

Review of the California Current Integrated Ecosystem Assessment (CCIEA) Program

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Southwest Fishery Science Center
La Jolla, California
February 10-12, 2015

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California Current IEA Review – February 2015

INTRODUCTION

The NOAA Integrated Ecosystem Assessment (IEA) Steering Committee (ISC) guides the development of the NOAA IEA program, tracks progress of national and regional implementation, and helps communicate the goals, objectives, progress and status of the NOAA IEA program to internal and external stakeholders. The ISC works with the regions to define and evaluate when an IEA region has successfully reached key milestones. One of the key methods to evaluate regional progress and success is to conduct periodic reviews of regional IEA programs. These reviews provide an important opportunity to identify lessons learned and best practices that can be shared across regions to enhance program development and implementation.

The purpose of the regional IEA review by the ISC is to provide a constructive analysis of the regional program and determine if the current IEA guidelines need to be modified to reflect lessons learned while conducting IEAs. The reviews are intended to examine the IEA progress relative to: the steps in the general IEA loop; IEA program goals; utility for resource managers; development of transferable methods, products, and best practices; integration of ecological and socioeconomic components; and inclusion of relevant partners and institutions. The review aims to identify strengths and weaknesses in the regional IEA with a focus on how to improve the IEA in that region and across all regional IEAs in NOAA. This includes a particular emphasis on increasing the utility of IEAs by management agencies to improve management of coastal and marine ecosystems, and NOAA trust resources.

On February 10-12, 2015 the ISC conducted its first regional review in the California Current IEA (CCIEA). The CCIEA is the most established and well-funded regional IEA within NOAA. It received over \$5M in IEA funding from FY10 through FY14. The intention of this report is to improve IEA activities within the California Current and throughout NOAA. Thus, the target audience is the NOAA IEA community and it is not intended that this review be used for national program-wide funding decisions. The review can and should provide guidance for where to invest their resources within the regional IEA.

General Observations

The review began with the historical perspective on the CCIEA and IEAs in NOAA followed by 12 scientific presentations and then programmatic discussions regarding future directions for the CCIEA. The science being conducted in the CCIEA is impressive in both its scope and depth. The research is of the highest scientific quality and was well presented. It is clear the CCIEA has made substantial progress in implementing its regional IEA, especially since 2012. The best evidence of the scientific progress comes from the 104 published peer-reviewed papers by the CCIEA team. These scientific contributions mean that the CCIEA process has resulted in an extensive knowledge base, scientific capacity, and expertise that is relevant and extensible to all other IEA regions.

A committed core team of dedicated and accomplished scientists was essential to progress in the CCIEA and will be just as essential to all regional IEAs. This core team was established at the onset in the CCIEA; although, its membership has changed over time. The current state of CCIEA is correlated with who made up the initial core group as well as its membership since its inception. Currently, this core team consists almost exclusively of NMFS staff.

It took 3-5 years for the CCIEA to establish the scientific capacity and cultivate the relationships necessary for effective implementation of the IEA process. This time was likely shortened by the use of the Puget Sound Partnership as a geographically focused IEA test bed. Part of the IEA relationship building is identifying and cultivating willing and interested recipients of the IEA information in the resource management community that will use IEA products to improve their natural resources decision-making process.

Over the past 5+ years the CCIEA has made tremendous progress in building out IEA capacity (e.g. indicators, risk assessment, management strategy evaluation) with an extensive number of ecosystem components (e.g. groundfish, salmon, coastal pelagic species, marine mammals, seabirds, habitat, human dimensions, ecological integrity). The experiences of the CCIEA have shown that the IEA framework is the appropriate architecture to provide scientific information to managers for incorporating ecosystem considerations into their decision-making frameworks and processes. Thus, allowing resource managers to take a more science- and ecosystem-based approach to management.

IMPLEMENTING THE CCIEA FRAMEWORK

The objectives and goals of the CCIEA have evolved over time as the science has advanced and relationships were cultivated to include a more diverse array of partners and clients. Since the CCIEA is dominated by NMFS staff and associated mandates, the CCIEA has been heavily focused on assessments and products in support of the Pacific Fisheries Management Council (PFMC). Due to the diversity of ecosystem components within the California Current Large Marine Ecosystem (CCLME), the need to build foundational capacity to implement the IEA approach, and limited resources, the CCIEA implemented the IEA framework using a phased approach. The phased approach focused on specific focal ecosystem components enabling products to be developed without having to wait for all components to be at the same level of analytical maturity. However, the disadvantage of the phased approach is that it did not provide for integration, since different modules (e.g. indicators, assessment, risk analysis, management strategy evaluation) of the IEA and different focal ecosystem components (e.g. salmon, groundfish, marine mammals, human dimensions) were at different stages of development. As is planned for the next phase of CCIEA, emphasis should now be placed on efforts to explicitly integrate across the CCIEA modules and components developed in the previous phases and develop a full end-to-end CCIEA.

The IEA Framework in the CCIEA

The NOAA IEA Approach

Management Strategy Evaluation

MSE is useful to help resource managers consider the system trade-offs and potential for success in reaching a target which helps make informed decisions. It uses simulation through ecosystem modeling to evaluate the potential of different management strategies to influence the status of natural and human system indicators and to achieve our stated ecosystem objectives.

Analyze & Evaluate Uncertainty & Risk

Ecosystem analyses and models evaluate risk to the indicators and thus the ecosystem posed by human activities and natural processes. These methods incorporate the degree of uncertainty in each indicator's response to pressures. This determines incremental improvements or declines in ecosystem indicators in response to changes in drivers and pressures and to predict the potential that an indicator will reach or remain in an undesirable state.

Taking, Monitoring, and Assessing Action

Based on the MSE, an action is selected and implemented. Monitoring of indicators is important to determine if the action is successful; if yes, the status, trends, and risk to the indicators continue to be analyzed for incremental change; otherwise as part of adaptive management, the outcomes need to be assessed and evaluated to refine goals and targets or indicators towards achieving objectives.

For more information visit: www.noaa.gov/iea

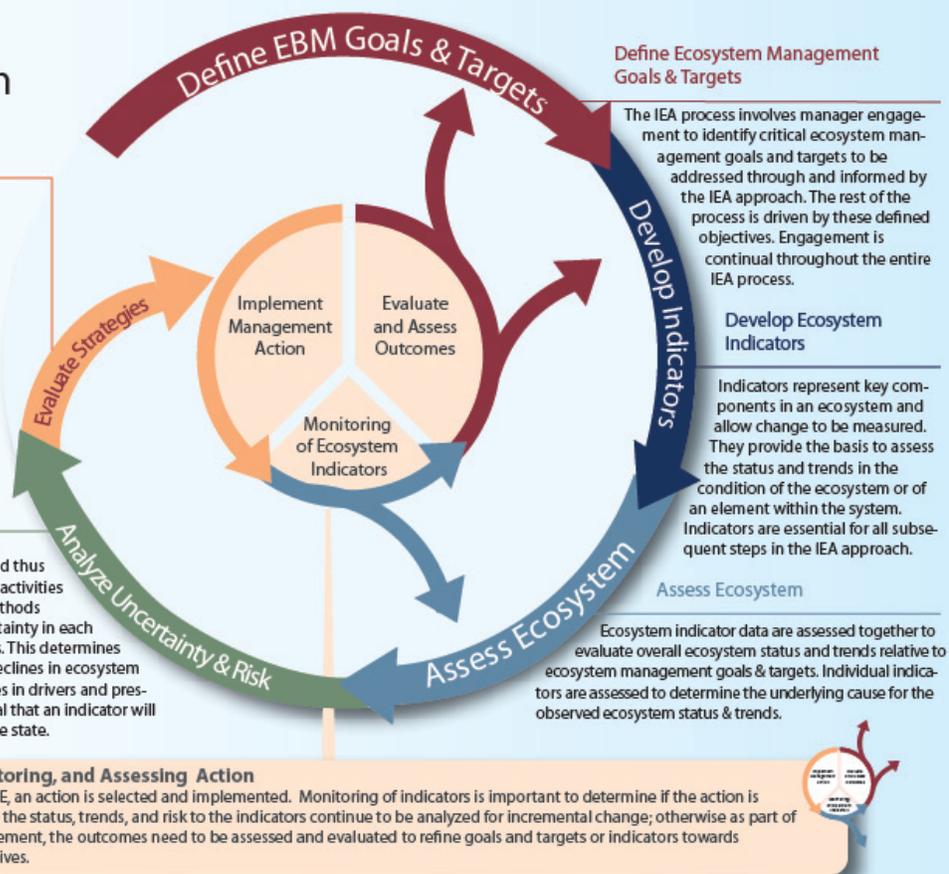


Figure 1. NOAA’s national IEA framework that is currently being implemented in many US coastal and marine waters, including the California Current.

