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Report of the National ESR Workshop

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Executive Summary

Ecosystem Status Reports (ESRs) are synthesized scientific products that provide information on the past and possible future conditions of marine ecosystems based on suites of indicators. This information provides vital context for a range of decisions affecting marine ecosystems and supports an ecosystem approach to marine resource management. Advancing ESRs is a goal of the NOAA Fisheries and one of the core components called for the NOAA Fisheries Ecosystem-Based Fishery Management (EBFM) Road Map, NOAA Fisheries Climate Science Strategy (NCSS), the NOAA Integrated Ecosystem Assessment (IEA) regional plans, and the National Responses to the FY 2016 Reviews of NOAA Fisheries' Ecosystem-Related Science Programs.

In May 2017, NOAA Fisheries held a workshop in Silver Spring to review the status of ESRs, develop plans to meet emerging requirements, and examine how to track progress in ESRs within each region. This workshop involved a pre-meeting assessment of current ESR efforts and was the first time the leads for all the ESRs across the country (the national ESR team) gathered for cross-regional collaboration and planning. This effort identified key challenges, opportunities and future efforts to advance ESRs in each region over the next five years.

ESRs provide timely and holistic ecosystem context as a background for stock assessments and other marine resource management. With indicators on socio-economic, biological, physical, and chemical aspects of ecosystems, the ESRs provide comprehensive system descriptions and valuable information on past, current and projected states of U.S. large marine ecosystems (LMEs) for marine resource managers and stakeholders such as NOAA Fisheries scientists and managers, Fishery Management Councils (FMCs), regional fishery commissions, state and tribal governments, and National Marine Sanctuaries.

During the workshop, participants identified goals for enhancing and expanding the applicability of ESRs, specifically focusing on ESR production, ecosystem indicator selection and development, ESR delivery, and how to evaluate the effectiveness of ESRs. Workshop participants valued the opportunity to share their experiences and explore best practices offered by each of the Science Center representatives. At the end of the workshop, each regional ESR representative identified their priorities and next steps for addressing current, emerging, and future ecosystem science and management objectives. The national ESR team developed the following guidelines for improving ESRs:

1) Establish a platform for information exchange, tool sharing, and data repository.
2) Incentivize engagement with and contribution to ESRs within NOAA Fisheries, across NOAA Line Offices, and beyond.
3) Develop strategies for streamlining ESR production and incorporation into the decision-making process.
4) Increase analytic capacity of indicator reporting.
5) Improve the ability to project future states of the system.

6) Develop appropriate indicators for human dimensions, recruitment strengths, ocean acidification, management complexity and for harmful algal blooms and other unusual events.

7) Broaden communication with multiple users, including NOAA Fisheries Regional Offices.

8) Develop a metrics and evaluation process to measure the effectiveness and uptake of ESR products.

Implementing ESRs in all NOAA Fisheries' regions is a critical step towards implementing EBFM and other key strategies and mandates. While additional efforts are needed—including increasing staff time and other resources, organizing targeted workshops and working groups, leveraging expertise and experiences across regions, engaging with the broader community, and increasing collaboration among NOAA focal components—the national ESR team will continue advancing ESRs as a key tool for promoting healthy and resilient ecosystems and productive and sustainable fisheries.

Acknowledgements

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Background

NOAA Fisheries has recently codified its support for ecosystem-based management with the release of its EBFM Policy (NMFS, 2016a) and Road Map (NMFS, 2016b) in November 2016. As NOAA Fisheries strives to meet its multiple mandates, account for environmental changes, and assess trade-offs for actions that impact multiple resources, there is an increasing demand for information on past, current and future conditions of ocean and coastal ecosystems. In order to effectively manage resources in a changing environment, decision-makers need ecological information provided through a coordinated, holistic approach that addresses issues across species and mandates. NOAA Fisheries has recognized this critical need, calling for improved understanding of ecosystem processes to better inform marine resource management.

To assist decision-makers coping with changing ocean conditions and complex issues that confront our valuable marine ecosystems, each ESR regional team endeavors to provide ecosystem context for marine resource management. In collaboration with other NOAA facilities, academics, and non-governmental organizations (NGOs), NOAA Fisheries scientists analyze environmental and socioeconomic data and synthesize biological, physical, chemical, and socioeconomic indicators with support from the FATE program, the IEA program, and other ecosystem science-related programs in NOAA. ESRs take advantage of the confluence of scientific disciplines to generate our best thinking on ecosystem conditions, and many of the indicators developed by ESR regional teams have been used in regional IEAs, state resource management, and fishery stock assessments.

By providing system context and highlighting the status and trends of indicators, ESRs are instrumental in supporting ecosystem-level advice for marine resource management. What began as an organic assembly in a few NOAA Fisheries Science Centers, today has propagated across the country to become a key product in all five NOAA IEA program regions. By producing summaries of ecosystem dynamics, including pressures and responses, ESRs provide comprehensive information for Fishery Management Councils, regional fishery commissions, state and tribal governments, National Marine Sanctuaries, and other marine resource management organizations. Currently published and routinely updated ESRs are:

- The Ecosystem Status Report for the Northeast (NE) Shelf LME (including the Current Conditions and the Climate update) (NEFSC, 2017a, b, c, d);
- The Gulf of Mexico (GOM) IEA Ecosystem Status Report (Karnauskas et al., 2017);
- The California Current (CC) Ecosystem Status Report (Harvey and Garfield, 2017);
- The Alaska (AK) Marine Ecosystem Considerations (including Eastern Bering Sea ESR, Gulf of Alaska ESR, and Aleutian Islands ESR) (Zador, 2016; Zador and Siddon, 2016; Zador and Yasumiishi, 2016); and
- The West Hawai‘i (WH) IEA Ecosystem Trends and Status Report (Gove et al., 2016).

ESRs play a significant role in aggregating disparate science programs and providing scientific information to support marine resource management. Successfully meeting the information demands requires understanding the status of ecosystem properties in each region, identifying clear goals, developing plans to meet the requirements, and tracking progress over time. To

address near-term issues and provide long-term planning, NOAA Fisheries held an ESR workshop in Silver Spring, MD from May 16 to 19, 2017. This workshop aligned with priorities of the FATE and IEA programs: to develop and apply ecosystem science to fishery stock assessment and NOAA's growing and diverse marine management partners' needs. This workshop also addressed calls to advance ESRs in Action Items 15 and 16 of the National Responses to the FY 2016 Reviews of NOAA Fisheries' Ecosystem-Related Science Programs (NMFS, 2016c), Action Item 2bi of the EBFM Road Map (NMFS, 2016b), and Objective 6 of the NCSS (Link et al., 2015).

Terms of Reference

Background

Ecosystem Status Reports (ESRs) are being developed in all NOAA Fisheries regions. With high and growing demand for information on ecosystem conditions from many sectors, ESRs are becoming important in supporting holistic approaches to management and are useful to NOAA Fisheries and other marine resource managers. To address the increasing demand for comprehensive information, NOAA leadership must understand the present state of ESRs in each region so that it can develop plans to meet new requirements and measure success. All current regional ESRs can be found at https://www.integratedecosystemassessment.noaa.gov/transfer-knowledge/science-supporting-ecosystem-status.html.

Goal

The goal of the ESR workshop was to analyze the current state and application of ESRs, assess requirements for enhancing and expanding ESR applicability, and identify next steps to address current, emerging, and future ecosystem science and management objectives.

Objectives

1. Describe the current state of reporting and evaluate ESRs in each NOAA Fisheries region in terms of report goals, content, use, and success. Discuss particular strengths, limitations, and lessons learned that could be applied across regions, focusing on both the scientific and management uses of ESRs.

2. Determine how ESRs should address the requirements for the NCSS, the EBFM Road Map, regional IEA work plans, and other ecosystem needs.

3. Develop a plan to continue advancing ESRs. The plan should include a five-year timeline and mechanisms for integration/cross-pollination across all regions. Consider future directions for ESRs that address new thinking, needs, and drivers, and focus on delivering ESR information to fisheries and other relevant management processes.

ESR Workshop Design

A three-day workshop was held at NOAA Headquarters (Silver Spring, MD) on May 16–18, 2017. The attendees included 1) experts involved in the development of ESRs, 2) senior leaders, related specialists, or stakeholders identified by each of the regional ESR experts, and 3) ecosystem program managers from headquarters. Participants from each Science Center

developed introductory material before the workshop. The workshop was divided into two main parts, described below.

Part 1: Current State

The first portion of the workshop reviewed the current state of ESRs. Participants provided materials in advance, and during the session shared goals and objectives, design considerations, underlying science, and delivery mechanisms. Participants also discussed the nature of communication between ESR producers and users to understand how this information is being used in fisheries and ecosystem management.

Some specific questions included:

1. What are the goals and objectives of the ESR?
   a. What are the overall goals and objectives?
   b. What needs/requirements are we trying to address?
   c. Who are the target audiences/users?
   d. What impact are we trying to have?

2. What are the contents of the ESR currently in place? What should an ESR contain and what is outside its boundaries?
   a. Do ESRs address similar indicators? (e.g., EBFM Road Map action item 2b)
   b. What are the management and science mandates that ESRs address?
   c. What management needs are not met by current ESRs? Should they be part of a future ESR?

3. What is the mode of delivery of ESRs between NOAA Fisheries and users?
   a. What are effective ways to report data?
   b. Are there advantages to using similar formats across regional ESRs?
   c. To what extent should we try to standardize ESR format and content across regions?

4. Who is using the ESRs, how are they using them, and what are the impacts?
   a. Who is using them?
   b. How are they being used (e.g., what management decisions are being informed?)
   c. How are those decisions influenced?
   d. What impact is this having? Can we assess the impacts?
   e. Are there existing or new requirements that are not being met effectively?

5. What changes to ESRs (timing, format, content, mode of presentation and dissemination, etc.) might improve their efficacy?
   a. What are the top five challenges/weaknesses of the current ESR that need to be addressed to better achieve its goal and objectives?
   b. What are the key changes needed to better meet the ESR goals and objectives?

Part 2: Future State

The second portion of the workshop aimed to improve the ESR to better meet current and new goals, objectives, and requirements. Participants explored these capabilities and asked why they are needed, what they entail, and how to achieve them. Participants explored what changes to ESRs might improve their efficacy, identified the key capabilities that need to be included or expanded, and examined the key steps to advancing ESRs over the next five years.

Some specific capabilities to consider include:

1. The incorporation of key indicators to serve as early warning signals and to adequately track and forecast climate-related ecosystem changes.
2. The inclusion of human dimensions indicators to advance plans for an integrated socio-ecological system approach.
3. The use of new statistical techniques to isolate signals in time-series data.
4. Exploring the role of spatial scale in ESRs. For example, are there available datasets that are underrepresented in regional ESRs? What are the overlap and divergence in indicators among ESRs?
5. Expansion of ESR applicability to meet NOAA Fisheries and other ecosystem management needs.
6. Ability to meet Science Center indicator information needs.
7. Expansion of ESR capacity to be diagnostic of ecosystem conditions (e.g., indicators across ecosystem components).
8. Expansion of ESR capacity to include analyses of risk as well as prediction of future states.
9. Development of online frameworks and formats (e.g., interactive data interface, customized indicator plots and data access) for improved efficiencies in ESR creation and delivery.

Current Status of Ecosystem Status Reports (ESRs)

The Marine Ecosystem Division of the Office of Science and Technology organized a pre-workshop survey and a pre-workshop webinar to assess the strengths, weaknesses, best practices and future needs of the current ESR systems. Major strengths across ESRs were quality and quantity of information and the tailoring of applications to local resource management. On the other hand, participants identified shared challenges to the ESR production cycle, including insufficient staff time and limited resources, issues of spatial and temporal relevance, data management, timing of the ESR release, and the difficulty of strategically updating ESRs. Best practices that could be applied across regions include providing an ESR template and standardizing data formats, streamlining the internal reviewing process, adopting narrative writing rather than simple reporting, providing content and short summaries before giving a science presentation to end-users, openly and broadly communicating with users, identifying users who can quickly facilitate science-to-management actions, and tailoring ESR messages for different users.

Production

The production periods and releases of ESRs vary among regions. AK ESRs (Zador, 2016; Zador and Siddon, 2016; Zador and Yasumiishi, 2016) and CC ESR (Harvey and Garfield, 2017) are updated annually, and they have established a routine schedule of ESR production that coordinates with their Fishery Management Councils (Table 1). The GOM ESR (Karnauskas et al., 2017) is currently updated every four years. West Hawai‘i published their first ESR (Gove et al., 2016) in September 2016 and will potentially update their ESR every two to three years depending on resources. The Northeast has a suite of products that include a Current Conditions (NEFSC, 2017c) and Climate Update (NEFSC, 2017d) that are issued twice a year, as well as two annual State of the Ecosystem reports (NEFSC, 2017 a, b) for the two FMCs they serve.

