

West Coast Governors' Agreement on Ocean Health

Integrated Ecosystem Assessment (IEA) Action Coordination Team

Draft Work Plan

Action 3.2 of the West Coast Governors' Agreement Action Plan

April 2010

Open for public comment until August 20, 2010.
Visit <http://westcoastoceans.gov/contact> and submit comments to
comments@westcoastoceans.gov

Prepared by:

Tom Hom (POC)
Amber Mace
Tim Quinn
Mary Ruckelshaus
Steve Rumrill (Chair)
John Stein
Tom Suchanek
Jacques White



Table of Contents

Introduction:

The West Coast Governors’ Agreement on Ocean Health3

Ecosystem-Based Management and Integrated Ecosystem Assessments3

Integrated Ecosystem Assessments on the Pacific Coast4

Work Plan to Address Priority Area 3 / Action 3.26

Work Plan:

Application of the IEA Concept to the Pacific Coast of North America6

Regional – Integrated Ecosystem Assessments7

- Puget Sound
- Coastal Oregon
- Northern California
- Central California

Conceptual Framework for the Regional IEA Pilot Projects12

Unification and Assembly of the West Coast IEA13

Work Plan Objectives and Specific Tasks14

- Finalize the West Coast IEA Work Plan
- Finalize Selection of the Regional IEA Pilot Projects
- Convene the West Coast IEA Workshop
- Initiate the Process to Establish Regional-IEAs
- Initiate the Process to Assemble Regional-IEAs into the Broader-Scale West Coast IEA
- Conduct Coordinated Coastwide Monitoring and Evaluation

Financial Resources Required (Phase I / 2010)18

Work Plan Summary, Milestone Schedule, and Deliverables.....20

Literature Cited22



Introduction

The West Coast Governors' Agreement on Ocean Health

In September 2006, the Governors of Washington, Oregon, and California signed the West Coast Governors' Agreement on Ocean Health. Working together under this agreement and consulting with federal agency leads and stakeholders, the three states developed a bold set of actions to improve the health of our ocean and coastal resources. In July 2008, the three states released a final action plan outlining activities on a range of issues that will be pursued with close regional collaboration.

The West Coast Governors' Agreement on Ocean Health (WCGA) identified Ecosystem-Based Management (EBM) as an overarching principle under which the following issues and priority areas can be addressed:

1. Ensure clean coastal waters and beaches;
2. Protect and restore ocean and coastal habitats;
3. Promote the effective implementation of ecosystem-based management;
4. Reduce adverse impacts of offshore energy development;
5. Increase ocean awareness and literacy among citizens;
6. Expand ocean and coastal scientific information, research, and monitoring; and
7. Foster sustainable economic development in coastal communities.

Ecosystem-Based Management and Integrated Ecosystem Assessments

The Pacific coast of the contiguous United States encompasses a very broad range of coastal ecosystems, each consisting of complex landforms and seascapes, diverse habitats and communities, and intricate ecosystem functions and services that provide a productive foundation for sustained economic development, appreciation of our cultural heritage, and aesthetic enjoyment. The large spatial-scale and complexity of the West Coast ecosystem will require balancing uses of the ocean, including energy development, coastal zone development, fishing, aquaculture, and shipping, among others.

Determining what management actions for these ocean uses will best maintain the delivery of ecosystem services while minimizing socioeconomic impacts is critical. As the region works to address these important issues, better science and scientific tools are needed that will inform the various types of decisions, such as siting for alternative ocean energy development, managing west coast fisheries, and protecting coastal habitats while addressing the effects of climate and climate change on the ecosystem.

A few years ago, the U.S. Commission on Ocean Policy and Pew Ocean Commission found that traditional single-species or single-sector approaches to managing ocean and coastal resources have failed to achieve long-term resource sustainability, effectively



balance uses and goals, or resolve conflicting management decisions. Both commissions recommended adopting an ecosystem-based approach to managing ocean and coastal resources. Ecosystem-based management (EBM) is a multidisciplinary process that can integrate information and management decisions across multiple ecological, social, and economic goals, ensure recognition of humans as key components of the ecosystem, and give full consideration to ecological boundaries while acknowledging political borders. EBM requires wide-ranging cooperation among the federal, tribal, state, and local governments and regional stakeholders to progress beyond single-issue or single-species management. A variety of management and planning tools have emerged to assist the transition toward EBM, including marine spatial planning. Promoting the effective implementation of ecosystem-based management is a priority under the West Coast Governors' Agreement on Ocean Health. EBM allows the region to take a holistic coast-wide view, to be adaptive in dealing with emerging regional issues and uses such as renewable ocean energy, while addressing the real threats from climate change, such as the impacts of sea level rise and ocean acidification, along the California Current Large Marine Ecosystem.

Science is critical to support successful EBM as well as marine spatial planning. Integrated Ecosystem Assessments (IEAs) will provide the necessary scientific foundation to support an EBM approach as well as any future marine spatial planning efforts for improving management of the shared resources along the West Coast. IEAs provide a means to explore the combined effects of management actions, identify efficient and effective management strategies, and reveal trade-offs between ecosystem services associated with desired ecosystem goals.

An IEA is a scientific framework for blending, synthesizing, and analyzing different types of ecological and social-science information that is all relevant within the context of specified ecosystem management goals (Levin *et al.*, 2009).

The IEA process:

1. Brings together multiple datasets and information to characterize and assess a suite of essential natural and socioeconomic processes.
2. Highlights the most important social and ecological drivers of desired ecosystem states or management goals.
3. Provides an analytical decision support tool for resource managers and policy makers.
4. Helps identify ecosystem indicators that can be used to determine if policy actions are effective.