The National IEA framework is shown in Figure 1. The IEA “loop” depicts an iterative and sequential approach to implementation of an IEA. The reality however is that capacity needs to be established in the various areas along the sequence before a seamless, end-to-end execution is achieved. This reality, along with limited resources led the CCIEA to approach the development of the IEA by focusing on building capacity in independent elements in the loop in non-sequential fashion. The first step in the IEA framework is to engage with potential clients to identify management needs and their Ecosystem Based Management (EBM) goals and targets. After engaging potential partners, the IEA should articulate the objectives to be achieved through the IEA process. To ensure at least some analytical infrastructure be in place to respond to defined management objectives, engagement with management agencies at the onset was somewhat limited, with the exception of the PFMC who has been engaged in the CCIEA from its early stages. As a result some CCIEA products have had limited applicability to non-fisheries management entities. Over time it has become apparent that a more directed and formal scoping effort early on in the process to clearly articulate the objectives of the IEA itself could have helped to define and focus the appropriate scale and scope to implement the IEA approach. By

clearly articulating IEA objectives, the IEA then has the ability to define and focus the needed level of human and fiscal resources to achieve these objectives. With greater knowledge gained over the years, and significantly advanced analytical capability established, the CCIEA is now expanding their management scope to meet and work with multiple state, federal and regional management agencies to address their management needs using the well developed suite of current and planned IEA products.

A key part of the CCIEA effort has been to describe the status and trends in several focal ecosystem components throughout the CCLME through extensive work to identify, define, and assess ecosystem indicators. This foundational work has helped lay the groundwork for the other steps of the IEA approach including the ability to conduct risk analyses, and to develop initial management strategy evaluations. Combined, this work has begun to provide managers with enhanced information needed to determine which management actions might be most effective at meeting their specified objectives. Thus, the cumulative efforts of the CCIEA are now coming together to provide a framework to support CCLME-wide decision-making. However, scaling to management relevant habitat spatial domains is a challenge the CCIEA will need to continue to address through the development of digital data layers, ecological indicators, and ecosystem assessments that can be applied at a variety of spatial and temporal scales. This will enable IEA products to address the specific science needs of agencies managing multiple uses of marine resources at different spatial scales.

Three of the four primary analytical components of the IEA (Figure 1), development of indicators, assessing the ecosystem, and analysis of uncertainty and risk have all been conducted at various levels of complexity in the CCIEA depending on the focal ecosystem component addressed. The groundfish focal component of the CCIEA is most mature, though the science presented for several other taxa (e.g. marine mammals, salmon, and seabirds) was also outstanding with respect to these three analytical components of the IEA loop. While the CCIEA has developed extensive capacity, capability, and expertise, and is a global leader in IEA, one area that needs to be further advanced in the IEA loop is Management Strategy Evaluations (MSE). Though CCIEA has run many MSEs, they have not yet been explicitly linked to a management decision and looped back to connect to adaptive management or scoping requirements. Additionally there needs to be more comprehensive execution of the full IEA loop (i.e. pulling together the “pieces and parts”) as well as integration across focal components. All of these recommendations are currently planned as next steps of the CCIEA.

SCIENTIFIC RESEARCH & DEVELOPMENT

The CCIEA has made significant scientific advancements in all of its phases. This is clearly shown by the number of peer-reviewed publications resulting from IEA work. The science has been cutting edge in the core IEA activities of modeling (including conceptual modeling), stakeholder engagement methods, indicator analysis, risk analysis, and management strategy evaluations.

Presentations of all of the phases (and conceptual models) provided lists of prioritized research for each area. In general, the CCIEA team has been good at providing “necessary next steps” in each area, although some of the “next steps” presented were fairly general. However, it should be emphasized that the CCIEA work is currently the best available science, and no significant gaps were noted that would prevent this work from moving to synthesis and/or operational activities rather than pursuing continual cutting edge advancement in individual phases. Specifically, while IEA might leverage or prioritize specific individual studies, the IEA-sponsored projects within the CCIEA should focus on synthetic tools and methods at this stage, rather than being spread across a new round of individual components.

In particular, the integration/synthesis of the “whole system” will require advances in cumulative risk analysis, valuations (including non-market value issues), and integration of human dimensions issues. The focus for the next phase of the CCIEA should be on these synthetic activities.

Transferability to other regions

The tools and techniques developed by the CCIEA (e.g. statistical techniques, risk assessment, indicator selections, conceptual models) will be useful, and have advanced the science for other regions in all phases/fields. While this allows the other regions to use these techniques and advance them further, the significant implementation work will still be region-specific (i.e. data gathering/preparation, performing the analysis, and interpreting /presenting results is region specific).

The most useful way forward to ensure transferability is for the IEA program to foster direct collaboration across IEA regional boundaries; e.g. the CCIEA team should work directly with other regions and Line Offices who could, for example, invite a CCIEA scientist to spend a short time in their center or laboratory to train other regions in specific analytical techniques; or develop IEA workshops (e.g. thresholds, risk assessment, etc.) that share expertise and lessons learned. The NOAA IEA program should strive to support activities that are done in a more cross-regional and collaborative manner and include more than 1-regional IEA program as principals in the activity.

Research Structure

The structure of a Core IEA Team and Conceptual Model–based focal ecosystem component teams established by the CCIEA is a strong structure that can be applied to other regions as their programs grow. As the CCIEA moves into more of an “integration” phase, the core team will need to take on a more integrative role, facilitating across focal ecosystem component teams. It may be that a new structural paradigm is required to facilitate integration and breakdown barriers that currently exist. For example, the core team could evolve to include lead members from each focal component conceptual model team and there may need to be increased mixing among the focal ecosystem component teams. Moreover, as the CCIEA program matures and becomes more operational, it will be important to consider how to evolve

the existing structure appropriately to move the program or, at least, specific products into an operational delivery mode. This will include a team that is able to provide the nexus between current operational approaches and scientific research. Techniques should aim to ensure operations continue to be cutting edge by effectively and quickly transitioning research into operations. The ISC should play a role in framing this structural evolution.

TRANSFERRING SCIENTIFIC KNOWLEDGE TO MANAGEMENT

Transferring scientific knowledge to management, also defined as Decision-Support, is one of the four "pillars" of the IEA strategic plan. This crucial pillar includes:

- integration and conversion of science components to products useful for management purposes
- engagement with management partners to assist in identification of management objectives
- conversion of science into management action
- completion of Management Strategy Evaluations (MSE) that are used to inform management decisions
- improving the scientific and ecosystem basis for marine resource management decision-making

A self-rating questionnaire on CCIEA performance was provided to the CCIEA project leads before the review process. Information on how the CCIEA has undertaken the transfer of scientific knowledge to management was therefore provided both from the answers to this questionnaire, as well as during the review process. These answers and the Review Panel's thoughts are organized below based on these initial questions.

Integration of CCIEA science and management efforts

Both the CCIEA leads and the Review Panel felt that there was integration within the scientific components, but differed in their opinion that there was integration among the scientific components. There were several very strong examples where specific modules (e.g. Salmon, Groundfish) were well integrated, with detailed and complete conceptual models, indicators, and in many cases completed risk assessments. However, the Review Panel did not see strong evidence that there has been success integrating these specific modules together. The Review Panel does acknowledge that this may be by design, as the initial strategy was to make advances on focal ecosystem components such as salmon and groundfish, and the CCIEA team did state that integration between these modules is planned to occur under the current phase. The Review Panel recommends that work to integrate these pieces be a central priority for the CCIEA team, with the goal that this integration be driven by the creation of useful management products.