The common challenges in ESR production are scales and scopes, timing, and limited resources (i.e., staff time and funding). Both the spatial and temporal scales and the scopes of ESRs need to be matched with management relevance, and the timing and frequency of releases and updates should be coordinated with decision-making time frames. Meeting production deadlines is challenging due to the limited availability of resources needed to process large amounts of data in a timely fashion. In general, there is insufficient staff time and funding, and in some regions, such as GOM and WH, the ESR production heavily relies on regional ecosystem scientists. Staffing dedicated to the development of ESRs would be tremendously beneficial to meet the growing demand for these ESR products.

Table 1. Annual ESR production time line in California Current and Alaska regions

	California Current region	Alaska region
Jan	Experts provide short interpretation	
Feb	Edit figures and sections and submit to Pacific Fishery Management Council (PFMC)	
Mar	**Present to the Scientific and Statistical Committee (SSC), various council advisory bodies, and the full PFMC.**	
Apr	Collect data from spring to fall	
May		
Jun		
Jul		Indicator update requests; final solicitation of new indicators (otherwise occurs year-round)
Aug		
Sep	Technical review of select indicators and analyses by SSC	Primary presentation to the Bering Sea and Aleutian Islands (BSAI) and the Gulf of Alaska (GOA) groundfish plan teams
Oct	• Compile data from long-term monitoring programs • Implement recommendations from SSC • Generate contents, conduct time-series analysis, and update website	Submit report
Nov		Final presentation to the BSAI and GOA groundfish teams
Dec		**Present to the Science and Statistical Committee, Advisory Panel and the council, post reports and update website**

Indicators

The regional ESR teams focus on providing the best available science for marine resource management, and ESRs have indicators covering physical, chemical, biological, and socioeconomic factors. There are common indicators across regions, but each region also carries unique indicators for their end-users' needs (Table 2). Indicators are selected based on expert opinions, manager feedback, peer-reviewed literature like Kershner et al. 2011 and Zador et al. 2017. At the Pacific Islands Fisheries Science Center (PIFSC), the indicator selection was also informed by the output of ecosystem models (Anderson et al., 2002; Hoegh-Guldberg, 2009; Hughes et al., 2010; McClanahan et al., 2011; Guillemot et al., 2014). NOAA Fisheries Science Centers also consider statistics like redundancy analysis, feedback from managers, and data availability when refining their indicator suites. An example of incorporating feedback from managers was provided by the CC team, which collaborated with the PFMC to improve the CC ESR using a formal process under the Council's Fishery Ecosystem Plan (Box 1).

Table 2. Select common and unique indicators from the regional ESRs.

	Common Indicators	Unique Indicators
Physical:	Sea Surface Temperature (SST), sea level, and large-scale climate indicators (e.g., Gulf Stream North Wall, Atlantic Multidecadal Oscillation (AMO), Pacific Decadal Oscillation (PDO), El Niño-Southern Oscillation (ENSO), etc.)	Upwelling (CC), snowpack (CC), streamflow (CC), eddy kinetic energy (AK and WH), wave power (WH)
Chemical:	Ocean acidification (OA), dissolved oxygen/hypoxia	Eutrophication (GOM)
Biological:	Primary production, zooplankton abundance, biodiversity, fish abundance, biomass ratios	Landings by aggregate groups (NE and CC), mean-trophic level (GOM and CC), bird abundance (GOM and CC), bird productivity (AK), bird diets (AK), fur seal pup production (AK), Macroalgae cover (WH), coral disease (WH), and invasive species (WH)
Social and Economic:	Fishery revenue, recreational fishing, coastal population, community social vulnerability indicators	Human population and growth (GOM, AK, and WH), school enrollment (AK), unemployment trends (AK), habit disturbance by trawls (AK), number of visitors (WH), shoreline modification (WH), on-site disposal system (WH)

Delivery and communication

Most regions target FMCs as their primary audiences. WH, on the other hand, targets state managers. Some regions also regard scientists and NGOs as their end users as well. All regions provide their ESRs in the Portable Document Format (PDF) format, and most regions distribute the ESRs via the Science Center's website and deliver presentations to their core users. Lack of travel funding is an issue for directly delivering to and communicating with the end users. The CCIEA team is planning to use a pre-recorded webinar for people who can't attend presentations and to engage with more audiences.

The ESR teams face challenges in formatting when FMCs request a short, written format, but some information is better presented in 3D or on web-based applications. In addition, managers may not have enough time to explore all ecosystem considerations, and the ESR report could be challenging for individuals to digest in a short time. Therefore, providing a "so-what" message (why the users should care) in addition to broader reports is often key to enhancing delivery efficacy.

Evaluating the effectiveness of ESRs

ESRs directly influence decision making in marine resource management. For example, the 2016 salmon harvest decision in the Pacific Fishery Management Region was influenced by the snowpack information in the 2015 CC ESR (Harvey and Garfield, 2017), and the tier level for harvest specifications in the Alaska region is adjusted according to the AK ESRs (Zador, 2016; Zador and Siddon, 2016; Zador and Yasumiishi, 2016). In Hawai‘i, the Coral Bleaching Recovery Plan (State of Hawai‘i, 2017a) and the 30x30 plan (State of Hawai‘i, 2017b) are informed by the WH ESR. ESRs also indirectly influence decision making by promoting ecosystem awareness in resource management. For example, Gulf of Mexico-wide ecosystem reorganization was discovered after the publication of the first GOM ESR (Karnauskas et al., 2013), and this has influenced the management view on data streams in the region.

Most regional ESR teams evaluate the effectiveness of their ESRs by noting how often end users respond to the ESR through direct feedback or by citing the report. The regional ESR teams follow up with end users and observes whether they have continually engaged with the report, requested updates, and if they have taken the advice offered in the ESR into account when making decisions. In addition, the GOM team has also adopted Google Analytics to track users of its ESR website and to evaluate the website’s effectiveness.

Box 1. Improvements to the California Current ESR under the Pacific Fishery Management Council's Fishery Ecosystem Plan (FEP)

In some cases, ESR end users may have processes in place that facilitate improvements to an ESR, ideally in collaboration with ecosystem scientists. Recently, the Pacific Fishery Management Council (PFMC) and the California Current Integrated Ecosystem Assessment (CCIEA) team engaged in a collaboration to better the CC ESR. The effort stemmed from a special initiative under the PFMC's Fishery Ecosystem Plan (PFMC 2013).

The FEP provides guidance on using ecosystem science to enhance single-species management activities under the PFMC's four Fishery Management Plans. It was in this FEP, in fact, that the PFMC first formally requested that NOAA Fisheries produce an annual ESR. While that formal request had guidelines on ESR format and content, it offered few specifics on which indicators should be included, and at what scales they should be summarized. The CCIEA team did its best to author ESRs that fit PFMC needs, but after numerous discussions decided that the CC ESR could be better aligned to PFMC needs.

The PFMC's FEP includes an "initiative" process, which directs studies issues that are relevant to two or more Fishery Management Plans. In 2015, the PFMC adopted the "Coordinated Ecosystem Indicator Review Initiative" to improve the ESR and make it a more effective decision-support document. Under this Initiative, an Ecosystem Working Group made up of representatives from state, tribal and federal fisheries agencies led a two-year process of reviewing and refining the physical, chemical, biological and socioeconomic indicators in the CC ESR. This process included CCIEA scientists, PFMC technical committees, and advisory bodies that represent a breadth of stakeholder groups. Highlights of this initiative process included:

- A series of five webinars, broadly publicized by the PFMC, in which CCIEA scientists provided detailed descriptions of the indicators; each webinar concluded with an extended session of questions and comments from webinar attendees.
- An extensive review of the CC ESR and webinars by the PFMC technical committees and advisory bodies, coordinated by the Ecosystem Working Group.
- An annotated table of recommended changes to the CC ESR compiled by the Ecosystem Working Group and provided to both the CCIEA team and to the PFMC.
- A timeline for implementing recommended changes, developed collaboratively by the CCIEA team and the Ecosystem Working Group.

Further details on this initiative process are available at http://www.pcouncil.org/ecosystem-based-management/coordinated-ecosystem-indicator-review-initiative/.

The process has led to many insights on the types of indicators, data visualizations, and spatiotemporal scaling that are most helpful to the PFMC. Moreover, dialogue between the CCIEA team and PFMC bodies has increased substantially. This engagement will not only improve the alignment of the CC ESR to PFMC needs, it will also help the CCIEA team to more clearly understand existing and emerging PFMC priorities. This understanding should lead to more useful synthesis-level products, such as risk assessments and scenario analyses, which the CCIEA team will be developing in the years ahead.

Summary of Key Findings and Recommendations

Internal Communication

Workshop participants regarded leveraging expertise and experiences across regions as a valuable goal, especially with respect to reducing duplicate efforts. They recognized the need to build an internal communication and collaboration platform for information exchange and tool sharing. Establishing a group email and a shared drive or a code repository were therefore proposed during the discussion.

Although ESR teams meet at various workshops, this was the first time that all regional representatives gathered to discuss improving ESRs. Participants expressed the need for frequent meetings and dedicated time to discuss ESRs. Post-workshop meetings at the upcoming 2017 National IEA meeting in June and the 2017 FATE Science Meeting in September were proposed to extend the conversations among ESR regional teams.

Recommendations

- Build a communication framework and foster information sharing.
- Establish tool exchange mechanisms across regions.
- Establish a national ESR team and continue engagement with each other beyond this workshop.

Production

Timing, in regard to both releases and updates, is one of the common challenges in ESR production. Production time frames are not easy to synchronize with managers' decision-making processes. For example, with no single decision-making time frame in the New England FMC or Mid-Atlantic FMC, the Northeast ESR team produces reports in April, which may not be the best time for some management decisions. Participants concurred that those producing ESRs should coordinate with their users to enhance the report's application and influence, and specific updating strategies should be developed based on the local decision-making process.

Ideally, ESRs would be updated frequently as soon as new information is available, however each region updates ESRs at different intervals based on team capacity and management readiness and need. Production could be accelerated by common tools that could combine indicators e.g. multivariate analysis and automated functions, as well as by conducting redundancy analysis or related multivariate statistical analyses to delineate indicator groupings. To alleviate the burden of data processing and expedite the updates of ESRs, participants suggested developing codes for automatic real-time updating and adopting a standardized report format. Improved automation, particularly of readily available data, would allow for synthesis across LMEs and on a national level that is currently difficult to achieve.

Another challenge is choosing proper spatial and temporal scales. ESRs often cover extensive geographic areas and contain various elements, from fisheries to human communities. Even within the same region, users request various ESR products over different spatial scales and time frames. For example, a Gulf of Mexico-wide indicator may not be the best fit for an unusual local event like an oil spill. To make ESRs more applicable, the group emphasized the importance of matching with management scales. A long-term goal would be to produce customized ESRs targeted to specific stakeholders and management questions, which would be produced more frequently, more quickly and at finer scales; however, with the current resources available this is unrealistic. Instead, we recommend publishing a comprehensive ESR once every few years while more frequently updating several addenda ESRs to specific users. The participants concluded that strategic updating of ESRs and the inclusion of primary users in the production process would help ensure the products meet regional needs.

Currently there are a number of ecosystem science efforts at NOAA Fisheries, including climate Regional Action Plans, EBFM Road Map, IEA, and ESRs, but there were concerns that a small number of people involved in ecosystem science are being tapped for these multiple efforts. It remains critical moving forward to align these groups and efforts. In addition, staff resources towards ecosystem science and management vary by region; some regions have big teams, but some only have a few people. Regardless of team size, people working on ESRs can only devote a portion of their time to producing them, and thus dedicated staff time will greatly enhance ESR production. Meanwhile, the approval process of ESR reports takes different lengths of time in different regions. It could be up to several months in some regions.

The participants concluded that streamlining the process by standardizing formats, adopting automation, increasing staff time on ESRs, expediting approval processes, developing update strategies and coordinating various ecosystem efforts would significantly smooth the production cycle of ESRs. It would also shorten the timing gaps between ESR production and the FMCs' or other users' decision-making process.

Recommendations

- Examine needs for improving automation.
- Develop strategies for routine updates.
- Develop a plan for incorporating priority users into the production process.
- Develop a plan for streamlined production and standard internal review and approval processes.
- Formally include staff's contributions to ESRs in their performance plans and national recognition.

Indicators

While traditional ESRs cover vast areas, requests for more subregional scale ESRs are increasing, and each region has specific needs. For some regions this means improving the

spatial resolution of data collection and resultant ESRs. Information and data are often lacking, however, which limits the capability to produce local indicators. For example, there are more data available from the Eastern Bering Sea region than the other regions in Alaska. More region-specific data and adaptive sampling are needed to support producing ESRs at finer scales. Participants recommended gap analysis as the first step in increasing the resolution of ESRs, as well as expanding ESRs to include new indicators tailored to each region's management needs. More indicators for management complexity, distribution and patchiness of parameters, harmful algal blooms or other unusual events, ocean acidification, recruitment strength, aggregate/synthetic measures, and general predictive capability will be developed according to regional needs.

