PREFACE

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WHAT IS AN INTEGRATED ECOSYSTEM ASSESSMENT?

NOAA defines an ecosystem as a "geographically specified system of organisms (including humans), the environment, and the processes that control its dynamics." NOAA further defines the environment as "the biological, chemical, physical, and social conditions that surround organisms. When appropriate, the term environment should be qualified as biological, chemical, and/or social."

An ecosystem management approach is one that provides a comprehensive framework for marine, coastal, and Great Lakes resource decision-making. Integrated ecosystem assessments (IEAs) are a critical science support element enabling ecosystem-based management (EBM) strategies. An IEA is a formal synthesis and quantitative analysis of information on relevant natural and socioeconomic factors in relation to specified ecosystem management goals. It involves and informs citizens, industry representatives, scientists, resource managers, and policy makers through formal processes to contribute to attaining the goals of EBM.

An IEA uses approaches that determine the probability that ecological or socioeconomic properties of systems will move beyond or return to within acceptable limits as defined by management objectives. An IEA must provide an efficient, transparent means of summarizing the status of ecosystem components, screening and prioritizing potential risks, and evaluating alternative management strategies against a backdrop of environmental conditions. To this end, IEAs follow the following steps:

- Scoping: Identify management objectives, articulate the ecosystem to be assessed, identify ecosystem attributes of concerns, and identify stressors relevant to the ecosystem being examined.
- Indicator development: Researchers must develop and test indicators that reflect the ecosystem attributes and stressors specified in the scoping process. Specific indicators are dictated by the problem at hand and must be linked objectively to decision criteria.
- Risk Analysis: The goal of risk analysis is to fully explore the susceptibility of an indicator to natural or human threats as well as the ability of the indictor to return to its previous state after being perturbed.
- Evaluation: Evaluate the potential different management strategies to influence the status of ecosystem components of management concern or the drivers and pressures that affect these ecosystem components.

Further description of IEAs can be found in Levin et al. (2008, 2009).

SCOPE OF THIS REPORT

The primary goal of the California Current IEA is to inform the implementation of EBM by melding diverse ecosystem components into a single, dynamic fabric that allows for coordinated evaluations of the status of the California Current ecosystem. We also aim to involve and inform a wide variety of stakeholders and agencies that rely on science support for EBM, and to integrate information collected by NOAA and other federal agencies, states, non-governmental organizations, and academic institutions. The essence of IEAs is to inform the management of diverse, potentially conflicting ocean-use sectors. As such, a successful California Current IEA must encompass a variety of management objectives, consider a wide-range of natural drivers and human activities, and forecast the delivery of ecosystem goods and services under a multiplicity of scenarios.

A full IEA of the California Current is thus a massive undertaking. Our approach to the daunting task of completing this IEA was to systematically decompose the California Current into a series of ecosystem components and ecosystem pressures that are of keen interest to resource managers, policy makers, and the public. Working with regional managers, we then selected a limited set of EBM components and pressures that we could address in the initial phase of the IEA (Levin and Schwing 2011)). This dialogue is ongoing (Scoping and Engagement), and thus we expect this framework to evolve over time.

EBM COMPONENTS, DRIVERS, AND PRESSURES IN THE CALIFORNIA CURRENT ECOSYSTEM

We define EBM components as the biological, physical, or human dimension entities that policy makers, managers, or citizens are trying to manage or conserve. Defined this way, the list of management concern targets is quite long; however, the IEA Action Team grouped these into six bins:

- Habitat—including biogenic and abiotic habitats both on the seafloor and in the water column.
- Wild fisheries—this EBM component is centered on the condition of fishery stocks included in the coastal pelagic species, highly migratory species, groundfish, and salmon fishery management plans.
- Ecosystem integrity—refers to the structure and function of marine and coastal ecosystems and ecological communities.
- Vibrant coastal communities—including social, economic, and cultural well-being and human health as it is tied to the marine environment.
- Protected resources—species legally designated as protected (e.g., Marine Mammal Protection Act, Migratory Bird Treaty Act, Endangered Species Act).