Integrated Ecosystem Assessments on the Pacific Coast

The specific management goal envisioned by the WCGA is to achieve *a healthy, thriving, and resilient marine and coastal ecosystem along the entire west coast that supports a range of human activities*. Realization of this goal will be aided by developing scientifically robust key indicators of ecological and socioeconomic conditions and



processes along the coast, and provide a consistent measure of the status of ecosystem health by conducting a series of rigorous regional-IEAs (R-IEAs). Successful R-IEAs will improve management and decision-making for coastal and marine ecosystems by evaluating proposed management strategies and the risks associated with alternative management decisions, while integrating biophysical and socio-economic information. R-IEAs will also address key management issues by identifying resources (*e.g.*, personnel, fiscal) and information gaps needed to make more informed management decisions. Finally, R-IEAs will build interagency connections, improve communication, and increase exchange of information. Integrated Ecosystem Assessments will be an important scientific foundation for continuing the West Coast transition toward ecosystem-based management of marine resources, including conducting marine spatial planning at regional or sub-regional levels.

Information generated by the R-IEAs for different sub-ecosystems along the west coast will be harmonized so that they contribute to the development of a West Coast-IEA (WC-IEA) that will address the broader-scale California Current Large Marine Ecosystem. At this early stage in the development of a WC-IEA, the specific R-IEAs will serve as pilot projects to test the individual elements of the IEA framework that addresses the range of issues and environments in the California Current ecosystem. It is important to recognize that additional R-IEAs may be necessary to provide a more complete view of the diverse coastal and marine environments and issues that occur throughout California, Oregon, and Washington and informs the development of the WC-IEA. It is anticipated that NOAA Fisheries will be simultaneously working to develop a WC-IEA. Those efforts will be closely coordinated with the R-IEAs proposed here, and may influence the relative priority of the individual R-IEAs.

Some sub-sections of the Pacific coast are clearly at greater risk to degradation and impaired ecological function than others, and the range of pressing management problems and socio-political issues vary considerably from place to place. Nevertheless, the R-IEAs that are initially selected as regional pilot projects will serve as building blocks to allow for concurrent development of a broader-scale WC-IEA. The WC-IEA will eventually address a more complete set of challenges including: (1) formulation of conceptual and numerical models linking watersheds with estuarine/marine environments; (2) documentation of the ecological connections between different biogeographic regions; (3) quantification of the exchange of materials and organisms between inshore and nearshore waters; (4) identification of physical and biotic connections between the benthos and the water column; (5) modeling the connections between the shallow inshore areas and the deeper regions of the outer continental shelf; and (6) ecological forecasting of the effects of climate change and the fluctuations in the global economy on west coast communities. In addition, the process to merge the R-IEAs and construct the WC-IEA also will require new advancements in analytical techniques to combine spatially-explicit socioeconomic information from different coastal communities and to develop broad-scale ecosystem simulation models that can be used to evaluate the outcomes from different management actions at larger scales.



Work Plan to Address Priority Area 3 / Action 3.2

The WCGA calls on the states, tribes, and federal agencies to develop an action plan to address each of the seven priority areas, including how well each action area incorporates ecosystem-based management approaches. An Action Coordination Team (ACT) was formed in 2008 to develop a work plan to address Action 3.2 of the West Coast Governors' Agreement:

Action 3.2 *Assess physical, biological, chemical, and socio-economic factors in ecosystem health across the West Coast to establish standards and indicators for ocean health.*

A core group of four individuals were identified in October 2008 as members of the initial ACT charged with responsibilities to develop a work plan to describe the federal, tribal, and tri-state collaboration required to implement Action 3.2 (hereafter referred to as the IEA ACT). Additional members joined the IEA ACT in Spring and Fall 2009 to constitute the following team:

- Tom Hom (POC), NOAA Fisheries, Northwest Fisheries Science Center
- Amber Mace, Executive Director, California Ocean Trust
- Tim Quinn, Washington Department of Fish and Wildlife
- Mary Ruckelshaus, Washington State Puget Sound Partnership (on detail from NOAA Fisheries)
- Steven Rumrill, Oregon Department of State Lands, South Slough National Estuarine Research Reserve
- John Stein, NOAA Fisheries, Northwest Fisheries Science Center
- Tom Suchanek, Lead Scientist, USGS Western Ecological Research Center
- Jacques White, Ecoregional Planner, The Nature Conservancy

The IEA ACT was unable to meet in person during the WCGA Coordination Workshop (October 2008) to begin the implementation phase of the WCGA Action Plan, which delayed development of the work plan and planned workshop in 2008. Since then, the IEA ACT convened several conference calls in late 2008 and early 2009 to discuss the conceptual components, scope, and spatial extent of IEAs, and to share information about emerging EBM and IEA activities in California, Oregon, and Washington, such as the initial efforts by the Pacific Fishery Management Council to scope the development of an ecosystem-based fishery management plan, the interest of the National Marine Sanctuary Program to use IEA as a decision support tool on the west coast, and connecting with the West Coast Ecosystem-Based Management Network to assess EBM efforts at the local scale.



Work Plan:

This work plan describes the steps for conducting pilot projects of four smaller-scale R-IEAs that will contribute development of the WC-IEA. The R-IEAs will be structured to evaluate a range of management objectives that are representative of the issues facing coastal communities in Washington, Oregon, and California, contribute to the process for integrating complex datasets, provide the foundation for expanding to broader geographical areas, and to make comparisons among different regions of the coast.

Application of the IEA Concept to the Pacific Coast of North America

The WC-IEA and R-IEAs will establish and work with a harmonized set of standards and indicators for ocean health including metrics for ecological integrity, ecosystem services, and socioeconomic conditions.