In line with the need to do additional scoping, the CCIEA identified that management communities are engaged, but not as many, nor as closely as ultimately desired by the program. It was apparent from the review that the strongest ties to management were with the PFMC and its Scientific and Statistical Committee (SSC). An example was given of the CCIEA providing their IEA "toolbox" comprised of a suite of conceptual models, indicator screening methods, and indicator assessments to assist with Washington State Marine Spatial Planning. This can be viewed as a successful transfer of tools developed for the IEA to management, yet these ties did not appear to be as strong as the examples of scientific transfer to the PFMC that were provided in the review. The CCIEA team agreed to provide this IEA toolbox to the ISC in order to

increase visibility. As with the preceding section, it was apparent during the review that the scientific components making up this toolbox were robust, yet it was less clear whether these tools were developed with a specific management customer in mind. Both tools for a specific customer or more broadly produced are useful to the IEA program with customer specific tools more likely to inform management decisions and broader tools more likely to be transferrable to other customers and geographic regions.

Both the CCIEA leads and the Review Panel felt that in the future, it would be beneficial to make the IEA's science and management components more spatially focused to integrate better into a comprehensive IEA. The rationale for this was that many of the interested management entities are spatially focused (e.g. State resource management agencies, Sanctuaries), and may be interested in products to assist in strategic decisions. This is in contrast to the PFMC's desire for products that assist in tactical decisions for coast-wide unit stocks.

Management use of CCIEA products

The CCIEA process has created many products that are either directly tied to a management entity or can be considered useful products for managers. As previously discussed, the majority of these products are for use by the PFMC, yet the CCIEA team shared upcoming opportunities for additional management use by Federal and State entities. Specifically the products developed by the CCIEA were used in the following management activities:

Annual State of the California Current Ecosystem

In support of its ecosystem-based management processes, the Council has requested that the CCIEA provide an annual state-of-the-ecosystem report at each of its March meetings (beginning in 2014). The Council asked that this report be bounded to approximately 20 pages in length, and not wait for the "perfect" science to become available.

2013 Pacific Coast Fishery Ecosystem Plan (FEP)

The PFMC adopted a FEP in April 2013 that, among other things, establishes an annual process for reviewing ecosystem science and management issues. The FEP is the formal vehicle for the request that the CCIEA provide an annual ecosystem status report to the PFMC. Additionally, the FEP and its appendix provide an ecosystem initiative process for the PFMC to take up new EBFM measures and programs. The PFMC's first initiative was to prohibit fishing for currently unfished and unmanaged forage fish. For its second initiative, the PFMC is taking a hard look at the indicators used in the annual ecosystem status report, providing a multi-tiered scoping process for the report's indicators and analyses. The FEP's appendix describes ten potential ecosystem initiatives that the Council might consider undertaking in the future.

Ongoing Groundfish recommendations

Groundfish is one of, if not the, most complete modules in the CCIEA toolbox. To date, the CCIEA team has completed a conceptual model, developed indicators, performed risk analyses, and completed an ecosystem status assessment on groundfish. The CCIEA team has also completed a stock status product for six target species used as part of an essential fish habitat (EFH) evaluation, and provided ecosystem context for a 2014 Groundfish Fishery Draft

Environmental Impact Statement (DEIS). Finally, the CCIEA provided analysis of spatial and temporal overlap between groundfish fisheries and protected species (cetaceans, sea turtles) to inform an ESA Section 7 Consultation on the risk of ESA-listed species to incidental mortality in West Coast groundfish fisheries.

Dynamic Ocean Management

The CCIEA analyzed predicted fisheries catch and bycatch areas to provide an “ecocast” to the PFMC to assist in Dynamic Ocean Management.

Human Dimensions

While not as developed as the other science components of the CCIEA, the Human Dimensions team has completed a suite of fishery-related indices (e.g., commercial fleet diversification, personal use, fishery community vulnerability), which were presented to the Council’s SSC.

Dynamic Web Presence

The CCIEA team is making progress in updating the CCIEA webpage to dynamically disseminate information and allow for interactive plotting and use of CCIEA data and products. While this is still in development, the examples shown during the review have strong potential, and should help to deliver these products to managers. The Review Panel advises that the CCIEA web team work closely with the IEA Program Manager and Steering Committee to ensure that there is no duplication in web effort at the National and Local level.

Overall, it was clear from the review process that these products do provide services to management entities such as the PFMC; however, as of yet there are no concrete examples where these products have directly informed management decisions. The closest example given was in Puget Sound, where IEA work helped inform management target levels. While still not a direct pipeline to management, it was felt that the information was well received and is close to use in management decisions. Several of the CCIEA products, including the State of the California Current report, are now requested by the PFMC. Additionally the PFMC has requested a review of indicators and models developed as part of the CCIEA. This will be an important step in the IEA process, as this request implies that these products are either now, or soon to be accepted for use in PFMC management decisions.

While some of these ties are currently strong, there was an overall feeling by the Review Panel that stronger ties are needed between IEA products and management questions. There was a definite sense of products being built for the process more than to answer specific management questions. The Review Panel again advises the CCIEA team to complete scoping to help refine existing projects to facilitate management adoption, as well as to understand management needs before expanding components of the CCIEA.

Effective methods for management use of IEA products

The CCIEA team presented several methods that were effective in transferring their scientific work into useful management products. These included conceptual models, indicator suites, risk assessments, and reports to the PFMC and other interested partners. The conceptual models that the CCIEA developed are not only visually striking, but built upon sound scientific research. These models, coupled with the indicator suites and risk assessments, can provide a very solid assessment of the IEA components they cover. The Review Panel understands the strength that these simple conceptual models have in conveying complex systems of information, and feel that this product in particular can serve as a model for a National level best practice. It was also evident in the review that the CCIEA team has invested a lot of time into presenting completed tools to the PFMC and SSC, and through this effort the PFMC has warmed to the idea of using these tools in future management processes. In fact the biggest management success for the CCIEA may be the adoption and formal request for the State of the California Current report at the beginning of annual PFMC meetings. This is a concrete example of management use of an IEA product presented during the review. There are several other examples of products, including the component risk assessments and MSE runs from the CCIEA Atlantis model that are now beginning to be included in PFMC processes.

Recommendations to increase management adoption of CCIEA tools

The Review Panel recommends that the CCIEA continue to work with the PFMC to continue to understand how present IEA tools may be useful in the PFMC process. As stated before, the review process clearly showed that the CCIEA is furthest ahead in working with the PFMC, so this may just be a maintenance activity to ensure continued partnership. This relationship is important from a NMFS perspective, and helps carry the science and management process closer towards Ecosystem-Based Fisheries Management. However, the Review Panel does note that many of the products were developed based on the IEA processes, and less upon the realized needs of their management partners. This places the CCIEA in the position of having a strong suite of ecosystem tools, but without a solid clientele to put these into use. It has been recognized that applied science products are most often used to improve management decisions when they are developed jointly with the intended end-user. Joint development ensures the product meets the managers needs and represents the best available science.

The Review Panel identified that the CCIEA proposed future directions seemed to focus less on engaging with management partners, but more on continued growth of CCIEA components (e.g. seabirds, marine mammals, highly migratory species). The Review Panel highly recommends that the CCIEA team realistically assess their future goals, and focus more on identifying how to integrate discrete CCIEA components (e.g. Groundfish, Salmon), and refine existing products to provide tools applicable to help answer management questions of interest or inform management decisions. This is especially important as the CCIEA looks to management partners outside of the NMFS arena.

COMMUNICATION

In general, the CCIEA has done a good job of outreach and leveraging with a variety of

partners across the region. Both Centers have had multiple successful IEA projects supported through the NMFS Fisheries And The Environment (FATE) program. It was observed that CCIEA has secured significant external funds to leverage IEA-related activities from a wide variety of sources (e.g. foundation grants), due, in part, to buy in from more ecosystem-based management partners (e.g. Puget Sound Partnership, Washington State Marine Spatial Planning).

The CCIEA has been primarily focused on living marine resources and has done well developing relationships and advancing the application of the IEA approach to support needs within the PFMC. However, a broader range of appropriate partners both within and external to NOAA should be incorporated into the CCIEA. There are some efforts underway to do this in the CCIEA, such as with the National Marine Sanctuaries Program (NMSP), where the CCIEA will cooperatively apply the IEA approach to address needs related to development of NMS Condition Reports, and with the Washington State marine spatial planning effort. There is also the potential to build out a mutually beneficial partnership with the West Coast regional IOOS groups – SCCOOS attended the CCIEA review and showed great interest in advancing its relationship with IEA.