The ultimate aim of the California Current IEA is to fully understand the web of interactions that links drivers and pressures to EBM components and to forecast how changing environmental conditions and management actions affect the status of EBM components. In this, the second year of our IEA work, we focused on four EBM components:

- Ecosystem Integrity
- Fisheries (groundfish and coastal pelagic species)
- Protected species (marine mammals, seabirds, Pacific salmon)
- Vibrant coastal communities

Similarly, a lengthy list of drivers and pressures was created. Here, we define drivers as factors that result in pressures that in turn cause changes in the ecosystem. For the purposes of an IEA, both natural and anthropogenic forcing factors are considered; an example of the former is climate variability while the latter include factors such as human population size in the coastal zone and associated coastal development, demand for seafood, etc. In principle, human driving forces can be assessed and controlled. Natural environmental changes cannot be controlled but must be accounted for in management. Pressures include factors such as coastal pollution, habitat loss and degradation, and fishing effort that can be mapped to specific drivers. For example, coastal development results in increased coastal armoring and the loss of associated intertidal habitat.

As we did for EBM components, we binned drivers and pressures into a series of broad categories (Levin and Schwing 2011). These are:

- Shipping
- Freshwater habitat loss or degradation
- Coastal zone development
- Fishing
- Invasive species
- Naval exercises
- Aquaculture
- Energy development
- Marine habitat disturbance
- Oil spills
- Climate change

Status, trends and impacts of oceanographic / climatic drivers and anthropogenic pressures are addressed throughout the IEA. Most prominently, we discuss status and trends of drivers and pressures in Chapters 2 and 3. Additionally, for some ecosystem components we examine the risk to the component from specific drivers or pressures. Finally, in Chapter 10 we articulate a series of scenarios that link large-scale drivers to pressures in the California Current, and then use a variety of techniques to estimate how the status of ecosystem components might change under different scenarios.

NEXT STEPS FOR THE CALIFORNIA CURRENT IEA

This report is the second in a series of efforts to complete a full IEA of the California Current. In addition to improving analytical techniques, models, and filling data gaps, the third iteration of

the IEA will expand to include more ecosystem components and pressures. Specifically, in FY2013 the California Current IEA will add "habitat" as an EBM component. In addition, existing EBM components will be expanded in several ways: "highly migratory species" (e.g., albacore, sharks, etc.) will be added to the fisheries component; risk assessments will be added to or improved for all the components; and, where appropriate, additional indicators will be evaluated and included in analyses.

In this document, we develop a semi-quantitative approach to conduct an ecosystem risk assessment and apply this approach to a limited set of human activities and ecosystem components in the Monterey Bay National Marine Sanctuary. In subsequent years, this approach will be extended to include additional regions, human activities and ecosystem components throughout the California Current. In addition, we envision more quantitative risk analyses will be developed for some ecosystem components. Chapter 10 lays out several detailed scenarios that underlie the management strategy evaluations we conducted. FY2013 will see the development of additional quantitative approaches that will allow us to more fully evaluate these scenarios.

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This is a web-based report and meant to be accessed online. Please note that this PDF version does not include some transitional material included on the website. Please reference as follows:

Full report :

Levin, P.S., B.K. Wells, M.B. Sheer (Eds). 2013. California Current Integrated Ecosystem Assessment: Phase II Report. Available from ***http://www.noaa.gov/iea/CCIEA-Report/index***.

Chapter (example):

K.S. Andrews, G.D. Williams, and V.V. Gertseva. 2013. Anthropogenic drivers and pressures, In: Levin, P.S., Wells, B.K., and M.B. Sheer, (Eds.), California Current Integrated Ecosystem Assessment: Phase II Report. Available from ***http://www.noaa.gov/iea/CCIEA-Report/index***.

Appendix, example for MS5:

Gray, I.A., I.C. Kaplan, I.G. Taylor, D.S. Holland, and J. Leonard. 2013. Biological and economic effects of catch changes due to the Pacific Coast Groundfish individual quota system, Appendix MS5, Appendix to: Management testing and scenarios in the California Current, In: Levin, P.S., Wells, B.K., and M.B. Sheer (Eds.). California Current Integrated Ecosystem Assessment: Phase II Report. Available from ***http://www.noaa.gov/iea/CCIEA-Report/index***.