The WC-IEA will identify indicators and address management issues, risk analysis, and ecological forecasting of the effects of different management strategies for the larger California Current Large Marine Ecosystem (LME). Four Regional-IEAs are currently under consideration, each with distinctive management issues and characteristic ecosystem attributes, some of which may be directly transferable among the different regions. Information generated by the R-IEAs will be drawn together, assimilated, and used to address data gaps in the WC-IEA for the larger-scale California Current LME. The WC-IEA assembly process also will require development of new and innovative tools for scaling up and coordinating inputs and outputs from the R-IEAs.

Regional – Integrated Ecosystem Assessments

Four pilot projects are currently being considered for Regional-IEAs: (1) Puget Sound; (2) Coastal Oregon; (3) Northern California; and (4) Central California. These regions have been selected because they are broadly representative of the diversity of coastal environments, marine ecosystems, and human communities that occur within the California Current LME. In addition, the regions are influenced by different management issues, including urban development and conservation of at-risk salmonid stocks, conflicts over marine use for wave energy and commercial fishing, designation of marine protected areas, accelerated losses of tidal wetlands in response to harbor improvements, and efforts to develop responsible and sustainable fishing in coastal communities. The distinctive characteristics of these marine ecosystems and their associated coastal communities and stakeholder groups pose different types of challenges and opportunities for the development of R-IEAs, and we anticipate that they will provide a fruitful and productive test-bed for new ideas and innovative approaches for the integration and analysis of seemingly disparate datasets. At the same time, the different regions share commonalities in the suite of fundamental processes and parameters¹ that are routinely used to characterize variability in the marine environment, indicator species and communities², and indicators of human well-being.³ All four regions are also active



participants in the Regional Associations of the Integrated Ocean Observing System (IOOS)⁴ and benefit from ongoing programs to generate, interpret, and disseminate IOOS data products. Finally, the four regions are also united in their effort to work together with the federal, tribal, and state agencies, academic institutions, community groups and stakeholders, and by the commitment of substantial institutional support in the form of long-standing partnerships and programs (see below). Consequently, the four regions exhibit a high likelihood of success with initiation of the R-IEAs, they can each make valuable contributions to a WC-IEA, and collectively they constitute a realistic pilot project that will provide adequate data information and lessons learned to evaluate the validity of the R-IEA and WC-IEA concepts.

Proposed R-IEA Pilot Projects:

1. Puget Sound: The Puget Sound Ecosystem supports a relatively high standard of living, a robust and diverse economy, and high quality of life. These attributes have resulted in rapid and sustained human population growth and more recently, a growing awareness of limits to the ability of the ecosystem to provide valued ecosystem services, including imperiled salmonid stocks for food and cultural benefits, clean recreational and commercial shellfish beds, endangered species listings, clean and plentiful water. The primary drivers of the declines in ecosystem functions and human well-being in Puget Sound are land-based pollution, habitat conversion and loss, and legacies of over-harvest. The State of Washington recently (2007) formed the Puget Sound Partnership (Partnership), a new state agency to coordinate state, local, tribal, federal, private and NGO efforts to restore the Puget Sound Ecosystem by 2020. Partnership efforts come on the heels and benefit from a number of recently completed studies and ongoing work in characterizing ecosystem conditions (for salmonids and their ecosystems, NOAA, Shared Salmon Strategy and others; terrestrial and fresh water biodiversity, The Nature Conservancy (TNC) and others; historic and current condition of the nearshore ecosystems, Army Corps of Engineers and WDFW). The Partnership recently endorsed the idea of using an IEA approach in their Biennial Science Workplan and Action Agenda, which describes a prioritized list of actions for the 2009-2011 state budget cycle, and a longer-term outline for recovery of ecosystem properties that will be achieved by 2020. Implementation of an IEA (led by NOAA Fisheries) has combined quantitative analysis and workshops with many local scientists to help quantify ecosystem stressors by subregion, identify ecosystem and human health and wellbeing indicators, and to develop approaches to specify scenarios and quantitatively model relationships

¹ ocean temperature and salinity, concentrations of dissolved oxygen, chlorophyll and harmful algal blooms, nutrient loading and eutrophication, fecal indicator bacteria, upwelling intensity, timing of spring transition, El Nino/La Nina events, Pacific Decadal Oscillation

² eelgrass beds, clams, salt marshes, kelp beds, crabs, non-indigenous species, seabirds, rockfish, bottom fish, salmon, sardines, marine mammals

³ demographic profiles, unemployment rates, property values and income, transfer payments, income generated by extractive activities and ecotourism, willingness to pay for ecosystem services

⁴ Northwest Association of Networked Ocean Observing Systems (NANOOS) and Central and Northern California Ocean Observing System (CeNCOOS)



between human actions and ecosystem outcomes in marine, nearshore and terrestrial environments. The IEA framework adopted by the Partnership is intended to help organize state agencies and others around a common set of indicators, and priority strategies to evaluate for achieving system goals. The Puget Sound IEA is being developed over a 3-year period; and in the first year, modules of a system model were developed: 1) a marine food web model, 2) quantitative analyses linking changes in nearshore habitats to changes in ecosystem services, and 3) a linked land-use/hydrology/climate watershed model. In the future, these and other analytical pieces will be combined into a system-modeling framework. Policy makers are working with scientists to better define broad Partnership goals (i.e., swimmable, fishable, drinkable) into specific objectives and benchmarks against which progress can be measured. In addition, the Partnership is developing implementation processes for protecting and restoring ecosystem elements, again under the guidance of multi-stakeholder science-policy groups.