ESR representatives emphasized the importance of developing more human dimension indicators to increase the applicability to management. Participants proposed both developing indicators of coastal vulnerability and management complexity and increasing coordination with economics to strengthen the human dimension component of ESRs. The group also proposed incorporating traditional and local ecological knowledge in future ESRs to include the fine-scale information held by indigenous communities, commercial and recreational fishermen, and other resource-user groups. While each of these indicators would be LME specific, developing them nationally would be a great best practice from the ESR working group.

Participants recommended determining whether a standardized time period or indicator-specific time period is appropriate when examining state and trends. For example, some regions use the most recent five years to assess whether a statistical trend exists, while longer periods might be better for indicators of slower processes, such as population trends in marine mammals or dynamics of decadal-scale climate indicators. Another recommendation was to conduct comparative analysis to determine whether standard time periods or process-specific time periods are appropriate.

To continue improving current indicators, participants concluded that cross-regional data science and statistics workshops are needed to hone analytical skills, especially on trend analysis, selecting and vetting indicators, short-term predictability, determining thresholds, network analysis, and indicator synthesis. One of the cross-region needs that was discussed for enhancing current indicators in ESR is acquiring a common Chlorophyll-a (Chl-a) indicator or source of indicators from satellites. ESR leads will work with the NOAA Fisheries Office of Science and Technology, which is actively working with multiple offices within NESDIS and with NOAA Fisheries satellite oceanographers. Together, they can provide ESR developers with the specific satellite data most relevant to their region and deliver with the right frequency and latency. In general, to advance current biological understanding, ESRs should cover more ecological interactions and species conditions. The ESRs would also benefit from the use of integrative, aggregate, or synthetic indicators.

Other issues discussed during the workshop included quantifying uncertainty, bundling indicators, and identifying thresholds. By improving the standardization, synthesis, and analysis of the current indicators and developing more broad-scale multivariate-type indicators, the ESR team will enhance existing indicators and add new ones based on end-user feedback, which will in turn enhance ESR applicability.

Recommendations

- Identify data gaps needed to develop/report on indicators.
- Continue work with Office of Science and Technology and engage with satellite requirements processes (NOAA and National Aeronautics and Space Administration) e.g. for Chl-a data and other common needs.
- Examine ways to develop human dimension indicator(s) of management complexity.
- Examine ways to foster development of additional human-dimensions indicators with national comparability (when possible).
- Explore synthetic/aggregate/integrative measures.
- Examine ways to develop indicators for recruitment strength, harmful algal blooms or other unusual events and monitor pH, nutrients, and dissolved oxygen.
- Examine ways to include prediction or leading indicators in ESRs.
- Explore traditional ecological knowledge and consider incorporating into ESRs.
- Arrange workshops to expand and enhance indicators and analytical skills.

Delivery and Communication

ESR teams noted that some graphics are more descriptive for end users than time-series plots. For example, the CC ESR team shared a "quad plot" figure that summarizes recent trends from multiple time series, and reported that quad plots have been well-received by the PFMC. Some ESR teams have also observed that presenting the data in a map format helps users visualize and understand the information, thus Geographic Information System (GIS) expertise would be beneficial. Participants proposed the establishment of working groups or webinars to share experience on data presentation and to improve data visualization.

Long-format, comprehensive ESRs can often lose the "so what" message. The Northeast ESR team rearranged their reports to the New England FMC and the Mid-Atlantic FMC to start with human dimensions and work down to the base of the food chain and physical/climate indicators. This allowed managers to see the things that resonate most with them first, while the rest of the document provided context for why they may be seeing certain trends. The reaction to this change has been overwhelmingly positive. More generally, ESR teams saw the value in providing a short summary with a "so-what" message, building a user-friendly data delivery platform, and providing better tailor-made content to different end users to improve the delivery effectiveness. Cooperation with Regional Offices is also recommended to integrate their expertise, knowledge, and relationships and facilitate better communication with FMC users.

Besides FMCs, there are many potential users, and participants agreed on the need to communicate to them with the languages and platforms they use. Social media has been instrumental in publicizing information and has resulted in rapid user uptake. For example, after a popular Facebook video highlighted the dangers of oxybenzone, a common UV absorber, to coral reefs, lawmakers proposed a bill to ban the sale of the ingredient in sunscreen sold in

Hawai‘i. In the future, ESR teams may explore forms of information delivery other than PDFs on websites to amplify the influence of ESRs by engaging with broader audiences.

Participants suggested wider-ranging advertisement of ESRs and other ecosystem activities to support other potential users. Promotion activities could include announcing ESR updates with news releases, and continuing to publish ESR results in peer-review journals. The national team discussed writing a joint paper about common indicators and national trends. Participants concluded that they would work on improving data visualization, web utilization, advertising ESRs and communicating with stakeholders.

Recommendations

- Develop visual depiction and description of ecosystem data, status and trends.
- Work closely with Regional Offices and advisory bodies to better understand their needs for ESRs and improve effectiveness.
- Increase the exposure of ESRs and related ecosystem products by publishing peer-reviewed papers and news releases.
- Develop plans to improve communication and relevance with a broader audience.

Evaluating Impact and Applications

Most regions have published ESRs on websites, and participants noted the need to track and evaluate interest or visits to website products. The Gulf of Mexico ESR team uses Google Analytics to track users of the website, and other ESR teams expressed interest in employing this tool. Participants proposed a demonstration webinar so other teams could learn and evaluate the tool.

Participants suggested tracking the uptake and application of ecosystem science products into management processes and decision making both directly and indirectly. We can track the direct influence of ESRs by tracing the impacts of scientific documents, citations, and downloads. Other direct measures include whether information from ESRs was used as context in decision-making, whether ESR data has been included in stock assessments, risk assessment, or Biological Opinions, and whether ESRs were directly cited in various management plans and scientific literature. We may also consider the evaluation process and the progress measurement matrix from other science-to-management programs and organizations like the Stock Assessment program and Landscape Conservation Cooperatives.

ESRs and many other ecosystem efforts together contribute to indirect impacts like raising awareness and changing perspectives. For example, there was no consideration of “community vulnerability” in management decisions decades ago, but it has become common now because of the awareness developed through ecosystem-based management and many other ecosystem efforts. Similarly, key words such as “risk assessments” or “climate vulnerability” can be discussed in management documents without mentioning inspirations from products such as ESRs or other ecosystem-related products. We could be creative when the linkage between ESRs and impact on management is indirect. For example, a proposed way to quantify the indirect

impact of ESRs is to analyze ecosystem-related keywords in Science Center publications, gray literature, and FMC meeting minutes and other documents.

Participants concluded it is beneficial to track and measure the influence of ESRs since proper evaluation is helpful to substantiate resource requirements regionally and nationally, and to keep ESR efforts moving forward.

Recommendations

- Examine ways to adopt Google Analytics to better identify users and evaluate delivery effectiveness.
- Research possible criteria and measures to quantify progress and success in ESR application and influence on management.
- Evaluate the impact of ESRs on management by researching instances of management basing decisions on ecosystem science and by analyzing FMC documents and reports (e.g. Scientific and Statistical Committee minutes), gray literature and Science Center publications for evidence of influence.

Institutional Support

Participants raised concerns that within Science Centers, ESRs often get less support than more routinely produced scientific products (e.g., stock assessments) and therefore are not given sufficient staff time or recognition within employee performance plans. As a result, ESR leaders experience difficulties getting input from other NOAA Fisheries employees, who are already quite busy and may perceive little personal gain in contributing time and effort to these reports.

ESR teams also encounter obstacles obtaining the survey data from certain taxa-oriented groups. Since many highly migratory species are economically important, marine mammals have protected status, and marine sanctuaries are a target user of ESRs, increasing collaboration with scientists and managers working in these areas would enhance data access and prompt ESR applications. The participants concluded that ESR producers need support from leadership to incentivize employees to work on ESRs and other ecosystem portfolio components like stock assessment and habitat science in order to break barriers among focal components.

Other desirable national support areas include 1) a database framework for indicators and narratives, 2) a full time IT employee for data organization, front-end development, and tool programming, 3) outreach and stakeholder engagement specialists, and 4) GIS specialists. With this institutional support, the national ESR team would be able to build a national-level database, produce standardized graphics, retain knowledge, stay updated on current technology, raise awareness and promote engagement, and most importantly, be able to focus on science and boost the overall efficiency of ESR production.

Recommendations

- Examine ways to incentivize staff engagement, participation, and contribution.
- Examine ways to incorporate ESRs and other ecosystem portfolios into performance plans.
- Broaden promotion of ESRs and other ecosystem priorities, including relevance to stock assessments.
- Broaden engagement with other focal components within NOAA.

Action Items and Next Steps

1. Build a communication platform and foster information sharing and tool exchanges across regions.
2. Establish a national ESR team and have members continue engagement with each other beyond the time period of the workshop.
3. Organize a national workshop on common analytical techniques:
    - Develop a proposal.
    - Arrange workshops to improve indicators.
    - Write a paper on ESR common indicators.
4. Examine needs for improving automation:
    - Develop a proposal.
5. Work closely with Regional Offices and advisory bodies to better understand their needs for ESRs, to improve effectiveness and to engage these partners:
    - Develop a list of partners currently being engaged, partners' teams hope to engage, or other partnerships.
6. Arrange a Google Analytics webinar to better identify users and evaluate delivery effectiveness.
7. Continue work with Office of Science and Technology for Chl-a data and other common needs.
8. Research possible criteria and tools to measure progress and success in ESR application and influence on management.

Regional Plans for the Next Round of ESRs

Five-Year Plan for the Northeast Ecosystem Status Report

Mission/Vision

The Northeast Ecosystem Status Report is a suite of products designed to inform stakeholders of recent and long-term trends in the ecosystem. It is meant to provide living marine resource managers the physical, ecological and social context needed for decision-making.

Goals and Objectives

The goal of the Northeast Ecosystem Status Report is to generate products useful for living marine resource managers. The products are tailored to provide information at different spatial and temporal scales. The most recent product, the State of the Ecosystem report, is tailored for the specific management council for which it is being produced. Ideally, reports will be representative of species, activities, and processes within the system that are most relevant to the management body receiving them.

Progress

The Northeast Ecosystem Status Report is actually a suite of products produced at different intervals. It includes a static encyclopedic webpage on the Ecology of the Northeast Shelf, a Climate Change webpage that is updated as new information becomes available, a Current Conditions webpage that is updated twice a year, and the annual State of the Ecosystem reports generated for the Mid-Atlantic and New England FMCs. The actual "Ecosystem Status Report," which was a product that was meant to be updated every two to three years, is also on the website but has not been updated since 2014. All of the products with the exception of the State of the Ecosystem reports can be found on the Northeast Fisheries Science Center's Ecosystem webpage (https://www.nefsc.noaa.gov/ecosys/).

The strength of the approach by the Northeast is the extensive list of indicators represented across the range of products. Together they represent a fairly comprehensive list of indicators for the Northeast Shelf. Some of the products are updated quite frequently (twice a year for Current Conditions), while others have become more static. A new strength of the State of the Ecosystem Reports is reproducibility. The Northeast has recently adopted the use of the R Markdown file format and a standard data format, which not only ensures reproducibility, but also allows new reports to be generated quickly.

Key challenges with the current approach are the lack of a clear message, stagnant content, and effective visualization. Managers are most interested in the "so what" message. With so many products, it can be difficult to coordinate the message, or the message may get lost in the volume of data. It is also difficult to identify the key audience for the products. Different audiences require different delivery methods, with more scientific audiences interested in graphs, while the public may prefer maps or other forms of visualization.

Top Priorities for the Next Five Years

1. Automation

A core challenge in the Northeast is the time commitment necessary to produce the State of the Ecosystem reports on an annual basis, as requested by Northeast's two core clients (New England Fishery Management Council and Mid-Atlantic Fishery Management Council). By standardizing the data formatting and automating core components of ESR analysis, the team hopes that effort can be shifted from production to research and interpretation in order to better develop the proactive management advice requested by clients. In support of this, the Northeast Fisheries Science Center is transitioning to platforms such as GitHub and software including R Markdown to streamline the production process. This will increase process transparency and reproducibility while decreasing the time investment necessary to produce the ESR on an ongoing basis.

2. Statistical analyses

Historically, the Northeast ESR has relied on the mean-variance tickertape representation of time series originally developed in the Alaska ESR. In the most recent iteration, the Northeast has transitioned to nonparametric Mann-Kendall statistical trend analyses to focus attention on significant trends. Ultimately, however, the Northeast is working towards multivariate and spatial analysis to extend the ability to develop proactive management advice and develop a more nuanced assessment of the system.