While there are some efforts to build out cross-LO partnerships, it is recognized that overall enhanced engagement with other Line Offices and integration and leveraging of program expertise to support CCIEA activities should be improved. While it is acknowledged that there are not substantial financial resources to be widely distributed, there are efficiencies that could be gained by leveraging and bringing in science expertise, management focal areas (e.g. coastal resilience) and other contributions from other NOAA line offices. It was noted that the internal governance structure for the CCIEA should be examined and an effort made to build out the CCIEA leadership team (i.e. the team that oversees budget development and planning) to include OAR, NOS, and other relevant programs within NMFS as fully integrated partners.

Some of the specific challenges associated with more comprehensive integration and leveraging with partners were identified as follows:

- IEAs are ultimately meant to inform an ecosystem level mandate that we don't currently have. In the near term, while IEAs are positioned to be able to support current more single sector management objectives in an ecosystem context, existing governance structures such as Fishery Management Councils are only just now gradually beginning to entertain more ecosystem-based approaches. Getting over the "why should we do this?" perspective is not trivial. In the longer term, though regional planning bodies (RPB) and ocean councils (ROC) would be an appropriate "home" and would provide a relevant governance structure to move towards EBM, these are currently in their infancy and there is some concern that investing too much time and effort in the emerging RPB/ROCs is a gamble as they are established under an Executive Order that might be dissolved in a new Administration.
- Some challenges result from a corporate culture that does not facilitate partnership unless there is funding to support that partnership. As noted, outreach in many cases has been considerable. However, unless there is a strong incentive from leadership, people will not

invest time or effort unless there are financial resources behind that investment, even if it is the right or better way to do it. Similarly, some potential partners have concerns about losing ownership or recognition of their work and products (e.g. their work is not funded by IEA therefore it is not an IEA product).

- Not enough engagement and partnership with the West Coast Regional Office (WCRO). This has many implications for improved engagement – first, the Regional Office can help communicate and pave the way for appropriate engagements and messaging at the Council level. Stronger and sustained partnership with WCRO might have enhanced and facilitated engagement with relation to non-fisheries management needs such as protected and endangered species, habitat, and other environmental considerations.
- More formalized “scoping” with managers at the outset might have resulted in more focused efforts with concrete products. Should start with clearly knowing the needs of managers and build the products to meet those needs.

Some positive aspects and lessons learned related to outreach...

- Even in the absence of funding, some partners are beginning to see IEA as an opportunity for networking and making their efforts greater than the sum of the parts; they see strength and value of the IEA as an opportunity to bring the community together to cooperatively and more effectively address science and management issues; and IEA provides a platform and home to integrate and leverage their work into a more holistic and comprehensive approach.
- Outreach and messaging needs to articulate what IEA is providing/ enables that a constituent doesn't already have or is able to do without IEA. Similarly, outreach and messaging needs to start with the more specific and concrete and move towards the more “abstract”. For example, approaching a manager with the concept of what an IEA or EBM is results in confusion and consternation (and was much of the way initial engagements were). Instead, start with a management challenge that a manager understands and then move in to describing how that challenge can be better addressed through a more holistic or ecosystem approach. Finally, describe how IEA is a method to achieve that enhanced decision-making. The overarching message is that this is about improving decision-making.
- In person engagement is critical to building trusted relationships. AND these relationships take time to build. Cannot do it in a year.
- Personal contacts cannot be underestimated.
- Know how you want to engage with your managers or stakeholders and perhaps even more importantly know how your managers or stakeholders are likely to engage with you (in many cases Regional Offices can help with this).
- The role of a regional project coordinator was noted as a critical outreach and relationship building capacity (both internal and external).

The CCIEA has developed and or used a variety of techniques to communication with managers and/ or stakeholders:

- Communication and Engagement Team
 - A team of 8-10 individuals was formed in 2012 to help with engagement and communication strategies. This team was cross-line office and cross-discipline, including a communications program manager from NWFSC.
- Toolbox
 - This concept was most useful to date with the State of Washington MSP process. Existing “tools” that were presented were capabilities in indicator selection and screening, indicator weighting, and conceptual model development.
- Presentations
 - These typically have been the most effective. They work best when tailored to the specific audience (i.e. Congressional staff, PFMC subcommittees/advisory bodies, NMS staff, parallel research groups) and there is opportunity for engagement and discussion with audience/stakeholders
- State of the California Current report (SOTCC) – The PFMC has requested this be a permanent annual submission for use in the Fisheries Ecosystem Plan. Annual update is presented to the PFMC at their March meeting. Refinements to the product are iterative with the PFMC each year to improve and tailor it for emerging needs.
- Publications
 - Absolutely essential for scientific credibility and to further the science
 - There is recognition that there needs to be a better way to highlight the large reports more effectively
 - They are often necessary to provide background/content for presentations; specifically to technical bodies/reviewers
- Videos
 - Beautifully made and engaging, however audience can be a bit limited.
 - Best used for general IEA engagement and interest
- Establishing a seat at the table (e.g. Scientific and Statistical Committee and PFMC meetings) and being persistent (don’t give up)
 - Can be very useful and important

Previous science co-lead of CCIEA Phil Levin, was a member of the PFMC Fishery Ecosystem Plan Development Team during the early ramp-up of CCIEA (2009-2012), which allowed early introduction of the IEA concept into PFMC discussions of EBM

- It took 2-3 years of annual presentations to the PFMC before real integration began and formal requests for continued presentations and reviews by the SSC
- Web-based California Current IEA report that synthesizes ecosystem information by combining diverse physical and biological attributes of multiple ecosystem components into a single dynamic assessment.

- Working on developing more dynamic web presence (including links to conceptual models); web plotting tools that allow indicator customization for users, including managers (who would have direct access)
 - Viewed as a major tool moving forward
- Workshops and product reviews (e.g. Atlantis model review; indicator selection review; scoping workshops)
 - Necessary and important to be able to integrate into management process
 - Helpful for the engagement process because it allows for one-on-one discussion and refinement of products for audience.
- Conceptual Models (see visualization products section)
 - Early feedback has been positive
 - Seen as a valuable tool going forward and plan to you use more
- Engagement Chapter in CCIEA Phase II report
 (<http://www.noaa.gov/iea/Assets/iea/california/Report/pdf/Engagement%20CCIEA%202012.pdf>)
- Informal interviews with managers and stakeholders
 - Allowed early management testing of various driver and pressure driven management needs

One of the key visualization products that is showing considerable effectiveness and would be a useful tool for other regions to enhance communication is conceptual models. They serve as a useful tool for engagement between scientists as well as between scientists and managers and other stakeholders. The conceptual models developed by the CCIEA:

- Are a good communications tool; they are simple, engaging, and readily adaptable,
- Provide a unifying framework,
- Link and integrate concepts across ecological components; enable consistent analyses across components,
- Can be used to help identify and define what indicators we need for each ecological component (e.g. what do we need to measure); Alternatively, indicators consistently map back to elements of the conceptual models,
- Help integrate scientists across ecological components by helping to visually define what they need to do together,
- Help define what needs to be included in ecosystem models,
- Show managers with different mandates how they all fit together,
- Depict human activities (positive and negative) as central aspect of the system
- Don't need to wait for perfection – get a strawman out there and start discussion and refinements with partners including managers,

Some potential areas for improvement and/ or next steps:

- The CCIEA took extensive time (18-24 months) to develop these; not a sustainable model for all regions to do the same; this effort can provide the template for other regions – need to develop and make available this template,
- Need to develop brief narratives to accompany the visualizations; the conceptual model won't get you there without a bit of explanation,
- Need to develop similar models for the Human Dimensions as has been done for the ecological components,
- Need to know audience and desired outcome of engagement (broad vs. tactical), some tools better than others depending on the audience

NOAA IEA FOCAL RESEARCH AREAS

The California Current IEA is making significant progress incorporating climate change, human dimensions, and reference points into the IEA process and its products. The California Current IEA is also facing significant resource constraints that are forcing the CCIEA to invest in only specific, focused activities. The review below is delineated by key topic areas, identified as national needs by the ISC, and suggestions are obviously resource constrained and should be pursued through leveraging opportunities and engaging new people where possible.