2. Coastal Oregon: The Oregon coastal zone includes an ecologically complex fusion of watersheds, estuaries, and the nearshore region of the Pacific Ocean that is intermingled with the urban environment of numerous small coastal communities. Governance of Oregon coastal areas varies, depending on the ecosystem type. Typically, management issues in state ocean waters are addressed by relevant state agencies under their legal authorities and the overarching policy requirements of Statewide Planning Goal 19, Ocean Resources. Planning for ocean uses may also involve advice from the Oregon Ocean Policy Advisory Council. Management inside estuaries is guided by Statewide Planning Goal 16, Estuarine Resources which sets out policy requirements for estuary management plans adopted by local governments as part of their comprehensive land use plans. Land uses in coastal watersheds are managed by local governments, in coordination with state agencies, through comprehensive land use plans required under state law. Land uses on federal lands in coastal watersheds are exempt from specific requirements of Oregon's land use planning program but must be consistent with state and local policies that have been approved by NOAA as part of the state's coastal management program. In Oregon, the R-IEA approach will seek to identify and define a few persistent management problems that can be best addressed by taking a broader, multi-jurisdictional perspective of the coastal zone ecosystem. In addition, the Oregon R-IEA approach will also develop and apply the best available scientific, traditional and local knowledge to address the intricacies and complexities of natural processes and social systems in a manner that is collaborative, fair, and beneficial to all components of the ecological and human communities.

The Oregon R-IEA will develop and test an integrated ecosystem-based approach to improved understanding, problem solving, and management of resource issues within linked watershed, estuary, and ocean ecosystem. The primary focus of the Oregon R-IEA is to establish a conceptual framework and utilitarian approach to



unify the ongoing scientific research and management planning work conducted within the diverse components of Oregon’s outer-coast land-margin ecosystems. Successful implementation of the pilot project will demonstrate the material and energy transfer links between the terrestrial, marine, and urban elements of the coastal landscape, and document the ecosystem functions and services that are provided to coastal residents. The pilot project will focus on concurrent and complementary development of the conceptual framework for R-IEAs and EBM approaches along the Oregon coast. Ecosystem-based management approaches being developed in Yaquina Bay, Coos Bay, or Port Orford could be used to provide ecosystem attributes for the R-IEA. These three Coupled Human and Natural Systems (CHANS) are remarkably similar in the composition, diversity, and ecological services provided by the inherent ecosystem components, yet they are distinctly different in the social interactions among scientists and managers, and in the perspectives and vision of their stakeholders. For example, EBM activities at Yaquina and Coos bays involve interactions among academia, federal agencies and watershed councils, whereas Port Orford is primarily driven by a community-based approach through the West Coast EBM Network. The Oregon R-IEA pilot project will provide an opportunity to develop a common conceptual framework for integrated coastal EBM in Oregon that will have immediate utility in the three coastal CHANS, help refine, strengthen, and adapt the EBM approach on the scale of coastal watersheds, estuaries, and the nearshore ocean, and provide a strategic R-IEA building-block toward future development of the WC-IEA.

3. Northern California: Humboldt Bay is one of the largest bays on the Pacific coast and is the largest estuary in California north of San Francisco Bay. In addition to being the “front yard” of the north coast’s population centers and a desirable travel destination, Humboldt Bay contains a diversity of habitats for fish and wildlife and significant state, national and international resources. The geographic scope of the Humboldt Bay Ecosystem extends from Trinidad Head in the north to Cape Mendocino in the south, the lower portions of the adjacent watersheds, and to the edge of the continental shelf (700 fathoms). Over 30% of the eelgrass habitat found in California occurs in Humboldt Bay, and some of the most important Coho populations spawn and rear in its watershed. The California Current system in Humboldt and north to Cape Blanco, Oregon, is diffuse with highly variable oceanic conditions. The northern boundary at Trinidad Head is considered ecologically important because of physical processes associated with the Eureka littoral cell and human management activities such as maintenance of Humboldt Bay navigation channels and the Humboldt Bay Offshore Ocean Disposal Site. Although Humboldt Bay represents a significant resource for the north coast region, it provides a manageable EBM project area because it has a well-defined geographic scope, a reasonably small number of active and committed stakeholders (there are about 75,000 people living the Humboldt bay area and many of them have been involved in, and are knowledgeable about, ecosystem-based approaches to management), and access to academic resources through the presence of Humboldt State University and California Sea Grant.



Implementation of EBM in the Humboldt region falls under the Humboldt Bay Ecosystem Program (HBEP), formed by a group of resource managers and scientists and coordinated by California Sea Grant, and involves local and state agencies, stakeholder groups and others. The HBEP has a strategic plan, based on the work of numerous previous efforts that developed various watershed and bay management plans between 1999 and 2006, to guide EBM efforts. The HBEP will feed into and complement future planning processes in the region, such as the development and refinement of the General Plan and the Marine Life Protection Act process. Since the Humboldt Bay Ecosystem Program is in the process of assessing the current status of ecosystem components and services and determining future goals for ecosystem health and the continued delivery of ecosystem services (*e.g.*, fishing, forestry, agriculture, and public use and access), this region is well situated to participate in the IEA process.