3. Redesigned web interface

The suite of Ecosystem Status Report products is housed on the Northeast Fishery Science Center's Ecosystem website. Most of the products were developed independently and contain overlapping content. Some of the data is outdated and needs to be replaced. In the coming years the Northeast plans to overhaul the website to have better coordination between the products. This should enhance the delivery to stakeholders and result in better integration of the information by management.

4. Becoming more inclusive

The current production of Ecosystem Status Report products is handled by the Ecosystems Dynamics and Assessment Branch of the Northeast Fisheries Science Center. One goal is to make the Ecosystem Status Report more of a Center-wide product by involving more branches and divisions across the Northeast Fisheries Science Center. A State of the Ecosystem workshop was held in July 2017 where various branches were represented to discuss the production of the council reports. Further collaborations are planned for the remainder of the year leading up to the production of new reports.

Expected Impact/Outcomes/Products

The ESR team expects closer cooperation with branches throughout the Northeast Fisheries Science Center to make the suite of Ecosystem Status Report products more of a Center-wide product. The Northeast will develop a clear "so what" message for the relevant management bodies, and coordinate the various products to support that message. The revamped website will

also offer a more coordinated message with less redundant data and updated information whenever it becomes available. Expected products include:

1. Tech memo of approach (statistical representation, metadata, etc.) for citation, reproducibility, and scientific rigor.
2. Paper on alignment of indicators to objectives, redundancy analysis, and multivariate analysis.
3. Tailored annual State of the Ecosystem reports (Regional for councils, others ad hoc).
4. Mid-Atlantic Risk Assessment based on indicators contained within the State of the Ecosystem Report.

Timeline and Approaches/Actions

Activity/Priority	**Approach/Action**	**Timeline**
Automation	Develop R Markdown for State of the Ecosystem Reports	Completed April 2017
	Develop standard format to receive data	Completed April 2017
Statistical Analysis	Explore statistical tests for linear and non-linear time series	Winter 2017/2018
	Explore methods for indicator selection	Fall 2018
Redesign Web Interface	Examine content for redundancy	Fall 2017
	Develop new organization for content	Winter 2017/2018
	Populate website based on new organizational scheme	Spring 2018
Becoming More Inclusive	Create process for developing reports and incorporating new indicators	Completed July 2017
	Hold State of the Ecosystem workshop	Summer each year
	Hold focus group meetings with branches across the Center	Summer each year

	Hold Center-wide meeting to develop synthesized message across indicators	January each year
Deliver State of the Ecosystem Reports	Provide a PDF of the report as well as present at each council's meeting	April each year
Create citable document	Develop a NOAA Tech Memo that details the methods used to generate the various indicators	Summer 2018
Develop reports for other entities	Develop similar State of the Ecosystem reports for organizations other than the Fishery Management Councils as needed	As needed but no earlier than 2019
Aid in Mid-Atlantic risk assessment	Provide the most recent status and trends from the State of the Ecosystem report for the Mid-Atlantic Fishery Management Council's risk assessment	October 2018
Continue support of other ESR products	Continue to add content to climate change website and bi-annual updates of Current Conditions	Spring/Fall each year

The Gulf of Mexico IEA Ecosystem Status Report

Mission/Vision

The overall mission of the Gulf of Mexico (GOM) IEA program is to "balance the needs of nature and society through integrated science for current and future generations." The GOM ESR is intended to support this mission by tracking status and trends in order to understand the influence of ecosystem stressors and determine the impact of various management actions.

Goals and Objectives

- To synthesize information on a wide range of ecosystem components, including human communities, in a concise and readable report.

- To provide scientific knowledge of the Gulf of Mexico integrated ecosystem, and transfer that knowledge to scientists and managers.

- To provide a broad-level overview of the current state of the Gulf of Mexico with respect to recent and historical trends.

Progress

An initial GOM ESR was published in 2014, and the first update report was published in 2017. The update report was structured based on informal feedback from managers and users of the initial report. Indicator selection was based on this scoping effort, as well as other criteria such as data accessibility, statistical redundancy, conceptual basis, and representation in temporal, spatial, and societal dimensions. The update report included a reduced and more refined suite of indicators that were thought to be responsive to management needs. Another major strength of both reports was the highly diverse author group, and in particular, the update report contained strong social science representation that resulted in a thorough section on human dimensions indicators. Finally, a web version of the update report was used to communicate a subset of the indicators, with the thought that multiple communication formats would broaden the potential audience.

Both versions of the GOM ESR reported indicators largely at basin-wide, national, or regional scales, which is a challenge for uptake in management, as larger scales may not be relevant to management bodies. For example, a state agency may be a target audience, but not all of the indicators can be interpreted as representing processes relevant to the scales they manage. Further exploration of relevant spatial scales would be useful. Also, uncertainty estimates

reported with each indicator would be useful for understanding the significance of observed trends.

Top Priorities for the Next Five Years

1. Complete follow-up analyses based on indicators from the 2017 Update Report. This includes analyses of effects of the Deepwater Horizon (DWH) oil spill and Bayesian network analysis to predict fish responses to climate change and their vulnerability on a local scale in response to management changes.
    - Publish online appendices to the 2017 ESR on website. Includes the analyses described in (1), plus single-species recruitment predictions (red snapper and gag grouper).
2. Begin addressing research recommendations with respect to refining some indicators. This includes leveraging expertise from the National Centers for Environmental Information to identify better satellite data sources, updating indicators on estuarine productivity, and improving indicators derived from eBird data. Consider reformatting delivery of indicators so that they align with legislative objectives, as is done by the Northeast Fisheries Science Center (NEFSC).
3. Update online-only indicators annually and post to website.
4. Explore and, as necessary, create improved data archiving and metadata system.
5. Explore opportunities for outreach of ESR material and extended analyses.
6. Carry out scoping, fully overhaul ESR and publish subsequent update report.

Timeline and Approaches/Actions

Action	**Deadline**
Complete analyses on effects of DWH oil spill.	December 2017
Complete Bayesian network analysis to predict fish responses to climate change.	September 2017
Complete single-species recruitment predictions.	July 2017
Publish online appendices to 2017 ESR on website.	Ongoing

Leverage expertise from the National Centers for Environmental Information to identify better satellite data sources.	Ongoing
Update indicators on estuarine productivity.	2018
Improve indicators derived from eBird data.	2018
Align indicators with legislative objectives.	2018
Update online-only indicators annually and post to website.	March of every year
Explore and, as necessary, create improved data archiving and metadata system.	Ongoing
Explore opportunities for outreach of ESR material and extended analyses.	Ongoing
Carry out scoping, fully overhaul ESR and publish subsequent Update Report.	2022

Expected impact/Outcomes/Products

Expected outcomes include:

- Peer-reviewed papers and conference presentations on DWH impacts and fish-climate responses.
- Online appendices summarizing important findings from follow-up analyses.
- Refined indicators to be used in subsequent update of ESR.
- Improved access to indicator data from ESR.
- Increased consumption of ESR by management bodies, particularly the Gulf of Mexico Fishery Management Council and the Gulf States Marine Fisheries Commission.
- Increased awareness of Gulf of Mexico ecosystem processes and linkages by target audiences (scientists, managers, and general public).

Five-Year Plan for the California Current Ecosystem Status Report

Mission/Vision

The present mission for the California Current ESR is to ensure that the Pacific Fishery Management Council (PFMC) understands the physical, ecological, and social conditions that form the ecosystem context for fisheries management and decision making. The vision for the future is that the ESR will provide contextual information for a broader suite of stakeholders and end-users (states, tribes, National Marine Sanctuaries, NOAA Regional Office partners), and that it will expand to include synthesis products such as risk assessment and predictive analyses.

Goals and Objectives

The current objective of the California Current ESR is to provide the PFMC with an annual update of the status, trends, and variability of a broad suite of ecosystem indicators related to climate, oceanographic, chemical, biological, fisheries, and socioeconomic attributes. These indicators are intended to be analyzed at spatiotemporal scales that are directly relevant to PFMC management activities and legislative mandates. Based on specifications outlined in the PFMC Fishery Ecosystem Plan (FEP), the report should be concise, timely, and designed to help the PFMC incorporate ecosystem considerations into decision-making.

Progress

The California Current ESR is produced by the California Current Integrated Ecosystem Assessment (CCIEA) team, made up of scientists from the Northwest, Southwest and Alaska Fisheries Science Centers. The ESR has been released in March each year since 2013. It includes a written report (~20 pages, plus appendices) for the PFMC March Briefing Book, and a ~30-minute presentation during an open session of the annual March PFMC meeting. Through an FEP Initiative in 2015–2017 and annual meetings with the PFMC Scientific and SSC, the ESR team has received regular feedback to tailor content and improve statistical analyses and data visualization. These interactions have improved the quality of the ESR and strengthened two-way communication between ecosystem scientists and the PFMC.

Other strengths of the report include: leveraging a broad and extensive network of monitoring programs and time series along the West Coast; a quantitative approach to indicator evaluation; participation of scientists ranging from climate scientists and oceanographers to social scientists; and the debt of leadership owed to the AFSC for the example set by its longstanding "Ecosystems Considerations" reports.

Key issues include: report staffing/production effort; data/monitoring gaps; the challenges of data availability, data quality and data visualization at fine, management-relevant spatial scales; developing a complementary web-based ESR that can be updated more frequently; and how to best incorporate higher-level products such as quantitative risk assessments associated with

important ecosystem pressures. The regular system of feedback between the ESR team and the PFMC provides a means by which these and other emerging issues can be prioritized.

Top Priorities for the Next Five Years

1. Closing gaps in data and analyses. The most pressing data gaps are for coastal pelagic species, highly migratory species, whales, seabirds and human systems. A key analytical gap is in time series analyses that separate underlying trends from observation error. Emergent gaps and needs are inevitable and require flexibility.
2. Improving the efficiency of report production (e.g., automation of figures, formatting) and the quality of graphics. This includes launching a semi-automated, web-based ESR with the most up-to-date data.
3. Refining the spatial scale at which indicators are analyzed, to match the needs of the PFMC.
4. Incorporating higher-level analytical products, such as risk assessments, ecosystem-based reference points, and analyses with a short- to medium-term prediction skills.
5. Implementing these improvements without making the report significantly longer or sacrificing effective narrative flow in the text.
6. Developing a complementary, concise, web-based ESR for a broader, multisector audience, without sacrificing the quality of the present ESR or its value to the PFMC. This will be done in collaboration with regional partners (state and federal agencies, tribes, etc.).
7. Providing targeted ESRs that leverage web-based delivery, in order to address finer-scale applications and issues as they arise, e.g., PFMC Stock Assessment and Fisheries Evaluation (SAFE) reports, and quarterly/event-based updates, if possible.

Timeline and Approaches/Actions

Activity/Priority	**Approach/Action**	**Timeline**
Generate ESR for PFMC	Update/compile/analyze present current indicators; write accompanying text.	October-March each fiscal year
Close data and analysis gaps	Meet with PFMC SSC for technical reviews of indicators and analytical methods.	September each year

	Address gaps and requests identified in the 2015–2017 FEP Initiative process.	Ongoing
Improve efficiency of ESR production	Automate report generation using the R Markdown coding environment.	Starting in March 2018
	Migrate all indicator data and figure generation to common, coast-wide platform (SWFSC Environmental Research Division's Data Access Program (ERDDAP)).	Fall 2018
	Launch web-based ESR, customized for PFMC and containing automated indicator data updates.	Spring 2019
Refine spatial scale of indicators	Engage in annual discussions with PFMC, SSC, West Coast Region, and other partners to identify questions, scales, analyses, and visualization methods.	Ongoing
Incorporate higher-level analytical products	Engage in annual discussions with PFMC, SSC, West Coast Region, and other partners to identify management priorities, scales, analyses, and visualization methods.	Ongoing
	Provide products specific to future FEP initiatives or other requests from regional partners.	As needed
Maintain concise narrative report	Engage in annual discussions with PFMC, SSC, West Coast Region, and other partners.	Ongoing
Create companion multi-sector ESR	Scope needs of broader community of sectors that rely upon the California Current for ecosystem services or individual, community or cultural values.	2018, if new resources are available
	Begin regular production of concise multisector ESR (web-based indicator portfolio and document).	2019, if new resources are available
Target ESR content to specific needs	Provide ESR content for specific needs, such as PFMC SAFE documents, or following major events in the ecosystem.	As needed, if resources are available

Expected Impact/Outcomes/Products

The team will continue to produce annual ESRs that will improve in value and alignment with PFMC priorities. If resources support expansion to include other uses and sectors, future ESRs will increasingly support the needs of other regional partners as well. The impact of these improvements will be better science support for ecosystem-based management at spatial and temporal scales relevant to multispecies fisheries, protected species conservation, coastal zone management, water quality, and climate change.

The ESR team expects multiple scientific publications to result from this process each year. These publications will stem from: the need for peer review of methods that support ESR development; synthesis products that contribute to or derive from the ESR; novel or emerging science needs identified during ESR generation; and "perspectives" publications that draw from accumulated experiences. Such publications will be informative for future ESR development in the California Current region, and are of potential value to teams producing ESRs elsewhere.