Human Dimensions

First, the CCIEA should be commended for putting together a large and diverse group of Human Dimensions Scientists to help integrate human dimensions into the CCIEA. The research being done currently is a good mix of secondary data products to advance the inclusion of human dimensions and theoretical work by the Social Well-Being In Marine Management (SWIMM) working group to develop the theory of how to use social well-being in marine management decisions. Moreover, the social vulnerability work provides a nice link between fishery management decisions and human impacts. This research is similar to that being conducted by Mike Jepson and Lisa Colburn in the Gulf of Mexico, southeast, and northeast (Jepson and Colburn 2013). There is already close collaboration amongst these groups to improve the methods being developed for assessing social and community vulnerability in NOAA writ large and within the NOAA-IEA program.

While the research on human dimensions science in the CCIEA is itself significant, the entire CCIEA could benefit from better integration of human dimensions with the biophysical research. This disconnect could be an artifact of the initial CCIEA leadership group having interest in human dimensions science, but no human dimensions scientists. The human dimensions scientists should be given a larger role in the leadership of the CCIEA and integration between disciplines should be a top priority, as it appears it will be based on the three-year plan. The CCIEA biophysical scientists should create products with logical endpoints to link to human dimensions. Ecosystem services provide the most widely accepted method to do this and could be pursued as an endpoint in the conceptual models for the biophysical

components and a starting point for the conceptual models on human dimensions. As funding allows, the CCIEA should broaden the number of social science disciplines conducting research for the CCIEA, especially working to incorporate geographers and sociologists. Lastly, we encourage the CCIEA to work on methods that enable MSEs that include the relevant human dimensions components to examine the likely impacts on human society both directly from the management action and indirectly from the management action affecting the biophysical ecosystem components and thus human society.

Climate Change

Some innovative research on the impact of climate change on the CC ecosystem has already been conducted under the auspices of the CCIEA, e.g. Hazen et al. (2013). The program is actively exploring a number of methods to explore the impact of climate change on the California Current System, which we fully endorse. Here are some recommendations for other climate change research:

- The CCIEA team's physical oceanographers should try to expand and deepen their interactions with the climate & regional oceanography community. Their ongoing involvement with the ROMS community (e.g., Enrique Curchitser, Al Hermann, Mike Jacox) will help reveal potential technical issues (like how are the winds downscaled and what that means for a set of simulations) and avoid dead-ends in the research process. The close contact with NOAA/ESRL could be expanded through greater interaction with both NOAA/GFDL and local scientists familiar with both physics and marine biology at CIMEC, JISAO, and NOAA/SWFSC.
- It is often easy to underestimate the natural variability in the climate system, especially in precipitation and dynamic fields such as the coastal winds, even in long-term trends (e.g. see Deser, C., et al., 2012: Communication of the role of natural variability in future North American climate. *Nat. Clim. Change*, **2**, 775-779, doi: 10.1038/nclimate1562.). Thus, it is important to have an ensemble approach to studying climate change. Since climate variability is outside of the funded scope of the CCIEA, the team is encouraged to strengthen their partnerships with NOAA/GFDL, NCAR, and NOAA/ESRL to include the climate ensemble projections developed by these groups. With closer contacts to the climate research community, the CCIEA would be able to take advantage of these ensemble forecasts to better analyze their ecosystem indicators in a climate context. Thus one will get a range or distribution of outcomes due to internal atmospheric variability (in addition to the inter-model difference people often think about) to which risk assessment can be applied.
- For the short-term (6-9) month predictions provided by the J-SCOPE program, the forecast skill should be rigorously assessed, using a large set of hind-cast simulations (this may be more appropriated directed at those running the model). For example, it is likely that there will be limited skill in the forecasts of the winds after a few weeks, which could impact the predictions of upwelling.

- For both climate change, for shorter-term forecasts and diagnosing the response to a given forcing (e.g. greenhouse gasses, ENSO), random atmospheric variability, can obscure the signal one is looking for. So, for example, the deepening of the Aleutian low in response to an El Nino event has a very wide range. So, an index might not necessarily be breaking down during a given decade or two, it may just be a period with greater noise in the Aleutian low relative to the signal than normal. In addition, significant events, such as droughts or ocean heat waves may be random events that are not driven by anomalous sea surface temperature and/or an increase in greenhouse gasses. This may confound a strictly index based approach to assessing current conditions or forecasts for the CC, and argues for a more holistic assessment of the climate system in addition to the values from a few indices and consideration of the noise inherent in the climate system.

Reference Points

The research on reference points in the CCIEA is advancing quite well. It is providing a natural connection to examine the relationship between anthropogenic drivers/pressures and biophysical ecosystem state. This includes the example regarding nutrient inputs and jellyfish off the coast of Oregon. The next steps for this research are to advance integration with human dimensions to define reference points related to societal benefits in addition to pressures and accounting for cumulative stress/pressures when defining reference points. The cumulative issue may be already be being addressed through the examination of a composite risk index. These pursuits are a fertile ground for scientific research that could lead directly to informing management.

LESSONS LEARNED

The CCIEA experience to date provides important lessons that all regions implementing an IEA can use to improve their likelihood of establishing a successful regional IEA. Many of these lessons have been captured in earlier sections of the review; however, the following is a summary of the most important lessons learned in the CCIEA experience that should be adopted and addressed by the other IEA regions.

First and foremost, the CCIEA experience has shown that the IEA framework is the appropriate architecture for providing scientific ecosystem information for use in resource management decision-making. This means all regional IEAs should continue to use, explore, and improve this framework.

The initial core development team of the IEA will have a large influence over what the IEA will look like for years to come. Nascent IEA programs are best to start with a small, focused, dedicated IEA group with careful consideration of the team's constitution that will lead IEA development in the region. This dedicated IEA core team should be cross-line office and cross-disciplinary; including human dimensions scientist(s) from the beginning. Incorporating multiple line offices helps to promote the program and project, build the project, and increase

leveraging opportunities. It is also necessary that NOAA leadership in the region support the IEA process and this core group by allowing them the time and resources necessary and facilitating connections to successfully develop the IEA. When developing a core group, nascent IEA regions should consult with the ISC, who will provide input on what has worked and not worked in the formation of other regional IEA programs and make sure the appropriate line offices and scientific disciplines are represented. Thus, it is best for regional IEA programs to start with an initial level of funding necessary to build this group. Once this group is well established with a clear vision for the IEA, including the definition of success; funds and capacity should be increased commensurate to fulfilling this vision. Changes in this core development team are inevitable and necessary to ensure its members do not grow weary of IEA. Thus, the IEA should plan ahead and ensure there is relative consistency and temporal overlap between leaders of the IEA. This will result in a continuity of operations and reduce transitional disruptions that are inherent with leadership changes.

When developing the IEA, it will be necessary to determine if you are using the IEA for a generic purpose or for a specific client. IEAs were originally envisioned to be multisectoral analytical engines providing essential scientific advice for ecosystem based management and thus were originally envisioned to support multisectoral marine planning. However, the governance structure for marine planning via regional planning bodies has yet to be implemented and is either non-existent or embryonic in US marine ecosystems. Under the current management paradigm, IEAs must deliver products to enable existing management entities to incorporate ecosystem science into decision-making. Thus, improving the management of marine ecosystems.

This shift in focus from IEAs supporting EBM by regional planning bodies to getting ecosystem considerations incorporated within the current management bodies occurred after the CCIEA began and forced regional IEAs to spend significant time early on defining the management entity(s) in their region that are willing and interested in incorporating the ecosystem context into their management decisions and/or those working on multisectoral marine resource decision-making (e.g. regional planning bodies, marine protected areas, environmental compliance, ecosystem restoration initiatives, etc.). Part of this process should attempt to identify geographically focused test beds where management entities are already thinking about EBM. These test beds can be used in a similar manner to how the CCIEA used Puget Sound. By defining the management entity early on and working with them to determine how the IEA process can help inform their decision-making the IEA will be able to define its scale (both spatial and complexity) and the endpoint it hopes to achieve (i.e. success). Defining the endpoint and scale allows the IEA to determine the resources necessary to achieve success. After securing the commitment of resources, the IEA can then work hand-in-hand with the receptive management entity(s) to achieve this endpoint and transition it to operations, allowing the IEA program to shift effort towards another region, management entity, or management decision. This does not mean the whole IEA process has to be undertaken at this scale, for example indicator development and ecosystem assessment can occur on the LME scale to

develop an Ecosystem Status Report. These can be easily downscaled for the specific management endpoint the IEA is working towards.