4. Central California: The Central California coastal region from Point Reyes to Point Conception is geomorphically diverse, and encompasses a mix of large and smaller coastal communities (*e.g.*, San Francisco, Santa Cruz, Monterey, Pacific Grove, Carmel, Lucia, Cambria, Morro Bay, Pismo Beach) that are situated along the shoreline of a productive nearshore marine environment. This section of the California coast is highly responsive to interannual variability in the California Current, and supports exceptionally rich and abundant communities of seaweeds and kelp, marine invertebrates, fishes, seabirds, and marine mammals. Two active nodes of the West Coast EBM Network occur in the region at Elkhorn Slough and Morro Bay, and a large section of the coastline and nearshore waters are encompassed by the Monterey Bay and Gulf of the Farallones National Marine Sanctuaries (NMS). Dense urbanization along major sections of the Monterey Bay NMS poses several problematic resource management issues including coastal armoring, beach closures, water quality degradation, emergency response to hazard material events, ecosystem conservation and marine reserves, invasive species, commercial and recreational fishing, ecotourism, and residential development. Accelerated loss of tidal wetland habitat is occurring within the Elkhorn Slough National Estuarine Research Reserve (NERR) due to multiple stressors including harbor development, altered tidal hydrology, and sea level rise. The San Luis Obispo Science and Ecosystem Alliance (SLOSEA) has been established within the Morro Bay coastal ecosystem to address multiple issues including identification of land-based pollutants in the marine environment, accelerated loss of sensitive coastal habitats, invasive species, human access and impacts, and sustainable commercial and recreational fisheries. The Bay Area Ecosystems Climate Change Consortium was formed to bring together numerous stakeholders to focus on climate change impacts on ecosystems in the San Francisco Bay region. Numerous federal, state, and regional agencies, academic institutions, NGOs, and private foundations are actively involved in advancement of ecosystem-based approaches to management and sustainable fisheries management within the region, and are likely to contribute important conceptual and organizational talents toward establishment of the Central California R-IEA.



The Central California pilot project will provide an opportunity to develop a common conceptual framework for integrated coastal ecosystem-based management in Central California that will help unify the similar, yet distinct approaches that have been taken by the Monterey Bay NMS, Elkhorn Slough NERR, and SLOSEA, and provide a solid R-IEA foundation for future development of the WC-IEA.

Conceptual Framework for the Regional IEA Pilot-Projects

The IEA ACT modified the framework of Levin *et al.* (2009) to identify the following steps that will be taken in collaboration with resource managers, policy makers, academic advisors, and other stakeholders to develop R-IEAs for the four regional pilot-project areas located in California, Oregon, and Washington:

1. Conduct scoping process to identify pressing management issues, establish specific ecosystem goals and objectives, articulate the spatial and temporal scale for the ecosystem, identify the key stressors that perturb ecosystem functions, and develop initial conceptual models relating human activities in the form of drivers and pressures to ecosystem states and responses. This scoping process is critical to the social process of establishing a science-policy dialogue that clarifies basic assumptions (*e.g.*, what is a pressing management issue);
2. Define, test, and establish thresholds for responsive indicators that reflect the important ecosystem attributes or states, and ensure that the indicators are incorporated into a driver-stressor-response model (or similar conceptual framework);
3. Conduct an ecological risk analysis to evaluate the susceptibility and sensitivity of the key coastal indicators to anthropogenic stressors and natural processes, and to appraise levels of uncertainty and ecosystem resiliency;
4. Evaluate alternative management strategies to assess the current status of the coastal ecosystem relative to historic conditions and identified indicators for ecosystem-based management, and develop an ecosystem simulation model to evaluate the potential for different management actions to influence the status of the key natural and socioeconomic indicators;
5. Monitor and assess the ecosystem indicators to identify changes in indicator status and trends, and to track the effectiveness of management decisions; and
6. Evaluate management decisions to determine whether ecosystem goals were achieved, identify critical knowledge gaps, and make adaptive changes to the indicators, thresholds, and strategies, as needed, to evaluate new insights about complexity of the coastal ecosystem.



Unification and Assembly of the West Coast IEA

Six additional steps will be completed following initial development of the R-IEAs to increase utility of the regional conceptual models and identify broader-scale applications to the larger California Current coastal ecosystem in California, Oregon, and Washington. These steps to generate the West Coast Integrated Ecosystem Assessment have been tentatively identified to include:

1. Identify the geographic limits of the R-IEAs to establish the appropriate boundaries for reasonable extrapolation, the restrictions on extended application, and identify significant gaps and the need to establish new R-IEAs (*i.e.*, southern California, Washington outer coast, etc.) These geographic areas will be determined based on biophysical and social boundaries and relevant scales over which management and policy structures occur for decision making audiences to help frame and use the R-IEA results;
2. Crosswalk the coastal management issues among the different regions encompassed by the R-IEAs to develop a detailed matrix of pressing problems, potential solutions, and the locations along the coast where they are relevant, and identify the goals and objectives to help scope the broader-scale WC-IEA;
3. Merge the conceptual models and risk analyses to allow for numerical integration across shared indicators, share insights on methodologies, collaborative synthesis of results, and to incorporate new model components that address linkages across the R-IEAs; and
4. Coordinate with the development of an initial West Coast Integrated Ecosystem Assessment that will include development of standard baseline indicators, a data system and services framework, a management strategy evaluation (MSE) model framework, initial MSE products for selected managers, and documentation of the full process of creating the California Current IEA. The MSE model framework will have the capacity to evaluate the ecological impacts of alternative management actions on key natural and socioeconomic indicators;
5. Monitor and assess the broader-scale ecosystem indicators and socioeconomic metrics coast-wide to identify changes in indicator status and trends, and to track the effectiveness of any tri-state management decisions so that a management strategy evaluation (MSE) of the IEA can be conducted; and
6. Evaluate management decisions that affect coast-wide resources to determine whether ecosystem goals were achieved and to make adaptive changes to the indicators, thresholds, and risk analysis models, as needed, to evaluate new insights about complexity of the coastal ecosystem.