Five-year Plan for Alaska's Ecosystem Status Reports

Mission/Vision

The Alaska Fisheries Science Center (AFSC) has produced ecosystem status ("Ecosystem Considerations") reports (ESRs) since 1999, as part of fulfilling the agency mission to provide sound science to support ecosystem-based fisheries management. The ESRs aim to strengthen links between ecosystem research and fishery management and to spur new understanding of the connections between ecosystem components by bringing together the results of many diverse research projects.

Goals and Objectives

Alaska's ESRs are produced annually to compile and summarize information about the status of the Alaska marine ecosystems for the North Pacific Fishery Management Council (NPFMC), the scientific community and the public. As of 2016, there are separate reports for the Eastern Bering Sea, Aleutian Islands, the Gulf of Alaska, and Arctic (forthcoming). These reports include ecosystem report cards, ecosystem assessments, and ecosystem and ecosystem-based management indicators. The objective of these ESRs is to provide context for ecosystem-based fisheries management in Alaska.

Progress

Current state: Separate reports by Large Marine Ecosystem were produced in 2016 and presented to the Plan Teams, Scientific and Statistical Committee (SSC), and Advisory Panel (AP) of the NPFMC. These reports ranged in length from 110 to 210 pages and included between 21 and 48 ecosystem indicator contributions. In 2016, the reports included between two and 11 new indicator contributions, demonstrating the continued effort to expand the ESRs to cover diverse aspects of the ecosystem.

Strengths: The Alaska ESRs are tightly connected to the Council process; reports are presented annually to the Plan Teams, SSC, and AP. To highlight the connection between the ESRs, management decisions (e.g., quota setting), and operationalized ecosystem-based fisheries management, in 2016 walleye pollock was managed as a Tier 3 species (more conservative) as opposed to a Tier 1 species, because multiple ecosystem indicators suggested deleterious conditions for growth and survival of juvenile pollock. Quota was reduced under the more conservative Tier 3 approach, demonstrating that consideration of ecosystem indicators impacted management decisions.

Key issues: A key issue in Alaska is the spatial area covered by each ESR. Splitting the ESRs by LME was a vast improvement that was well-received by the Council; however, each LME encompasses broad geographic areas and diverse marine landscapes. The Council supports, to the extent possible, including region-specific ecosystem indicators within the broader LME

ESRs. For example, the Aleutian Islands ESR presents indicators and assessment by three ecoregions: western, central, and eastern Aleutian Islands.

An additional issue is limited staffing. Options for reducing the timeline of product delivery to the Council was discussed with the AFSC Science Director. The option decided for 2017 was to postpone updating the Aleutian Islands ESR until 2018.

Top Priorities for the Next Five Years

1. Continue to produce ESRs for each LME in Alaska as stand-alone products. This includes modifying current or developing new indicators at appropriate spatial scales within each LME, filling indicator gaps in regional ecosystem report cards, organizing ecosystem assessments at ecoregion scales, and minimizing redundancies among reports where possible.
2. Revisit the short list of indicators in ecosystem report cards on a rotating schedule reflecting when initial lists were selected and/or major advancements in ecosystem understanding. For example, the Eastern Bering Sea Report Card indicators should be revisited as part of the current Eastern Bering Sea Fishery Ecosystem Plan development.
3. Enhance human dimensions sections. This may include:

    a. Developing indicators of traditional ecological (or local) knowledge. Leveraging efforts of cooperative organizations (e.g., the U.S. Fish and Wildlife Service Landscape Conservation Cooperatives and various Alaska Native Associations).

    b. Restructuring current human dimensions-related indicators ("EBFM Indicators") using the objective-driven process used by the March 2017 Mid-Atlantic ESR.

4. Develop a plan for unanticipated and unneeded indicators that may be submitted.

5. Continue work on the conceptual model of the Eastern Bering Sea being developed in conjunction with the integrated into the Eastern Bering Sea ESR, and ecosystem indicators will be linked to that diagram. The conceptual model and the proposal to structure the 2018 Eastern Bering Sea around this model will be presented to the Council for review and feedback in Fall 2017.

Timeline and Approaches/Actions

ESR	Action	Timeline
Eastern Bering Sea	Produce 2017 ESR.	Summer, Fall 2017
Aleutian Islands	Postpone annual production of ESR.	For 2017. Resume production 2018
Gulf of Alaska	Produce 2017 ESR.	Summer, Fall 2017
Arctic	Postpone production.	Indefinitely, but no more than three years

Expected Impact/Outcomes/Products

Annual production of the Eastern Bering Sea ESR, annual or biennial production of the Gulf of Alaska ESR, biennial production of the Aleutian Islands ESR, occasional production of the Arctic ESR.

Five-year Plan for West Hawai‘i’s Ecosystem Status Report

Mission/Vision

The West Hawai‘i Ecosystem Status Report aims to provide information that forms the underlying basis and context for ecosystem-based management and decision making in the region.

Goals and Objectives

The current objective of the West Hawai‘i Ecosystem Status Report is to assess the status, trends, and variability of a broad suite of ecosystem indicators in West Hawai‘i, including climate, oceanographic, chemical, biological, fisheries, and socioeconomic attributes. Ecosystem indicators and associated analysis are intended to inform current and future resource management decisions in the region.

Progress

The first West Hawai‘i Ecosystem Status Report was released in September 2016. The report presents a general overview of the region and 29 ecosystem indicators across several broad categories: social, ecological, climate and ocean. To date, it is the most comprehensive report of West Hawai‘i and is informing current research and management processes underway in the region. Contributors were diverse and spanned the federal government, the state, and key non-governmental organizations in the region. However, there were some key issues with the report that will need to be overcome for future updates, including (but not limited to): lack of automation, limited data availability, issues with data quality, numerous data gaps, limited staffing to produce the report, poor data visualization with a lack of web-based content, no real avenues for feedback, and additional, more tailored products needed.

Top Priorities for the Next Five Years

1. Including additional indicators to provide a more comprehensive assessment on the status and trends of West Hawai‘i’s social-ecological system.
2. Improving the efficiency and automation of ESR production.
3. Establishing a web-based ESR presence, including real-time updates on indicators (where data allows).
4. Incorporating higher-level analytical products, such as risk assessments, ecosystem-based reference points, and analyses with short- to medium-term prediction skill.
5. Providing additional analysis and products at relevant spatial scales for specific resource management needs.

Timeline and Approaches/Actions

Activity/Priority	**Approach/Action**	**Timeline**
Expand indicators	Collect/compile/locate additional data on key aspects of West Hawai‘i’s Social-Ecological System.	Ongoing
Improve efficiency and automation of ESR production	Identify indicators that can be regularly updated (e.g., SST) and work with data providers (e.g., OceanWatch) and web managers to provide real-time, up-to-date indicator information.	Fall 2018
	Switch to a common system of production used by other regions (e.g., R Markdown).	2018-2019
Establish a web-based presence	Produce content suitable for web posting and work with local and national web managers on content posting.	2019-2020
Incorporate higher-level analytical products	Identify management priorities, scales, analyses, and visualization methods.	Ongoing
	Work with other regions and assess which products are most useful and relevant.	Ongoing
Maintain concise narrative report	Conduct annual discussions with the Western Pacific Fisheries Management Council, the Scientific and Statistical Committee, West Coast Region, and other partners.	Ongoing
Address specific management needs	Have continued discussions with resource managers in the region, including the state and the Council, to ensure the ESR meets their needs.	Ongoing

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Appendix A - Workshop Agenda

Day 1 (May 16)		
Time	**Activity**	**People**
9:00 – 9:05	Welcome	Slater
9:05 – 9:15	Opening Remarks	Osgood
9:15 – 9:35	ESR & EBFM	Link
TOR 1: Analyze the Current State and Applications of ESRs		
9:35 – 10:15	ESR Summary	Centers
10:15 – 10:30	Break	
10:30 – 10:55	Case study 1: Improving ESRs through the FEP Initiative Process in the California Current Region	Hazen / Harvey
10:55 – 11:20	Case study 2: Alaska Marine Ecosystem Considerations & North Pacific Fishery Management Council	Zador
11:20 – 12:00	Discussion: Review the Current State of ESRs	Facilitator: Slater Rapporteur: Townsend
12:00 – 1:30	Lunch	
TOR 2 & 3: Where do we need to go? Goals, Requirements & Next Steps		
1:30 – 2:00	Discussion: What Changes to ESRs Might Improve their Efficacy?	Facilitator: Slater Rapporteur: Peterson
2:00 – 4:30	**Building block 1: Scope, Scale, and Production**	Facilitator: Brady Rapporteur: Armstrong
3:15–3:30	Break	
4:40- 4:55	Summary	
4:55 – 5:00	Announcement	Slater
5:00	Adjourn	
6:00	Happy Hour	

Day 2 (May 17)		
Time	**Activity**	**People**
9:00 – 9:05	Opening	Slater
9:05 – 12:00	**Building Block 2: Indicators** (short break from 10:30 – 10:45)	Facilitator: Griffis Rapporteur: Bellamy
12:00 – 1:30	Lunch	
1:30 – 1:45	Summary	
1:45 – 4:45	**Building block 3: Delivery and Use** (short break from 3:15 – 3:45)	Facilitator: Peterson Rapporteur: Armstrong
4:45 – 5:00	Summary	
5:00	Adjourn	

Day 3 (May 18)		
Time	**Activity**	**People**
9:00 – 9:05	Opening	Slater
9:05 – 10:05	**Building block 4: Evaluation**	Facilitator: Brady Rapporteur: Shuford
10:05 – 10:15	Summary	
10:15 – 10:30	Break	
10:30 – 12:00	**How do we get there? The Plan for Next Gen ESRs**	Facilitator: Shuford Rapporteur: O'Brien
12:00 – 1:30	Lunch	
1:30 – 3:00	Small working groups: Synthesis/Plan development	Centers
3:00 – 3:15	Break	
3:15 – 3:45	Regional report	Centers
3:45 – 4:45	Open Discussion	All
4:45 – 5:00	Closing remarks	Link
5:00	Adjourn	

Appendix B - Participants list

Name	NOAA Fisheries Office	E-mail
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Appendix C - Pre-Workshop Survey and Responses

A. Goals and Objectives

1. What are the overall goals and objectives of your ESR?

Region	Responses
NE	The goal of the Northeast ESR is to inform stakeholders of the recent and long-term trends in the ecosystem.
GOM	1. To provide scientific knowledge of the Gulf of Mexico integrated ecosystem, and transfer that knowledge to scientists and managers. 2. To provide a broad-level overview of the current state of the Gulf of Mexico with respect to recent and historical trends.
CC	At present, the overall goal of the CCLME ESR is to inform the PFMC of the status, trends and variability of a broad suite of ecosystem indicators related to physical, chemical, biological, fisheries, and socioeconomic attributes. The purpose is to ensure that the Council understands the climate conditions, ecological dynamics, and social systems that form the ecosystem context for fisheries management and decision-making. The Council FEP is structured such that ecosystem information can be included by adding appendices to the foundational document. Concurrently, we are working with National Marine Sanctuary partners to develop a focused ESR from the IEA for their sanctuary condition reports.
AK	-
WH	The 2016 West Hawai‘i Trends and Status Report was the first report of its kind for the West Hawai‘i IEA and PIFSC. Our principle goals were to provide a concrete overview and background on the West Hawai‘i IEA; to present the Conceptual Ecosystem Model results, which both identified the principle pressures and drivers of the ecosystem state and helped support the selection of ecosystem indicators; and to present the status, trends and variability of ecosystem indicators related to key physical, chemical, biological, and social aspects of the region.

2. In general, how well do you think the ESR is meeting these goals and objectives now?

Region	Responses
NE	I believe that our ESR is a comprehensive list of various drivers, pressures, and states in the ecosystem. The real question is how that information is being received by the stakeholders and/or being incorporated into management.
GOM	Pretty well; the new update report was tailored specifically based on feedback from our management audience so we have some confidence it is meeting managers' needs.
CC	The ESR is meeting these goals and objectives well, and continues to make iterative improvements with direct feedback from the Council and its advisory bodies. There

	are, of course, many areas for improvement in reporting, broader reach to a wider variety of end-users, and greater impact of the ESR as a means of decision support. Long-term goals of portability, e.g., a full ESR for the California Current with the ability to make subsetted ESRs for specific regional bodies are underway.
AK	-
WH	I think we achieved our goals with the first report. I also think that there are clear gaps in the report that should be filled if/when we produce an updated report.