The first step of scoping the IEA is still confusing to many and was better refined in Levin et al. 2014, which came out 4 years after the CCIEA was initiated. Scoping objectives for the IEA should focus on engaging the management agencies that are going to use IEA products, not the stakeholders themselves. The management agencies ideally should already have scoped the stakeholders to define their EBM goals. In engagement with managers, we should start with concrete management examples they are familiar with, and then move into how this management could be improved (i.e. ecosystem approach), and finally the more “abstract” of the IEA process (i.e. how we help get to that better management). To date most interaction with managers via the IEA program both in the CCIEA and beyond is with Fisheries Management Councils. These provide a natural client as they move toward ecosystem based fisheries management. Ideally, through the scoping step we should identify management partners willing to incorporate more ecosystem based scientific management advice beyond fisheries. These management partners should become integral parts of the IEA as it can take years to cultivate the relationships necessary for these managers to feel confident and comfortable using IEA products to inform decision-making.

To get integrated into these management entities and get them to use their products it is often important to be fully engaged in their processes. For example, if you determine the Fishery Management Council is one of your IEA management partners, then researchers from the IEA should continue to embed themselves in this process whether as members of the SSC or other sub-committees and advisory bodies where IEA information might be transferred to advise management decisions. The CCIEA did a good job of this with the fishery ecosystem plan development for the PFMC.

One important communication tool that the CCIEA found was useful when engaging managers are visually pleasing conceptual models. The CCIEA seemed to have achieved the right balance between simplicity and complexity through the use of hierarchical conceptual models to effectively communicate without losing significant information. These models should be built using expert knowledge in conjunction with manager input to ensure the models are scientifically accurate and useful to managers. The CCIEA has also found the conceptual models quite useful to their scientists by showing them how to integrate different components across the IEA process (e.g. climate, plankton, and fisheries). CCIEA conceptual models along with symbols available via IAN press (<http://ian.umces.edu/symbols/>) could be borrowed by other regions to quickly and efficiently develop their own conceptual models. By doing this, we could allow all regional IEA programs to communicate with their respective managers using a standard IEA tool.

When selecting indicators the CCIEA developed a very robust indicator selection framework that was used for their biophysical indicators and modified for selecting human dimensions indicators. Other regions should adopt this indicator selection framework and in fact those with indicators seem to already have employed a process similar to that of the CCIEA.

This indicator selection process in the California Current ecosystem originally used a literature review process before moving to combined literature review and consultation with experts. This sped the process up significantly since the experts had the literature review already completed in their minds and could recall that information quickly. This also decreased the chances of IEA researchers burning out by conducting extensive literature searches for 100s of potential indicators.

Another key lesson regarding indicators is the use of seabirds and marine mammals as indicators of ecosystem health and integrity that also translate fairly easily to human dimensions. As top-level predators, these indicators integrate a lot of the physical and lower trophic level variability and trends providing large temporal and spatial scale indicators that are often lacking. They also tie directly to human dimensions, because they are ecosystem components that human society has shown they highly value both in terms of economic activity via ecotourism and legislation such as the Marine Mammal Protection Act (MMPA).

When conducting risk assessment and management testing and scenarios there is a need to make sure the two components are closely aligned, as the division between the two is often arbitrary, especially with respect to things like climate change. Specifically, the CCIEA is investigating the use of risk assessment as a screening tool for MSE. This way MSEs are certain to target the most at-risk ecosystem components.

Once IEA products become routine and regularly delivered to management entities, the IEA program must determine how best to transition these products to operational/application status. Given the current funding limitations, IEAs need to pass off the production of products once they have reached this stage and the ISC and regional programs need to work now to determine how best to do this. The goal should be to have a defined structure with willing operational entities in place once products reach this stage. The State of the California Current Report in the CCIEA may be one of the first products to reach this stage and the potential to use this as an operational guinea pig should be investigated.

Communication is essential for IEAs to be successful and learn from one another. The CCIEA and ISC both felt it would be beneficial to increase communication with the CCIEA NMFS science centers being funded by the IEA. The CCIEA also expressed a desire to work significantly more across regions. This echoes the sentiment expressed by researchers from other regions at the national IEA meeting in 2014. The ISC will make opening these communication routes a top priority in the ensuing year. The ISC is seeking to establish and fund a couple IEA working groups to share experiences across the IEA program and advance IEA science. The ISC will also work to develop rotational assignments for IEA scientists wishing to spend some time working with IEA researchers in another region. The idea being that we can concentrate the scientists working on IEA to develop cross-regional methods for IEA components. These efforts will increase the transferability of products and knowledge across the regional IEA programs.

There were also a number of specific lessons learned by the CCIEA about implementing the IEA that do not pertain to a specific part of the IEA process. The first was to be willing to be a guinea pig and test things in the IEA recognizing that not everything will be successful and

there will be some mistakes as IEAs are still in their infancy. The CCIEA felt their biggest setbacks happened when they were sitting back to wait and see what happened. The IEA website experience to date has been inadequate and we need a dynamic, up to date website with regional content management for efficient updating. The IEA program provides a platform for capabilities that lack a home elsewhere in NOAA, specifically with respect to non-stock assessment ecosystem modeling, biophysical and human dimensions integration, and risk assessment. However, these are not ends unto themselves in the IEA and we must ensure they feed into the IEA process. The unfortunate situation we are facing in the national IEA program with insufficient funding to significantly invest in more than one regional IEA program means we have had to decrease funding to the CCIEA. This decrease in funding and the associated lost capacity results in a reduction in our IEA-related capabilities not just in the CCIEA, but also throughout the IEA program.

SUGGESTED FUTURE DIRECTIONS FOR THE CCIEA

The following list is a compilation of the highest priority recommendations made throughout this document to the CCIEA.

Highest Priority

- Focus on integrating the products and research rather than on expanding to new things (e.g. HMS indicators). There is already an impressive amount of science being conducted. The focus now should be on integrating these parts. New research within a single focal ecosystem component should only be undertaken if it is essential to conducting the IEA for a specific management client, or if it is funded outside of the IEA program through a leveraging opportunity.
- The CCIEA should focus on defining their end-users and developing products tailored to meet their needs. The CCIEA has done a good job of this with the PFMC, who is currently asking for an annual CCIEA state of California Current report and the PFMC SSC is asking for greater communication and interaction with the CCIEA. These are excellent examples of the CCIEA informing management. This engagement should be continued and expanded if appropriate. The CCIEA has yet to be able to directly inform/influence a resource management decision in the CCLME. This is due to a number of externalities; most relevant are the CCIEA being developed with the expectation of becoming a >\$3M per year program in the CC alone and the difficulty in scoping managers without any concrete examples of products that will be produced by an IEA. Thus, the conversation was often too abstract for managers to invest significantly in the IEA process. Also, the PFMC does not have a multisectoral mandate without embracing the concept of optimal yield. Thus, they require more engagement to show how ecosystem science information and management can improve their fisheries decision-making within its current governance structure. The recent involvement with Washington State marine planning might be more fruitful.

- Moreover, the CCIEA should focus on developing IEA products to directly inform management decision(s). One way to do this is to evaluate and test management strategies that will inform specific management decisions. This will need to be done by working with managers to understand what decisions are pending or on the immediate horizon. Then, get the managers comfortable with MSE and finally tailor the MSE to meet their needs and inform the decision.
- To help further the potential of informing management decisions and now that we have a number of products from the CCIEA and other regions to demonstrate, potential management partners (e.g. Regional Office, Regional Planning Body, Marine Sanctuaries, etc.) should be reengaged and the scope of the CCIEA refocused by determining how the IEA can successfully be integrated into resource management decision-making as a successful endpoint. Then, work to achieve that success with the management partners and operationalize the product, so you can move on to the next topic.
- Enhance the CCIEA team by engaging and building cross-regional collaborations across the NOAA IEA program. Regions cannot work in a silo, and need to both leverage IEA experience from other regions, as well as promote collaborative work with IEA partners from other regions. This can be either through formal workshops to promote knowledge and experience in specific IEA Loop activities (e.g. Indicator development, Risk Assessments), collaborative work on specific IEA activities (MSE development and implementation for IEA sectors/modules, or training or mentoring in that region's particular skills using a "Center of Excellence"-type model. The ISC will form working groups for each IEA component and other shared topics. Additionally, rotational assignments within the IEA program should be encouraged to allow IEA researchers to move around and work with other IEA programs and share ideas and suggest improvements. This is especially important when two regions desire to tackle the same problem, e.g. connecting biophysical state to human well-being, at the same time as is currently proposed for both the California Current and Gulf of Mexico Regional IEAs. The CCIEA should also increase its participation at NOAA IEA annual meetings to better convey their experiences to other regions and increase cross-regional learning.
- Communication between the ISC and CCIEA needs to be improved to benefit both the CCIEA and other regions by making them more aware of CCIEA activities.
- At this stage, the CCIEA should fund synthetic, integrated activities focused on advancing the IEA. Individual studies within focal ecosystem components should be conducted with leveraged funding opportunities. This is not ideal, but necessary given the funding constraints facing the IEA program.
 - An example of these synthetic activities that the CCIEA is pursuing and the ISC encourages is the development of a dynamic website for real-time or near real-time indicator tracking and assessment.