Work Plan Objectives and Specific Tasks

The following objectives and tasks provide an overarching set of checkpoints conducting the Regional-IEAs and coordination with a broader-scale West Coast-IEA. These objectives will be achieved through collaboration with state, federal and local agencies, as well as tribal governments, non-governmental organizations, industry, academic institutions, and others.

Objective 1. Finalizing and updating the WCGA IEA Work Plan

Task 1A. Finalize the current draft of the WCGA IEA work plan for approval by the WCGA Executive Committee (EC) and release for public comment. Collate public comments and incorporate into final draft of IEA work plan for posting on the WCGA website (*Timeframe*: May 2010)

Task 1B. Expand the IEA ACT to include additional members with strong links to the West Coast EBM network, and with expertise for planning the West Coast IEA workshop in collaboration with concurrent efforts by NOAA / Office of Ocean and Coastal Resource Management. Further integrate the TNC Ecoregional Assessment for the Pacific Coast, the West Coast EBM network, the Pacific Fishery Management Council's Ecosystem-based Fishery Management Plan Development Team (being established), state tools like coastal atlases, NOAA IEA planning, and other federal tools like biogeographic assessments conducted by the National Marine Sanctuary Program and the Multiple Use Marine Cadastre into the WCGA IEA work plan, refine the process leading up to the IEA workshop, and define post-workshop products. The IEA ACT would serve as a California Current IEA Task Team to facilitate communication and coordination among R-IEA projects. (*Timeframe*: Ongoing)

Task 1C. The WCGA IEA Work Plan will evolve as new collaborations among groups, such as the West Coast EBM Network and NOAA Office of Ocean and Coastal Resource Management and others, are formed. New sections that are developed will be incorporated into the existing plan. (*Timeframe*: As needed 2010-2015)

Objective 2. Convene a West Coast IEA Workshop

Task 2A. Establish Steering Committee to refine management objectives, select operational objectives, and develop performance measures for an IEA prior to planning and hosting a West Coast IEA workshop—activities include development of agenda, outcomes and products, and venue. (*Timeframe*: Summer 2010).



Task 2B. Convene a West Coast IEA Workshop, in coordination with the NOAA WC-IEA effort, to introduce participants to the concept of IEAs, discuss recommendations provided by the steering committee for a West Coast IEA, and initiate establishment of four interoperable Regional IEAs. (*Timeframe: Fall/Winter 2010*).

Workshop Purpose: In concert with state and federal agencies, local and tribal governments, nongovernmental organizations, and academia, the states will hold a West Coast IEA workshop in the Summer or Fall of 2010 to discuss the current thinking about integrated ecosystem assessments as an analytical tool to improve management, and to initiate the process to develop R-IEAs and the West Coast IEA. The primary purpose of the West Coast IEA workshop will be to gain consensus about the conceptual approach that will be followed, identify the scope of relevant management issues, and present the driver-stressor-response and risk analysis models. Participants will identify commonalities among likely useful indicators, quantitative methods, and establish a process for periodic exchanges of technical information as each R-IEA progresses. The workshop will also establish the framework required to ensure interoperability of the R-IEAs for future assembly into the broader-scale WC-IEA.

The specific objectives of the workshop are to: (1) present workshop participants with the conceptual framework and working examples for the WC-IEA and the most recent developments with integrated ecosystem-based management; (2) discuss the feasibility and practicalities required for tri-state coordination and full interoperability of multiple R-IEAs, including input from relevant WCGA ACTs (i.e., alternative ocean energy, habitat mapping, climate, sustainable communities, others); (3) identify the specific regions and institutions that will serve as pilot-project R-IEAs, their ecosystem attributes, and their respective management issues; (4) evaluate, refine, and adapt a simple driver-stressor-response model for utility within Pacific coastal ecosystems; and (5) designate R-IEA Team Leaders and project collaborators, identify their resource needs, and establish an action plan to move forward with implementation of the R-IEAs.

Note: NOAA (Office of Ocean and Coastal Resource Management) is planning to host two workshops, the first primarily for an audience of coastal managers where the participants would be introduced to the concept of IEAs and identify pressing management issues. The second workshop will target a more technical audience and focus on indicators, data availability, and development of the IEAs. If these workshops take place, it will be important for the WCGA IEA ACT to leverage with NOAA efforts to coordinate planning for the West Coast IEA workshop, and to ensure that the conceptual approach, selection of indicators, and risk analyses are fully compatible and interoperable for Washington, Oregon, and California.



Task 2C. Solicit and engage new members that can provide technical support and ecological risk analysis and forecast modeling expertise for the West Coast IEA Task Team. (*Timeframe*: Fall/Winter 2010)

Task 2D. Discuss early lessons learned about engaging the scientific community and general public in IEA development with IEA practitioners in other regions of the United States. (*Timeframe*: Fall/Winter 2010)

Objective 3. Finalize Selection of the Regional IEA Pilot Projects

Task 3A. Identify Regional Team Leaders and work with them to develop summary statements that describe the Regional-IEA process within the context of local and regional management issues, ecosystem attributes, and initial pilot project goals, and coordinate with NOAA efforts to develop the initial WC-IEA. (*Timeframe*: Winter 2010)

Task 3B. Develop criteria to assess likelihood of programmatic success for each of the four proposed R-IEA pilot-projects. (*Timeframe*: Winter/Spring 2010)

Task 3C. Conduct interviews, site-based visits, and a preliminary evaluation to assess likelihood of R-IEA success for each pilot-project area. (*Timeframe*: Winter/Spring 2010)

Task 3D. Generate and deliver comments and recommendations to strengthen and improve the approach proposed for each of the initial R-IEA pilot projects. (*Timeframe*: Spring 2010)