B. Production

3. What are the ESR products and how often are they produced (e.g., an annual ESR, quarterly advisories, etc.)?

Regions	Responses
NE	Recently the Northeast ESR has morphed into a series of products. The base ESR was migrated to a web version in the last iteration. The reasoning behind that was to continuously update the information. However, that has not happened. We do, however, provide what we call "Current Conditions" which are bi-annual updates on various indicators, mostly biological oceanographic ones. There is also a "climate update" section of our website that is maintained more frequently than the base ESR. For various Councils, we have recently begun production of annual State of the Ecosystem reports. It is the goal of these reports to be similar to an executive summary of the ESR and give the Councils the big picture of what is occurring in their region.
GOM	An ecosystem status report, which is published as an Southeast Fisheries Science Center (SEFSC) Tech Memo, when the IEA team has "spare time" – currently once every four years.
CC	The ESR products consist of an annual written report (~20 pages, plus a ~40 page supplement of appendices) and an annual presentation (~30-40 min.) to the PFMC and its advisory bodies. There is a web-based portfolio of tools (https://www.integratedecosystemassessment.noaa.gov/regions/california-current-region/indicators/climate-and-ocean-drivers.html) that provides the backbone for data access and status/trend plot generation. These products are delivered at the PFMC meeting each March. There have been other products on an ad-hoc basis, such as a series of webinars in early 2016 that described the process by which the ESR is developed. The web-based tools and the conceptual diagrams have been adapted for use in the West Coast National Marine Sanctuaries.
AK	Annual ESR for the Eastern Bering Sea; annual ESR for the Gulf of Alaska; annual ESR for the Aleutian Islands.
WH	ESR products consist of one 45-page report that was released in September 2016. The report was delivered in a number of presentations to local management agencies, including the Western Pacific Fishery Council and West Hawai‘i Fisheries Management Council. We also generated a series of interactive, web-based products

	to facilitate exploration and understanding of the report, but owing to lack of resources and a backlog of requests, this material has not yet been posted to the PIFSC website.

4. If you could make changes to the ESR product line, what changes would you make and why (e.g., Change timing? Change content? Produce other products?)?

Regions	Responses
NE	We are planning on overhauling our Ecosystem Considerations webpage, which houses the ESR and other products mentioned above. The goal is to fix the legacy issues surrounding the separate development of various products to create one product that is served in different formats based on the audience. We are also trying to standardize the time frame and process for assembling the necessary data and producing the reports.
GOM	More frequent updates would be ideal, but only if we had some support for it. The ESR product line would benefit from a platform for data delivery to stakeholders; this likely would require designated staff support. Organizing and packaging data for stakeholders takes time, and an automated data management system would help speed this effort.
CC	The timing of ESR products could certainly be improved so that it accounts for the decision-making schedule of the annual PFMC calendar. For example, the PFMC oversees four different Fishery Management Plans (FMP), but it is not clear that delivering the ESR in March of each year is well-timed to inform the decision-making process for any one particular FMP, let alone all four of them. Further development of web-based products could allow for more near-real-time updates as data become available. The content could be improved as well so that it focused not just on the status and trends of indicators, but also on how those indicators were trending relative to particular thresholds of risk, so that it was clearer to end-users that there were potential consequences of (as well as uncertainty around) the trajectories of particular ecological indicators and stressors. Incorporating risk assessment into the ESR is an essential next step. Another useful addition would be the inclusion of outputs from ecosystem models that put indicators more fully into context. Presumably this would be a useful first step toward engaging the PFMC in the process of interactive management strategy comparisons and testing. More broadly, the ESR could be tailored to other end-users in addition to the PFMC. Examples include West Coast states, National Marine Sanctuaries, and the NOAA West Coast Region Protected Resources Division. Additionally, the ESR development helps to identify critical gaps in our ecosystem understanding.
AK	More web-based content.

WH	Timing: I believe we should produce the West Hawai‘i ESR at some regular interval, possibly every three to five years, depending on resources allocated towards its production. Content: Our ESR was not as comprehensive as it could have been. For example, our list of social indicators could certainly be broadened. We also could expand our suite of indicators to track additional biological components important to the Council, such as bottom fish. Products: In addition to the ESR document, we should provide a two to three page *Summary for Policy Makers* document, in which we highlight the key findings and their relevance to local management issues. We should also have a comprehensive web presence, allowing individuals to explore the report, as well as access the report via mobile devices.

5. What important indicators/contributions (physical/chemical/biological/social) does your ESR include/address?
(In this question, we would like to compare indicators across regions and find out what indicators are generally included and what are only included in some regions. No need to list all indicators, but pick some significant or special ones. You can use this table below or other formation you like.)

	Physical	Chemical	Biological	Social
NE	• Bottom temperature • Stratification • North wall of the gulf stream • Other large-scale climate on web, not in the State of the Ecosystem	• OA (in progress) • Salinity	• Primary productivity • Biovolume of zooplankton • Survey biomass trends of aggregate groups • Biodiversity (expected number of species) • Fish condition • Fish productivity • Landings by aggregate groups (included in human dimensions) • Biomass/abundance of species of concern	• Revenue from fisheries • Recreational fishery participation • Coastal community fishery engagement and reliance • Coastal community vulnerability to climate risk • Fleet diversity
GOM	• AMO • SST • Sea level rise	• Eutrophication • Hypoxia • OA	• Habitat cover (natural and artificial) • Net Primary Productivity	• Human population • Population density • Coastal urban

			• Zooplankton biomass • Forage fish • Biodiversity • Mean trophic level • Fish abundance • Bird abundance • Overfishing status	land use • Ocean economy • Commercial revenue • Social connectedness • Fishing engagement • Recreational fishing effort
CC	• Basin-scale temperature and circulation indices • Regional temperatures at surface and depth • Regional upwelling • Regional snowpack • Regional streamflow maxima and minima	• Dissolved oxygen • Aragonite saturation state	• Zooplankton community composition • Forage fish community composition • Salmon abundance • Groundfish abundance and fishing pressure • Pinniped abundance and condition • Seabird abundance and diversity	• Fishery landings; gear contact with seafloor • Fishery revenues • Aquaculture production • Non-Fisheries human activities (shipping, energy extraction, nutrient loading, pollution, etc.) • Community Social Vulnerability Index • Fleet diversification
AK	-	-	-	-
WH	(Climate and Ocean) • PDO • ENSO • Rainfall • Sea level • Eddy Kinetic Energy • SST • Thermal Stress • Wave Power • Chl-a		(Ecological) • Total Reef Fish Abundance • Total Reef Fish Biomass • Mead Adult Reef Fish Length • Species Richness • Herbivore Biomass • Target Reef Fish Biomass • Juvenile Yellow Tang	• Population Growth • Number of Visitors • Shoreline Modification • New Development • On-Site Disposal Systems: Effluent and Nutrient Flux

		• Hard Coral Cover • Macroalgae Cover • Coral Disease	• On-Site Disposal Systems: Total Number • Invasive Algae • Invasive Fish • Commercial and Non-Commercial Fishing Pressure

6. What is the process of selecting indicators for use in the ESR (What criteria, selected by whom, etc.)?

Regions	Responses
NE	Most indicators were selected using expert opinion, but a more rigorous process is underway to refine the indicators we will be presenting. Multiple approaches are in progress, including the application of criteria used in the CCIEA and a similar process involving a subset of criteria combined with statistical redundancy analysis applied in Canada (Scotian Shelf).
GOM	The original 2013 Ecosystem Status Report for the Gulf of Mexico included over 100 indicators representing various physical forces, ecosystem pressures, biological states, ecosystem impacts, and community responses in the region. For the 2017 Update Report, we carried out steps to refine the original list into a more robust and easily interpretable suite of indicators: • First, we engaged in informal feedback requests with regional managers and users of the report with an eye toward identifying deficiencies and understanding which indicators had most direct linkages to management. • Second, we took into account data accessibility and reliability issues, preferentially developing indicators based on long-standing data collection programs such that they can be routinely updated in future reports. • Third, we took into consideration statistical issues, such as redundancy and sensitivity. A multivariate analysis of the indicator suite from the 2013 report revealed that a large number of indicators changed in response to what was hypothesized to be a climate-driven ecosystem shift. The statistical analysis showed that many indicators were immediately responsive to this shift, and were thus sometimes highly correlated; in these cases, a single indicator can then be representative of a wide range of processes. • Finally, we reviewed the existing indicators for other common selection criteria, particularly regarding: o a strong conceptual basis

	o representation of the appropriate spatial and temporal scales o track records of use in other regions o direct linkages to important societal dimensions. With respect to this latter attribute, it was recognized that the original Status Report lacked robust representation of human dimensions ecosystem components, and this update contains a much more focused representation of this sector. In sum, the indicators reported within this document were selected by carefully balancing considerations regarding management linkages, data availability, statistical robustness, and representation in spatial, temporal, and societal dimensions.
CC	Most indicators went through an extensive indicator screening process (described by Kershner et al., 2011) to identify robust indicators that relate to the state of key ecosystem attributes. The indicators included in the first ESR (2012) were chosen by the California Current IEA (CCIEA) team; since then, there have been iterative changes to the indicators included, based on consultation and feedback from the PFMC, its advisory bodies, and an ad-hoc Ecosystem Work Group formed in 2015 as part of a Fishery Ecosystem Plan initiative on improving the ESR.
AK	For our Report Cards, indicator selection has been by expert group selection. All other indicators are requested, selected, discontinued or developed by the editor (Stephani Zador) and in the last year, with assistance by Ellen Yasumiishi and Ebett Siddon.
WH	Indicator selection was both informed by the outputs of the Conceptual Ecosystem Models and our current understanding of subtropical marine ecosystems (i.e. Anderson et al., 2002; Hoegh-Guldberg, 2009; Hughes et al., 2010; McClanahan et al., 2011; Guillemot et al., 2014). Data availability also factored into indicator selection.

7. What is the basic process and timeline for producing the ESR products (data collection, assessment, figure generation, graphic design, synthesis, production, delivery, etc.)?

Regions	Responses
NE	The timeline for producing ESRs has been variable. They were originally scheduled for every two years but rarely were they produced on this time scale. The most recent version was published on the web with the idea that it would be continuously updated. However, that has not happened. At the moment, State of the Ecosystem reports are prepared annually for the management Councils. The Councils have requested these documents for their April Council meetings. The data for these documents take a while to compile. Our group is still trying to figure out the best practice for timing.
GOM	One person leads the process and does the bulk of the work processing data, generating figures, synthesizing information and writing the report. Other collaborators scramble to find spare time to contribute specific sections, as the development of the ESR is not part of their normal job duties (most tasks are completed on volunteered time). The process takes about a year. For the current

	update we are working on a web version that was put together entirely by an individual with knowledge on web design.
CC	Data collection occurs through normal long-term monitoring programs (both within and outside of NOAA) mostly but not entirely from spring through fall. From October through January, the different CCIEA subject experts that handle particular indicators will compile their data and provide updates to the data and metadata that are housed by the SWFSC ERDDAP server. The data are processed through annually updated R-code to generate error estimates, short-term means and trends, and time series plots that are automatically uploaded to indicator webpages on the CCIEA website. Subject experts provide short written interpretations of the updated time series by mid-January. This process is overseen by the CCIEA leads and CCIEA coordinator. The CCIEA leads edit the figures and written sections into the final document and appendices by early February and submit it to PFMC staff for inclusion in the PFMC March Meeting Briefing Book. The CCIEA leads take core materials from the written report and appendices to create the presentation, which is delivered in early March, first to a series of advisory bodies (including the PFMC Scientific and Statistical Committee, the Ecosystem Advisory Subcommittee, and various other advisory panels and management teams) and then in a final version to the full Council.
AK	Consultation about indicators occurs year-round. Otherwise, the annual process follows the following schedule: • Late July–early August: indicator update requests begin • Early September: presentation of information so far to the BSAI and GOA Plan Teams • September–October: continued production • End October: report submission • Mid-November: complete presentation to the BSAI and GOA Plan Teams • Early December: presentations to the Scientific and Statistical Committee, Advisory Panel and the Council • Beginning mid-December: post reports and data to website.
WH	The West Hawai‘i IEA does not have a formal process in place for producing the ESR. Approximately 90% of the report was developed by one individual, including data assimilation and analysis, figure generation, and write-up. Additional support was provided with the layout design, indicator selection, figure generation, and specific portions of the write-up.