- The CCIEA's work on reference points is also encouraged, but it should be integrated with the human dimensions, which is critical for developing reference points that reflect societal concerns and viewpoints and treat humans as more than a pressure upon the ecosystem.
- The toolbox/presentation that was shown to Washington State to get them interested in using the IEA process should be made available to the NOAA IEA community.
- The CCIEA should investigate pursuing ecosystem services as a way to bridge biophysical and human dimensions sciences to integrate the two. Including ecosystem services in the conceptual models could help to communicate with managers, since many resource managers make their decisions based on the expected delivery of ecosystem services, even though they rarely use the ecosystem service term.

Next Highest Priority

- In addition to the toolbox, develop a few poster children to show examples of how the IEA can successfully result in improved science-based management. One example might be the PFMC asking for an annual ecosystem status report, but we need others that show how the full IEA framework improves resource management.
- The CCIEA should attempt to engage other NOAA line offices. Given the current budget, this would have to be with no money to offer, so it may be difficult. IEA Leadership will work to get buy in from line office leadership to aid the regions in getting engagement where no funds are available for the other line offices. Other line offices could help to build the expertise and increase leveraging opportunities for the CCIEA. One of the most logical paths that the CCIEA is currently pursuing is working with the National Marine Sanctuaries for indicators and thresholds that can be incorporated into the sanctuaries' condition reports.
- The CCIEA should move away from the voluminous reports they have been producing, which they openly admit don't have a broad audience. The 20-page Ecosystem Status Report goes along way toward this, but may not contain all of the information the CCIEA should be conveying to managers. As the CCIEA has suggested, they should explore ideas such as dynamic, mobile websites and apps that can be used to better transfer CCIEA knowledge and products to managers.

TERMS OF REFERENCE FOR IEA STEERING COMMITTEE REVIEW OF REGIONAL IEA PROGRAMS, WITH SPECIFIC TERMS OF REFERENCE FOR REVIEW OF THE CALIFORNIA CURRENT IEA IN 2015

I. Purpose of the Review

The Integrated Ecosystem Assessment (IEA) process is a complex, iterative science-to-management endeavor, which requires broad expertise and participation to execute successfully (Levin et al. 2009, Levin et al. 2014). Recognizing the implementation complexity, the purpose of the IEA review by the IEA Steering Committee is to provide a constructive analysis of each regional program and determine if the current IEA guidelines need to be modified to reflect lessons learned while conducting IEAs. The IEA steering committee will use each review to strengthen all regional IEA programs. Thus, the reviews will focus on lessons learned, best practices identified, and transferrable products, analyses, and methods.

The review should also assess the regional IEAs contribution to the IEA Program's goals and objectives. In addition to general overarching goals and objectives for each Large Marine Ecosystem (LME) with IEA funding, the IEA Program has the following goals:

1. Identify methodology to develop Reference Points
2. Develop frameworks to fully incorporate Human Dimensions into IEA development and implementation
3. Ensure climate change is being appropriately incorporated into IEAs

II. General Guidelines for Regional IEA Reviews (draft)

1. Each review will be conducted by the IEA steering committee and will consist of a subset of the IEA steering committee and a manager or two from the region that will participate in the review, but not have writing responsibilities.
 - a. There will be leads for each section of the review and other reviewers will provide comments to the lead reviewer for each section.
2. The goal is to review one IEA regional program every other year, ordered according to the length of time the regional IEA has been funded
3. Reviews should be interactive, critical, and constructive (rather than an administrative requirement) and produce concrete outcomes. Reviews will examine the IEA progress relative to: the steps in the general IEA loop; IEA program goals; utility for resource managers; development of transferrable methods, products, and best practices; and integration of ecological and socioeconomic components and institutions.
4. Reviews will identify strengths and weaknesses in the regional IEA with a focus on how to improve the IEA in that region and all regional IEAs in NOAA
5. Reviews should identify successful processes in that region that should be transferred to other regions to strengthen the overall IEA effort
6. Upon completion of the review, and iteration between the review panel and the regional IEA leadership to clarify any outstanding issues, the final report will be made available on the IEA website.
7. These general guidelines should be updated regularly as the review process evolves

III. Regional IEA: California Current Guidelines

In FY14-15 the IEA Steering Committee will review the California Current IEA (CC-IEA) program to run coincident with the California Current internal review and planning process. This review should not interfere with the internal review process. It is anticipated that the review of the CC-IEA will take place the week of January 19, 2015 and preliminary results will be presented to the CC-IEA leadership team at that time. It will be revised based on feedback from the CC-IEA leadership group and an agreed upon final review will be submitted to the IEA Steering Committee in March 2015.

IEA implementation has focused on the scientific program with each regional IEA process at a different development state. Therefore, within the context of the general and programmatic guidelines, it is appropriate for the review committee to provide specific questions to be addressed by each IEA. The review of the CC-IEA should include answers the following questions, but should not be constrained to just these questions:

IMPLEMENTING THE IEA FRAMEWORK

- 1) Were the CC-IEA mandates sufficiently well defined to allow concrete milestones and significant advancements? If they were not well defined, are they now or what needs to be better defined?
- 2) What were the biggest challenges faced in the IEA and how were they overcome?
 - a. Are similar challenges likely to be encountered in other regions and would similar solutions likely be successful?
- 3) What is the appropriate spatial scale for the first cycle of the California Current IEA?
 - a. If you had it to do over would you change the spatial scale?
 - b. Have all of the major ecosystem components received an appropriate level of research focus?
 - c. Were the methodologies applied to each step in the IEA sufficient to adequately complete that step at the appropriate spatial scale for the CC-IEA?
- 4) The CC-IEA received \$5M from FY10 to FY14 to initiate the CC-IEA. Was this an adequate level of time and funding to conduct a full revolution of the IEA loop?
 - a. Should allocations be different in other regions based on the lessons learned in the CC-IEA (i.e. can lessons learned here make other regions more efficient)?
 - b. What was and is the level of internal NOAA support for the CC-IEA? Is it sufficient to meet the ongoing needs of the IEA team?
 - c. How much is going to be lost as the IEA program gets cut back to base funding levels?
 - i. What are options to mitigate these losses?
- 5) Does NOAA's IEA vision or priorities need to be adjusted based on the results from this IEA?

SCIENTIFIC RESEARCH & DEVELOPMENT

- 6) Has the CC-IEA made significant scientific advancements that are transferrable to other regions?
 - a. Which phase(s) of the IEA framework has the IEA been able to provide significant scientific advancements to further our ability to successfully conduct that phase of an IEA?
 - b. What phases are most in need of scientific advancements?

- 7) What scientific advancements and lessons have we gained in the California Current IEA that could be adopted elsewhere?
- 8) What was the structure for conducting scientific research in the IEA? Was it appropriate and did it result in significant scientific achievements?

TRANSFERRING SCIENTIFIC KNOWLEDGE TO MANAGEMENT

- 9) How well integrated are the CC-IEA science and management efforts?
 - a. Are the science components integrated?
 - b. Are management communities engaged?
 - c. Should science and management be more spatially focused to integrate better into a comprehensive IEA?
- 10) What IEA products did management use?
 - a. What management decisions did they inform?
 - b. Are there management entities now asking for (and/or paying for) IEA products?
- 11) What was the most effective method for getting IEA products to be used to inform management decisions?
 - a. What was the biggest management success to date?

COMMUNICATION

- 12) Did the CC-IEA comprehensively integrate and leverage IEA-related activities in the California Current and incorporate all appropriate partners (both within NOAA and externally)?
 - a. If not, what were the reasons or causes?
 - b. Is the CC-IEA effective at securing additional resources from relevant partners and external funding sources?
- 13) What different techniques were employed to communicate with managers and/or stakeholders?
 - a. Which were most successful or ineffective?
 - b. What would your recommendations be for other regions to communicate with their stakeholders and managers?
- 14) What visualization products were produced by the IEA?
 - a. How did visualizations help improve engagement with IEA partners?
 - b. Were any visualizations notably successful or ineffective?