Objective 4. Initiate the Process to Establish Regional-IEAs

Task 4A. Complete a scoping process to verify pressing management issues identified by the preliminary R-IEA pilot proposals, establish specific ecosystem objectives, articulate the spatial and temporal scale for the ecosystem, and identify the key stressors that perturb ecosystem functions. (*Timeframe*: Winter 2010)

Task 4B. Host local planning meetings at the R-IEA pilot sites to identify a common suite of natural and social science stressors and indicators that are sensitive to changes in ecological conditions, applicable within the pilot R-IEA project ecosystems and could connect to the broader, coast-wide IEA. The planning meetings will also evaluate the availability of information required (*e.g.*, status and trends datasets, periodic surveys of local habitats and communities, high resolution remote sensing data, seafloor maps, ocean observing system data, socioeconomic information, ecological forecasting models, etc.) to advance



ecosystem management approaches at the scale of R-IEAs. (*Timeframe*: Winter 2010)

Task 4C. Conduct an ecological risk analysis to evaluate the sensitivity of the key indicators to anthropogenic stressors and natural processes, and to appraise coastal ecosystem resiliency. (*Timeframe*: Winter 2010)

Task 4D. Integrate multiple indicators to assess the current status of the ecosystem relative to historic conditions and identified targets (*Timeframe*: 2011, as determined during West Coast IEA Workshop)

Task 4E. Coordinate with NOAA on the use of ecosystem simulation model to evaluate the potential for different management actions to influence the status of the key natural and socioeconomic indicators. (*Timeframe*: 2011, as determined during West Coast IEA Workshop)

Task 4F. Initiate process to integrate and assemble information from R-IEA pilot projects into broader-scale, west coast-wide IEA. (*Timeframe*: 2011, as determined during West Coast IEA Workshop)

Objective 5. Initiate the Process to Assemble Regional-IEAs into the Broader-Scale West Coast IEA

Task 5A. Identify the geographic limits of the R-IEAs to establish the appropriate boundaries for reasonable extrapolation, the restrictions on extended application, and identify significant gaps. This task addresses the ‘scaling up’ issue to a WC-IEA and thus the linking of sub-ecosystems to a larger scale ecosystem (*Timeframe*: TBD during West Coast IEA Workshop).

Task 5B. Crosswalk the coastal management issues among the different regions encompassed by the R-IEAs to develop a detailed matrix of pressing problems, potential solutions, and the locations along the coast where they are relevant, and identify the goals and objectives for the broader-scale WC-IEA. (*Timeframe*: TBD during West Coast IEA Workshop)

Task 5C. Merge the conceptual models and risk analyses to allow for numerical integration, collaborative synthesis, and to incorporate new model components that address linkages across the R-IEAs. (*Timeframe*: TBD during West Coast IEA Workshop)

Task 5D. Coordinate with NOAA’s initial WC-IEA activity to inform that process and at same time learn from the WC-IEA to inform and insure harmonization of the R-IEAs to scale up to the California Current Ecosystem assessment. (*Timeframe*: TBD during West Coast IEA Workshop)



Objective 6. Conduct a Coordinated Coast-wide Evaluation of Coastal Management Decisions

Task 6A. Synthesize information from broader-scale ecosystem indicators and socioeconomic metrics to identify changes in indicator status and trends, and to inform on the effectiveness of any tri-state management decisions. (*Timeframe: TBD during West Coast IEA Workshop*)

Task 6B. Evaluate management decisions that affect coast-wide resources to determine whether ecosystem goals were achieved and to make adaptive changes to the indicators, thresholds, and risk analysis models as-needed to evaluate new insights about complexity of the coastal ecosystem. (*Timeframe: TBD during West Coast IEA Workshop*)

Financial Resources (2010)

Phase I / Initiation of the WC-IEA Process (estimated funding needed):

• <u>WC-IEA Workshop</u>	\$30K
• <u>Puget Sound R-IEA</u>	
Pilot project coordinator	\$60K
Project Expenses	\$30K
Operational funds	\$10K
• <u>Coastal Oregon R-IEA</u>	
Pilot project coordinator	\$60K
Project Expenses	\$30K
Operational funds	\$10K
• <u>Northern California R-IEA</u>	
Pilot project coordinator	\$60K
Project Expenses	\$30K
Operational funds	\$10K
• <u>Central California R-IEA</u>	
Pilot project coordinator	\$60K
Project Expenses	\$30K
Operational funds	\$10K
<u>Phase I / Initiation total:</u>	\$430K



The above estimates do not take into account the potential leveraging of the WCGA IEA ACT with current and future IEA activities conducted by NOAA and others. For example, IEA efforts for the Puget Sound are currently underway, with much of the scoping process to identify key management objectives and threats and development of a provisional list of environmental indicators completed, as well as development of ecosystem models to test indicators, perform risk assessments, evaluate proposed management strategies and refine monitoring programs. Leveraging with the Puget Sound Partnership and NOAA would reduce IEA efforts by the WCGA, so that fewer resources would be necessary to implement the R-IEA in Puget Sound. Additionally, the WCGA IEA ACT will explore leveraging possibilities of other NOAA IEA efforts taking place along the west coast that may reduce resources needed for other R-IEAs in 2010.