8. What offices/groups/organizations provide data?

Regions	Responses
NE	Most of the data in the ESR are prepared locally by the NEFSC. However, data is collected by a number of partners.
GOM	Too many to be listed. Includes NOAA, other federal agencies (e.g., USGS), state agencies, academia and NGOs.
CC	• West Coast NOAA Line Offices, particularly the Northwest Fisheries Science

	Center (NWFSC), SWFSC and AFSC • NOAA Climate Prediction Center • NOAA Headquarters, Office of Science & Technology • The three NOAA Integrated Ocean Observing System West Coast Regional Associations (the NW Association of Networked Ocean Observing Systems, the Central and Northern California Ocean Observing System, and the Southern California Coastal Ocean Observing System) • California Department of Water Resources • USDA Natural Resources Conservation Service • California Cooperative Oceanic Fisheries Investigations • Multiple CA, OR, WA and ID state agencies charged with natural resource management • UC Santa Cruz and San Diego • University of Washington (UW) • Georgia Institute of Technology • Farallon Institute • Pt. Blue Institute • Pacific States Marine Fisheries Commission • U.S. Census Bureau, American Community Survey
AK	• AFSC • UW, Pacific Marine Environmental Laboratory (PMEL) • Alaska Department of Fish and Game (ADF&G) • Sir Alister Hardy Foundation for Ocean Science (SAHFOS)
WH	• State of Hawai‘i Department of Health • State of Hawai‘i Division of Aquatic Resources • NOAA’S PIFSC (The Coral Reef Ecosystem Program, The Ecosystems and Oceanography Program) • The Nature Conservancy • ERDDAP

9. What offices/groups/organizations provide analysis?

Regions	Responses
NE	Almost all of the analysis is done internally by NEFSC.
GOM	Mostly SEFSC, NOAA Fisheries Southeast Regional Office, Atlantic Oceanographic and Meteorological Laboratory, and the National Centers for Coastal Ocean Science
CC	Most data analyses are limited to summary statistics or time-series analyses conducted by CCIEA subject experts. Analysis of some large-scale climate indicators is done by the NOAA Climate Prediction Center, the Georgia Institute of Technology, and the UW. Groundfish abundance and fishing pressure is analyzed by NWFSC and SWFSC stock assessors. Fishery diversification is analyzed at the AFSC.
AK	AFSC, UW, PMEL, ADF&G, SAHFOS
WH	NOAA PIFSC, State of Hawai‘i

10. What other indicators/information do you think needs to be added to the ESR to meet its goals and objectives? Which are the most important ones to add over the next three years?

Regions	Responses
NE	We have a lot of indicators already. Our priorities are gap analysis (aligning general objectives with current indicators suggests that habitat indicators are needed for quality, quantity, and diversity, and indicators for employment require updating), and synthesis across indicators to move from a list of indicators to an actual assessment.
GOM	We have a research recommendations section that describes these needs. Two are most generalizable: 1) standardization and centrality of data collection, archiving and access, and 2) measures of uncertainty reported with each indicator.
CC	The CC LME ESR needs to add indicators on (* = most important to add soon): • *any/all of the above indicators, but at ecologically and management-relevant spatial scales • *coastal pelagic species (sardine, anchovy, mackerels, squid) • highly migratory species (tunas, billfishes and sharks) • harmful algal blooms • ecological interactions and species condition; e.g., diets, reproductive success • economic indicators • *additional indicators of coastal community human wellbeing
AK	In general, it would be nice to see more broader-scale multivariate-type indicators to replace some of the single species and/or localized indicators that we use. This is especially needed for representing the lower trophic organisms. Also, marine mammals, particularly cetaceans, are not represented.
WH	• Additional socioeconomic indicators, especially those that target ecosystem services and human wellbeing. • Additional information on economically and socially important fish groups, including bottom fish, coastal pelagics, and locally relevant pelagics. • Additional data analysis that informs the interplay between the physical, biological and social indicators. This could include performing some sort of threshold analysis and/or highlighting which indicators can be considered "early warning" for key ecosystem components.

C. Key Audiences and Uses

11. Who are your target or intended audiences?

Regions	Responses
NE	The targets of the ESR are the general public and stakeholders, although we would like it to be useful to the scientific community as well. Scientists generally want links to references and actual data, while more general audiences can be distracted by these details.

GOM	Broad scientific and management community within the Gulf of Mexico
CC	• Pacific Fishery Management Council and its advisory bodies and committees • The stakeholder communities that are engaged in West Coast fishing
AK	Primary target is the North Pacific Fisheries Management Council. Additional audience is industry, scientists, teachers, and the public.
WH	Because many of the regionally important ecosystem components that comprise the West Hawai‘i IEA are < 3 nm from shore (i.e. corals and reef fish), State of Hawai‘i resource managers are the principal target audience. Additional target users include the Council, the West Hawai‘i Fisheries Management Council, and key non-profits and researchers that do a considerable amount of data collection and monitoring. NOAA users include Sanctuaries and the Habitat Blueprint Focus Area.

12. Who are the actual users?

Regions	Responses
NE	It is unclear who is using the web version of the ESR. We are looking into Google Analytics as a means to better track this. The Fishery Management Councils are using the State of the Ecosystem Reports.
GOM	Broad scientific and management community within the Gulf of Mexico
CC	• Pacific Fishery Management Council and its advisory bodies and committees • The stakeholder communities that are engaged in West Coast fishing • NGOs • West Coast NOAA line offices
AK	North Pacific Fisheries Management Council
WH	Actual users are the State of Hawai‘i (managers and scientists) and other researchers that work in the region.

13. For the various users, what do they want/need from the ESR (do they have clear information needs/requirements)?

Regions	Responses
NE	Unknown, but scientists want indicator data to use in their own analyses.
GOM	This varies depending on the user. We have a large spreadsheet of compiled responses from managers that outlines what each would like from the ESR.
CC	The information needs for the ESR were formally outlined in Section 1.4 of the PFMC’s 2013 Fishery Ecosystem Plan: *“Information in the report is intended to improve the Council and public’s general understanding of the status and functions of the CCE and is not tied to any specific management measures or targets for Council-managed species. When the Council receives future annual ecosystem reports, it anticipates continuing to review the reports’*

	contents so that they may be tailored to best meet management needs."
AK	The Council wants a holistic description of current ecosystem state as well as indications of areas of concern for managers – in other words, the implications for Fisheries management.
WH	No clear articulation has ever been made with respect to the report. However, feedback has been provided that would help inform a subsequent report, including the development of a shorter (2–4 page) *Summary for Policy Makers*.

14. How do they actually use the ESR (general information and examples welcome)?

Regions	Responses
NE	Unknown. We are in the process of iterating with Council SSCs and full Councils, so time will tell.
GOM	Many use it as a broad reference for the Gulf of Mexico, and it has been cited as such. The indicator data set has been used in at least three publications.
CC	The PFMC mainly uses the ESR for context in fisheries management decision-making; for example, information from the 2015 and 2016 reports describing the historically low snowpack of the winter of 2014–2015 was cited in the PFMC discussion about its 2016 salmon harvest management decisions. However, the ESR process has not evolved to a point where any specific PFMC decisions can be explicitly linked to contents of an ESR; for example, the 2016 harvest decisions do not mention the ESR in writing, nor are there ecosystem threshold indicators that trigger any decision rules. The information needs and requirements are iteratively evolving through collaboration between the CCIEA team, the Council-appointed Ecosystem Working Group, and PFMC advisory bodies. It is our hope that these interactions will lead to identification of specific indicators, analyses or applications where ESR information can provide explicit and valuable decision support.
AK	Our ESRs provide contextual information for the discussions of harvest specifications. Clear examples of information uptake include: adjusting allowable biological catches (up and down) in part because of ecosystem indicators/components and facilitating discussions of stock splitting.
WH	The West Hawai‘i ESR has helped inform two key management processes currently playing out at the state: The Coral Reef Bleaching Response Plan and the 30x30 Plan, in which 30% of all nearshore areas are expected to be effectively managed by 2030.

15. What are the main challenges/barriers audiences face in using the ESR information (e.g., access to the information, understanding how to use it, knowing what to do with it, scale or scope of information not useful to their decision time frame, trusting the information, or other)?

Regions	Responses
NE	Previous engagement with Council SSCs has been the lack of the "so what" message. We have done a good job at collecting a large and diverse amount of data, but have yet to deliver a message that is easily digested by the target audience.
GOM	• Using indicators at spatial scales relevant to management bodies. For example, a state agency may be a target audience, but not all of the indicators can be interpreted as representing processes relevant to the scales they manage. • Specific to the Fisheries Council, the main barrier is that including ecosystem information more routinely equates to a reduction in throughput of assessments, a tradeoff that has not been seen as favorable. The stock assessment analysts do not have time or support for exploring ecosystem considerations; thus, the information is largely left out of the management process.
CC	The main challenge seems to be a mix of understanding how to use ESR information, knowing what to do with it, and matching the scale and scope of information to the decision time frame. The CCIEA team and the PFMC advisory bodies still have not had the kind of extensive scoping conversations that would serve to clearly identify and prioritize PFMC needs for which ESR indicators could be applied in a specific, targeted and timely manner, for example in support of specific assessments, or to assess impacts of and ways to mitigate against potential stressors, or to help choose between management alternatives.
AK	Making the scale or scope of information useful to their decision time frame is of great importance, but this is the responsibility of the editor. The main challenge is having clear quantitative thresholds for proscribed action; but even this would not be appropriate in all cases.
WH	Access and the total size of the report are key barriers to individuals using the ESR. I also think if we conducted some more in-depth analysis (e.g., multivariate analysis) it would aid in the interpretation and highlight the usefulness of the data sets presented.

16. How do you identify target audiences and their requirements?

Regions	Responses
NE	The Councils requested a State of the Ecosystem report. Through work with the Mid-Atlantic Fishery Management Council (MAFMC) SSC, we have refined what is provided. We hope to engage in a similar process with the New England Fishery Management Council (NEFMC). We need to do a better job at assessing the needs of other stakeholder groups.
GOM	We carried out an informal feedback request process by emailing management bodies and scientists who were known to have used the report or thought to be target audiences.

CC	We have mostly identified target audiences through agency mandates (i.e., doing applied science that focuses on fisheries issues, protected species, habitat, National Marine Sanctuary priorities, and other NOAA trust resources) and through the "inherent partnerships" (e.g., with the PFMC, Sanctuaries, related agencies, West Coast states, stakeholders) that arise from serving those mandates. There have been some cases, such as the state of Washington marine spatial planning effort, where partners have reached out to us. There are other cases, such as interactions with particular fishing sectors, coastal communities, tribes, NGOs, etc., where we have likely fallen short in identifying target audiences, due in large part to the relatively low numbers of social scientists whose research interests and agency mandates would create similar "inherent partnerships."
AK	Annual review by the Council includes information requests.
WH	Reaching out to partners, community members and the state. Their respective requirements do not necessarily overlap; however, we've tried to balance their needs to deliver a product that is useful to as many end-users as possible.

17. Based on your ESR experience, what are some key lessons or suggestions on understanding and meeting user needs?

Regions	Responses
NE	Based on my experience, the ESR takes a long time to compile and even longer to sort out the message. It is the message that the users want, not necessarily the data. Be sure to give yourself plenty of lead time to produce one of these reports. Also, getting contributors used to a common format for data submissions and text as well as lead times and deadlines will be helpful.
GoM	Communicating with a wide range of end users is very important. Different audiences have different expectations for the report and a fine balance is required to meet multiple different needs.
CC	• Seven years into our interaction with the PFMC, it only now feels like we are starting to have some impact, which indicates that simply showing up to give an ESR once a year is not enough for understanding and meeting management needs. It is informative to the Council, but much attention gets paid to making small tweaks to the report rather than to prioritizing and aligning science capacity with management needs. • We may be able to make more progress in making our ESR a management-applicable product (as opposed to merely a management-relevant product) for the PFMC by putting greater emphasis on our interactions on the Council advisory bodies, management teams, etc., rather than expecting our report to the Council to be the catalyst for management uptake. • Meeting with the advisory groups may be the better way to have the "scoping" conversations to align our work with management needs and advance the ESR beyond simple indicator reporting and more toward integrative applications of indicators (e.g., risk assessments, threshold analyses, dynamic ocean management, management strategy evaluation).

	• For other users, such as the West Coast Regional Office, there seems to be less "inertia" than there is in the Council, and that may facilitate more rapid alignment of science and need, more uptake of ESR-related science into management, etc. • Ensuring that there is some "narrative" form to the written version of the ESR seems to have improved its readability and reception by the PFMC and advisory bodies.
AK	Understand the user's needs. In other words, the information needs to be useful in order to be used. In the Fisheries management context, this means matching the scale and timing of the ESR and presentations for maximum benefit. Information needs to be relevant to the time period of interest. In an annual management system, this mean ecosystem information needs to be up to date within the past year or two at the most. At a small scale, contextual information needs to be presented before discussion of harvest specifications; presentations following harvest specs discussions are ineffective.
WH	As mentioned above, if we presented a short *Summary for Policy Makers,* which synthesized the key findings of the report and presented it in a glossy, aesthetically pleasing format, it would be an important contribution that would facilitate use of the report. Expanding our list of indicators beyond those presented in the 2016 report would also help meet our user needs.

D. Delivery

18. What mechanisms are used to deliver the ESR to your core users (e.g., regular meetings with Councils, presentations, webinars, PDFs, printed documents, websites, etc.)?

