplinary, time-to-fruit, internal vs. external, or management-sector orientations”.

NOAA’s implementation efforts to date have focused on products and services to make this transition. Difficult decisions remain regarding organization of NOAA and resourcing the vision created in the EERTT report. NOAA has made some progress in implementing some of the EERTT recommendations, and is committed to an open, transparent and collaborative process in achieving the goals of the EERTT report, and more broadly those of its ecosystem portfolio stakeholders and the public.

Appendix. Terms of Reference for the External Ecosystem Research Review Task Team

The purpose of the review is to answer the following questions: Is the mix of scientific activities conducted and/or sponsored by NOAA appropriate for its mission needs, including its legislative and regulatory requirements, in terms of

- Subject matter,
- Distribution along the continuum from long term research to products for immediate use (including mandated scientific advice),
- Internal and external (to NOAA) balance?
- Links to international science programs?

How should NOAA organize its ecosystem research and science enterprise, in terms of:

- The relationship to non-ecosystem science activities (e.g., weather, climate or mapping), which is in part an artificial separation,
- The continuum from long term research to information products for immediate use (including mandated scientific advice),
- Line Office distribution,
- Program Structure used in NOAA's Planning, Programming, Budgeting, and Execution System,
- Other categorization schemes, such as by scientific discipline, mission area or mandate (implicitly including all sectors that are users of science advice), ecosystem or region, internal/external, etc.

In answering these questions, the review should include the following:

- Strengths and weaknesses of existing organizational structures used by NOAA, and by other entities with missions similar to NOAA's (domestic, foreign and multinational).
- Advantages and disadvantages of requiring that all scientific activity within a category of research, (e.g., long term or short term) be organized in the same way.
- How well organizational structures and approaches facilitate the transition from research to operations and information products,
- How well organizational structures and approaches facilitate the transition from research to operations and information products.
- How well organizational structures and approaches enhance the relevance, responsiveness, quality and credibility of scientific advice and products.
- Cost implications of organizational structures, including the transition costs of change,
- The FY-09-13 and FY-10-14 program plan processes for the Ecosystem Goal Team have considered a variety of strategic investments in ecosystem monitoring, analysis, integration and forecasting. Significant new investments in ecosystem monitoring will occur under most FY-08 and potentially FY-09 budget scenarios. Analysis activities specifically for ecosystems will occur in the IEA pilot activities, and new forecasting tools for ecosystems are planned as part of the IEA process
- NOAA plans to engage other federal agencies (especially EPA and DOI) in development of regional and local-scale IEAs through the JSOST and SIMOR processes.