DRAFT



Work Plan Summary

#	Deliverables	Timelines	Resources & Funding Needed	Lead organization(s) & support	Research/Scientific Support
1	<i>Finalize and update WCGA IEA Work Plan</i>				
1A	Complete Draft IEA ACT Work Plan. Submit for public comment.	May 2010	None	IEA ACT; WCGA EC	None
1B	Expand IEA ACT membership, if necessary.	Winter 2010	None	WCGA EC; IEA ACT	None
1C	Integrate with groups and organizations, such as the West Coast EBM Network, NOAA and others that are engaged in significant IEA/EBM activities (gathering information). Update work plan, as needed.	2010 - 2015	TBD	IEA ACT; NOAA; West Coast EBM Network	TBD
2	<i>Convene a West Coast IEA Workshop</i>				
2A	Establish Steering Committee to refine management objectives, select operational objectives, and develop performance measures for an IEA prior to planning and hosting a West Coast IEA workshop	Summer 2010	None	IEA ACT; NOAA, West Coast EBM Network	None
2B	Convene a West Coast IEA Workshop, in coordination with the NOAA IEA efforts, to introduce participants to the concept of IEAs, discuss recommendations provided by the steering committee for a West Coast IEA, and initiate establishment of four interoperable R-IEAs	Fall/Winter 2010	\$30K	IEA ACT; NOAA; IEA Workshop Steering Committee	TBD
2C	Solicit and engage new members that can provide technical support and ecological risk analysis and forecast modeling expertise for the West Coast IEA Task Team	Fall/Winter 2010	TBD	IEA ACT; IEA Workshop Steering Committee	TBD
2D	Discuss early lessons learned about engaging the scientific community and general public in IEA development with IEA practitioners in other U.S. regions	Fall/Winter 2010	TBD	IEA ACT; IEA Workshop Steering Committee	TBD
3	<i>Finalize Selection of Regional IEA Pilot Projects</i>				
3A	Identify leads for R-IEA pilot projects that will work with IEA	Winter 2010	None	IEA ACT; NOAA;	None



WCGA IEA ACT Work Plan DRAFT

	ACT to develop work statements and goals for each of the regions			West Coast EBM Network	
3B 3C	Develop criteria, interviews, site visits for initial evaluation to assess programmatic success for each R-IEA pilot projects	Winter/Spring 2010	TBD	IEA ACT; NOAA; West Coast EBM Network	None
3D	Generate and deliver comments and recommendations to strengthen and improve the approach proposed for R-IEA pilot projects	Spring 2010	None	IEA ACT	None
4	<i>Establish and Implement Regional-IEAs</i>				
4A	Complete scoping of pertinent management issues and establish ecosystem objectives related to spatial and temporal scales for R-IEAs	Winter 2010	<u>Note:</u> Estimated funding needed for <u>each</u> R-IEA (Tasks 4A-E) is \$100K	IEA ACT plus others (TBD)	TBD
4B	Host local planning meetings at R-IEA pilot project sites to develop R-IEAs, including identification of indicators, stressors, information gaps to advance IEA approaches at proper scale	Winter 2010	See 4A	IEA ACT plus others (TBD)	TBD
4C	Conduct an ecological risk analysis to evaluate the sensitivity of the key indicators to anthropogenic stressors and natural processes, and to appraise coastal ecosystem resiliency	Winter 2010	See 4A	IEA ACT plus others (TBD)	TBD
4D	Integrate multiple indicators to assess the current status of the ecosystem relative to historic conditions and identified targets	2011, as determined at WC IEA Workshop	See 4A	IEA ACT plus others (TBD)	TBD
4E	Coordinate with NOAA on the use of ecosystem simulation model to evaluate the potential for different management actions to influence the status of the key natural and socioeconomic indicators	2011, as determined at WC IEA Workshop	See 4A	IEA ACT plus others (TBD)	TBD
4F	Initiate process to integrate and assemble information from R-IEA pilot projects into broader-scale, west coast-wide IEA	2011, as determined at WC IEA Workshop	See 4A	IEA ACT plus others (TBD)	TBD
5	<i>Initiate the Process to Assemble Regional-IEAs into the Broader-Scale West Coast IEA</i>				
5A	Identify the geographic limits of the R-IEAs to address the 'scaling up' issue to the broader WC-IEA	TBD during West Coast IEA Workshop	TBD	IEA ACT plus others (TBD)	TBD



5B	From the R-IEAs, develop matrix of issues, potential solutions, and relevant coastal locations and identify the goals and objectives for the broader-scale WC-IEA	TBD during West Coast IEA Workshop	TBD	IEA ACT plus others (TBD)	TBD
5C	Synthesize IEA information to merge conceptual models and risk analyses and incorporate new model components that address linkages across the R-IEAs	TBD during West Coast IEA Workshop	TBD	IEA ACT plus others (TBD)	TBD
5D	Coordinate with NOAA's WC-IEA activities to inform and ensure harmonization of the R-IEAs to scale up to the California Current Ecosystem assessment	TBD during West Coast IEA Workshop	TBD	IEA ACT plus others (TBD)	TBD
6	<i>Conduct a coordinated coast-wide evaluation of coastal management decisions</i>				
6A	Synthesize information from broader-scale ecosystem indicators and socioeconomic metrics to identify changes in indicator status and trends, and to inform on the effectiveness of any tri-state management decisions	TBD during West Coast IEA Workshop	TBD	IEA ACT plus others (TBD)	TBD
6B	Evaluate management decisions that affect coast-wide resources to assess ecosystem status and to recommend changes to indicators, thresholds, and risk analysis models, as needed relative to EBM goals	TBD during West Coast IEA Workshop	TBD	IEA ACT plus others (TBD)	TBD

Literature Cited:

Levin, P.S., M.J. Foarty, S.A. Murawski, and D. Fluharty. 2009. Integrated Ecosystem Assessments: Developing the Scientific Basis for Ecosystem-Based Management of the Ocean. PLoS Biology 71(1): e1000014; doi:10.1371/journal.pbio.1000014