Regions	Responses
NE	The ESR itself resides on our Ecosystem Considerations webpage. The same is true for the Current Conditions and Climate Update reports. Presentations have been given at the MAFMC and NEFMC April meetings. These presentations are based on the State of the Ecosystem Report, which is provided in a PDF format.
GOM	Report in PDF form. For the 2017 update we have a web version. Meetings with target audiences would be ideal, but there is little to no travel support for this activity.
CC	• Regular meetings with Council and advisory bodies. • Presentation and PDF report. • Webinars; also, this year we will experiment with a pre-recorded version of the presentation for advisory bodies whose members cannot attend our presentations in person. • CCIEA website, which we are presently improving so that indicators are updated continuously and can be used more interactively by users; we are also planning to develop customized pages of indicator suites tailored to specific end users.
AK	PDFs, regularly scheduled meetings
WH	At the initial release of the report (sent primarily as an email informing key partners, collaborators, and community members), I presented the findings to the SSC, the

	Council, and the West Hawai‘i Fisheries Management Council. We also developed interactive content for the web, however, we are lacking support with web content posting.

19. What are the main challenges you face in delivering the ESRs to core users? (Deadlines, format capacity, etc.)

Regions	Responses
NE	ESRs and similar reports take a fair amount of time and effort to prepare. Staff time required to execute them is at a premium. So the biggest challenge is creating them in a timely fashion with our limited resources.
GOM	Lack of funding to travel to relevant meetings. Also, the current update has a very nice web version but this was put together by a single contractor. If we lose this person, we will no longer have a nice web interface.
CC	• Deadlines are difficult (they come relatively soon after winter holidays) • Formatting is also difficult because the PFMC is increasingly asking for new time series as well as maps and three-dimensional oceanographic plots, which are difficult to fit into the document with clarity and adequate fonts, given the ~20-page limit they have requested. Something web-based for such figures would be better, but as of now that does not adhere to the format requirements of the PFMC briefing materials.
AK	A huge amount of information needs to be synthesized in a very short period of time.
WH	The principal challenge in producing a second ESR for the West Hawai‘i IEA is support. We are a small region with few employees focused on the IEA. As such, we would need institutional support (i.e. interdisciplinary collaborations, data management, web-delivery, graphic design, media outreach, etc.) at PIFSC to facilitate an updated version and expansion of our 2016 Report.

20. What are the main challenges? What actions have you taken or want to take to improve delivery and use? Any lessons or suggestions for improving delivery and use?

Regions	Responses
NE	The current iterations of the State of the Ecosystem reports are being prepared using R Markdown. We are also developing a standard data format. Both should help in reproducibility and timing of the product.
GOM	Lack of resources for producing regular reports. Also, once products are produced, lack of resources for actually incorporating the information into management.
CC	• We have not made any changes to delivery. • To improve use, we have worked with the Council on refinement of the document under a specific initiative passed in 2015 under the PFMC Fishery Ecosystem Plan; we have worked with the ad-hoc Ecosystem Working Group, the Scientific and Statistical Committee, and other Council advisory bodies to iteratively review

	and improve the content and presentation of materials in the report. • For future improvement, we plan to develop a page on our website that is tailored to the PFMC and the indicators it has identified as most useful. As we improve the speed, efficiency and frequency at which indicators are updated, we will promote this page to the PFMC as a closer-to-real-time ESR so that they can follow ecosystem indicators more interactively rather than relying on the March reports for all of their ecosystem status information.
AK	Not enough staffing resources.
WH	Having a dedicated team that is focused not only on content, but the layout and delivery of information, would be hugely helpful for developing a useful, relevant, and timely product that reaches as many diverse end-users as possible.

E. Evaluation

21. What are the strengths of your ESR?

Regions	Responses
NE	It is a fairly comprehensive collection of information on the Northeast U.S. Shelf LME.
GoM	Highly diverse author group and indicators representing broad ecosystem components. The update report is particularly strong in the human dimensions category. The web version of the current update is also very well done.
CC	• It covers a broad suite of physical, chemical, biological, ecological, and socioeconomic indicators. • It is reasonably concise (20 pages) and rich with information and informative figures. • It follows a consistent format of data presentation and status/trend determination (derived from the successful approach taken by the AFSC). • It uses a narrative approach to connect indicators (and ecosystem components). • It is a joint written report and presentation, which enables us to reach a broader audience with diverse learning styles. • It is explicitly requested by our main end user, and thus is a well-established process and part of their annual agenda. • A new addition to the ESR (for 2017) is a short section of "research recommendations," which may help address some of the challenges above.
AK	They have developed with regular interaction and input with the main user and thus have been adaptive to their needs.
WH	• The novelty of the information for the region • The comprehensive information presented for coral reef ecosystems, which is repeatedly stated as the most important ecosystem component for West Hawai‘i.

22. What are the challenges/weaknesses of your ESR?

Regions	Responses
NE	The weakness of our ESR products is that they tend to lack the overall take-home message that stakeholders are looking for. They could always use more synthesis across indicators. Another challenge is that the visualization of complex information requires help from visual information specialists to communicate messages.
GOM	The ESR is improved iteratively, by putting reports out and then understanding how people use them and seeking feedback on how they are used. We are still working on our first update so have had only one opportunity to improve content. Also, we need further exploration of the spatial scales that are relevant to report for various indicators and many indicators need a more in-depth analysis (e.g., is a Gulf-wide average the most useful metric?).
CC	• Standard issues of people/resources being spread thinly, even as end users ask for improvements and additions. • Time lags between data collection and processing of data so that they can be reported; for many indicators, these lags are measured in years. • We face a great challenge in improving the spatial resolution of our time series so that we can report on conditions at the scale of sub-regions, species ranges, etc. • We are a long way yet from being able to provide indicators that are leading and support forecasts or predictions. • We do not have many social indicators, for example, indicators of human wellbeing that would enable better understanding of social tradeoffs that result from ecosystem changes. • We have several other key gaps, especially with regard to pelagic species. • We have not been able to add many broader, more integrative products into the ESR. • Finally and importantly, we still do not have a clear sense of the Council's highest priorities for goals and objectives that need ecosystem-scale science for decision support, which hinders our ability to provide the best information in our ESR.
AK	The limited staff devoted to the production of the ESR limits the potential quality of the products.
WH	• The lack of variety for ESR information accessibility. • Limited socioeconomic indicators. • Limited indicators for offshore (e.g., pelagic fishes) and deeper biological (e.g., bottom fish) communities.

23. How do you track whether current ESR is achieving its goal? What metrics do you think should be tracked?

Regions	Responses
NE	We do not have a method of tracking how the ESR is doing. I do not know what metrics should be tracked.
GOM	• number of citations • number of times ESR data are used in publications, stock assessments, etc. • number of management decisions based on consideration of ESR
CC	There are a suite of metrics that can be used to assess ESR utility. The first being that the end-user continues to ask for updates to the ESR. The second being that the end-user has suggestions for updates to the report, showing continued engagement. The final would be whether the end-user is using the ESR directly in management decision-making.
AK	Documentation of any mention of ecosystem issues in Council notes
WH	The ESR is regularly discussed when I attend relevant management meetings, but beyond that, we honestly (and ironically) don't have any indicators to track the use of our ESR.

24. Are any important management needs NOT addressed by the current ESR? If so, any suggestions on how to address them?

Regions	Responses
NE	Right now the ESR is focused on fishery management needs. It would be great to broaden this perspective both for fisheries and other sectors as well. This would require greater collaboration with other federal and state agencies.
GOM	Most managers primarily have questions about process (e.g., how is SST influencing the migration of a stock under my jurisdiction). The ESRs tend to report on status and trends but do not interpret the causal linkages between processes. Thus, there are many management needs not addressed by the ESRs. Producing the necessary information requires a great deal of time and resources; I'm not sure that this is currently within the capacity of ESRs.
CC	Because the PFMC is our primary end-user, the ESR is heavily focused on the fisheries sector. We would like to address additional sectors but money and in turn people-time is a significantly limiting factor.
AK	-
WH	Many of the ecosystem components (e.g., bottom fish) I've mentioned above are not addressed and certainly should be. To overcome this for a second ESR, PIFSC would need to support the document's development and assign an interdisciplinary team of researchers focused on pulling the ESR together.

25. What types of management decisions are being influenced by this ESR? Please describe (examples are great).

Regions	Responses
NE	At this time it is unclear whether the ESR has had any influence on management decisions.
GOM	After the publication of the first ESR, evidence of a Gulf of Mexico-wide ecosystem reorganization was discovered. This has influenced thinking on interpretation of various data streams in the region – for example, CPUE trends, and marine mammal stranding patterns.
CC	Example of salmon above, although the ESR was not directly mentioned.
AK	Tier level for harvest specifications are adjusted in light of ecosystem concerns.
WH	Two major state initiatives are underway. 1. Coral Reef Bleaching Response Plan: In response to the 2015 coral bleaching event, the state is developing a management plan to promote recovery of corals from bleaching and resilience to future bleaching. The ESR is directly supporting this process. 2. 30x30 plan: The state will be designing new management rules for 30% of nearshore areas by 2030. West Hawai‘i is considered one of the most intact nearshore ecosystems in the state, and the ESR is helping to inform what management is likely needed in this region.

26. What are the top things you think need to be done to strengthen the ESR to better meet its goals and objectives? (List up to five)

Regions	Responses
NE	Overhaul the website to eliminate the legacy issues (e.g., redundancy) produced by the development of the various products. Increase the timeliness and regularity of production to ease the burden on staff.
GOM	• More resources put toward development of ESR and dissemination of information. • Report estimates of uncertainty associated with each indicator. • More statistically rigorous treatment of trend analysis and synthesis. • Further exploration of relevant spatial scales for reporting indicators.
CC	• Web-based tools to simplify updating time series. • Better integration with multiple Council subgroups • More complex analyses, ecosystem-based statuses.
AK	More staff, more staff, more staff, more staff, more staff.

WH	• Broaden the scope of the ESR to include additional ecosystem components and indicators of ecosystem services and human wellbeing. • Identify a project team that is responsible for leading the development of the ESR, including data assimilation, analysis, and figure generation. • Develop a communications and outreach plan that employs a variety of user-friendly methods, such as a Summary for Policy Makers, an interactive, web-based version of the ESR, social media, and other ways that facilitate broad dissemination of the report. • Provide the ability for stake-holder input both before and after the release of the ESR.

27. If there is anything else you would like to share regarding your ESR, please describe here.

Regions	Responses
NE	-
GoM	-
CC	There are multiple N. Pacific ESRs including: • CCIEA for Council • The National Marine Sanctuary condition reports • The California Cooperative Oceanic Fisheries Investigations State of the California Current report • PICES North Pacific Ecosystem Status Report There is a good bit of duplication of data, but plotting differences among status reports. Having a common backbone (data repository) and multiple web-based plotting tools would aid compatibility and reduce duplication of effort. Also, real-time updating (plots updating as data come in, ideally with interpretation) will take investment, but the payoff could be quite large as well.
AK	-
WH	The West Hawai‘i IEA is unique compared to other regions in that much of the management in the region falls on the state. As such, this is our primary “client,” so to speak. We could potentially think about expanding the ESR to include all of Hawai‘i or other areas within Hawai‘i (which has been suggested by the Council), but the indicator selection process and data assimilation would be dramatically different than those used in the previous ESR.

Appendix D – Acronyms Table

Acronym	Definition
AFSC	Alaska Fisheries Science Center
ADF&G	Alaska Department of Fish and Game
AK	Alaska complex region
AMO	Atlantic Multidecadal Oscillation
AOML	Atlantic Oceanographic and Meteorological Laboratory
AP	Advisory Panel
BSAI	Bering Sea and Aleutian Islands
CC	California Current
CCIEA	California Current Integrated Ecosystem Assessment
Chl-a	Chlorophyll-a
DWH	Deepwater Horizon
EBFM	Ecosystem-Based Fisheries Management
ENSO	El Niño-Southern Oscillation
ERDDAP	Environmental Research Division's Data Access Program
ESRs	Ecosystem Status Reports
FATE	Fisheries and the Environment
FEP	Fishery Ecosystem Plan
FMP	Fishery Management Plans
FMC(s)	Fishery Management Council(s)
GIS	Geographic Information System
GOA	Gulf of Alaska
GOM	Gulf of Mexico
IEA	Integrated Ecosystem Assessment
LME(s)	Large Marine Ecosystem(s)
MAFMC	Mid-Atlantic Fishery Management Council
NCSS	NOAA Fisheries Climate Science Strategy
NE	Northeastern
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NGO	Non-Governmental Organizations
NMFS	National Marine Fisheries Service/NOAA Fisheries
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
NWFSC	Northwest Fisheries Science Center
OA	Ocean Acidification
PDF	Portable Document Format
PDO	Pacific Decadal Oscillation

PFMC	Pacific Fishery Management Council
PIFSC	Pacific Islands Fisheries Science Center
PMEL	Pacific Marine Environmental Laboratory
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SEFSC	Southeast Fisheries Science Center
SSC	Scientific and Statistical Committee
SST	Sea Surface Temperature
SWFSC	Southwest Fishery Science Center
TOR	Terms of Reference
UW	University of Washington
WH	West Hawai‘i