FOCUS AREAS FOR RESEARCH IN THE 3-YEAR PLAN

- 15) How did the IEA incorporate human dimensions/social science into the process?
 - a. Was the incorporation of human dimensions sufficient? Was it ideal?
 - b. How would the IEA have incorporated human dimensions differently in an ideal (i.e. not resource limited) IEA?
- 16) How was climate change incorporated into the IEA process?
 - a. Was climate change addressed or incorporated into scenarios when conducting MSEs and providing management advice? Was it incorporated into risk assessments?
- 17) What methods were employed to define reference points in the IEA?
 - a. How were these reference points utilized when assessing the ecosystem, analyzing risk, or evaluating management strategies?

EVALUATION (*This section will be small and not have a designated lead reviewer*)

18) What was the internal review process for the IEA? Was it effective what would you have changed to improve its efficacy and utility?

DAY 1--Tuesday, Feb. 10, 2015

WebEx info:

<https://mmancusa.webex.com/mmancusa/j.php?MTID=ma72691860037bca670dbd1e40bd76898>

teleconference #: 1-866-692-3582; Attendee access code: 191 194 0

<u>Time</u>	<u>Topic</u>	<u>Presenter(s)</u>	<u>Relevant Readings in "CCIEA REVIEW, 2015" Google Drive folder</u>
<u>OVERVIEW PRESENTATIONS</u>			
8:30-9:00	Welcome/Introductions/TORs	Chris Kelble	/agenda and TORs/IEA Steering Committee Charge to Reviewers 140829 - clean.docx
9:00-10:00	CCIEA history	Frank Schwing, Cisco Werner, John Stein, Brian Wells	/Phase I report (2011)/CCIEA Phase I tech memo_final.pdf /Phase II report (2013)/Report Preface CCIEA 2012.pdf
10:00-10:30	CCIEA present status	Toby Garfield, Chris Harvey	/Phase III report (2014)/Introduction CCIEA Phase III_DRAFT.pdf
10:30-10:45	COFFEE BREAK		
<u>INDICATORS AND CONCEPTUAL MODELS</u>			
10:45-11:15	Conceptual models	Chris Harvey, Greg Williams	browse files in subfolder "Conceptual models"
11:15-12:00	Indicator evaluation in the CCIEA	Kelly Andrews	/background literature/Kershner et al 2011
12:00-1:00	LUNCH BREAK		
<u>ECOSYSTEM COMPONENTS PART I</u>			
1:00-1:45	Physical drivers	Elliott Hazen, Toby Garfield	/Phase II report (2013)/Drivers and pressures/Ocean and Climate CCIEA 2012.pdf /Phase III report (2014)/Drivers and pressures/Ocean and Climate Drivers_2013.pdf
1:45-2:30	Forage species & Salmon	Brian Wells	/Phase III report (2014)/Ecosystem Components/Coastal pelagics forage_2013.pdf /Phase III report (2014)/Ecosystem Components/Salmon_2013.pdf
2:30-3:15	Groundfish	Chris Harvey, Greg Williams	/Phase II report (2013)/Ecosystem Components/Groundfish Status CCIEA 2012.pdf /Phase III report (2014)/Ecosystem Components/Groundfish_2013.pdf
3:15-3:30	COFFEE BREAK		
3:30-4:15	Habitat	Correigh Greene	/Phase III report (2014)/Ecosystem Components/Habitat_2013.pdf
4:15-5:15	GROUP DISCUSSION	Chris Kelble	
5:15	Adjourn		

DAY 2--Wednesday, Feb. 11, 2015

WebEx info:

<https://mmancusa.webex.com/mmancusa/j.php?MTID=ma72691860037bca670dbd1e40bd76898>

teleconference #: 1-866-692-3582; Attendee access code: 191 194 0

<u>Time</u>	<u>Topic</u>	<u>Presenter(s)</u>	<u>Relevant Readings in "CCIEA REVIEW, 2015" Google Drive folder</u>
8:30-9:00	Any follow-up from Tuesday	Chris Kelble	
<u>ECOSYSTEM COMPONENTS PART II</u>			
9:00-9:45	Marine mammals	Sharon Melin	/Phase II report (2013)/Ecosystem Components/Marine Mammal Status CCIEA 2012.pdf
9:45-10:30	Seabirds	Tom Good	/Phase II report (2013)/Ecosystem Components/Seabirds CCIEA 2012.pdf
10:30-10:45	COFFEE BREAK		
10:45-11:30	Anthropogenic drivers	Kelly Andrews	/Phase II report (2013)/Drivers and pressures/Anthropogenic Drivers and Pressures CCIEA 2012.pdf
11:30-12:15	Human dimensions	Karma Norman	/Phase II report (2013)/Ecosystem Components/Human Dimensions CCIEA 2012.pdf /Phase III report (2014)/Ecosystem Components/Human Dimensions_2013.pdf /Phase III report (2014)/Ecosystem Components/Human dimensions Appendix_2013.pdf
12:15-1:30	LUNCH BREAK		
<u>RISK ASSESSMENT AND MSE</u>			
1:30-2:15	Risk assessment activities	Jameal Samhoury	/Phase II report (2013)/Risk/Ecological Integrity Risk CCIEA 2012.pdf /Phase II report (2013)/Risk/Groundfish Risk CCIEA 2012.pdf /Phase II report (2013)/Risk/Marine Mammal Risk CCIEA 2012.pdf /Phase III report (2014)/Risk/CPS Climate change risk_2013.pdf /Phase III report (2014)/Risk/Top predator risk_2013.pdf
2:15-3:30	MSE activities	Isaac Kaplan	/Phase II report (2013)/MSE/Management Strategy Testing no Appendices CCIEA 2012.pdf /Phase III report (2014)/MSE/Management Strategy Evaluation 2013.pdf /other reports/2014 Pacific Fishery Mgmt Council docs/SSC Review of Cal Current Atlantis_Final Report.pdf
3:00-3:15	COFFEE BREAK		
<u>STRATEGIC PLANS AND SYNTHESIS</u>			
3:15-4:15	CCIEA three-year strategic plan	Toby Garfield, Elliott Hazen, Chris Caldwell, Chris Harvey	
4:15-5:30	SYNTHESIS AND DISCUSSION	Chris Harvey	
5:30	Adjourn		

DAY 3--Thursday, Feb. 12, 2015

WebEx info:

<https://mmancusa.webex.com/mmancusa/j.php?MTID=ma72691860037bca670dbd1e40bd76898>

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<u>Time</u>	<u>Topic</u>	<u>Presenter(s)</u>	<u>Relevant Readings in "CCIEA REVIEW, 2015" Google Drive folder</u>
8:30	Any follow-up from Wednesday	Chris Kelble	
<u>PROCESS, LOGISTICS, LESSONS LEARNED</u>			
9:00	Relationships with HQ, PFMC, "customers"	Werner, Stein, Garfield, Harvey	/other reports/2013 Pacific Fishery Mgmt Council docs/Groundfish EFH report 2013.pdf /other reports/2013 Pacific Fishery Mgmt Council docs/SSC report_groundfish harvest specs_2013.pdf /other reports/2014 Pacific Fishery Mgmt Council docs/IEA State of the California Current report.pdf /other reports/2014 Pacific Fishery Mgmt Council docs/IEA State of the California Current supplement.pdf /other reports/2014 Pacific Fishery Mgmt Council docs/SSC Review of Cal Current Atlantis_Final Report.pdf /other reports/2015 Pacific Fishery Mgmt Council docs/SOTCCreport_SSCEsreview_draft2.docx
9:45	Website	Greg Williams, Elliott Hazen	
10:30	COFFEE BREAK		
10:45	Funding/resources; other issues <i>(how much do you need to do an IEA?)</i>	SC, Werner, Stein, Garfield, Harvey	
12:15-13:30	LUNCH BREAK		
1:30-?	Continued discussion	SC, Werner, Stein, Garfield, Harvey	
<u>STEERING COMMITTEE DISCUSSIONS</u>			
?-?	Report preparation	Chris Kelble	
?	Adjourn		