ECOSYSTEM ADVISORY SUBPANEL REPORT ON FISHERY ECOSYSTEM PLAN COORDINATED ECOSYSTEM INDICATOR REVIEW INITIATIVE

1.0 Introduction

This Ecosystem Advisory Subpanel (EAS) report is intended to provide the Council with input on future editions of the Annual California Current Ecosystem Status Report (Report). The EAS separated its advice on the Report from its consideration of other uses for ecosystem indicators in keeping with the recommendation of the Ad Hoc Ecosystem Workgroup (EWG) in its March 2016 report: Agenda Item D.2.a, Supplemental Ecosystem Workgroup Report 2 for the Council meeting. In that report, the EWG recommended "…proceeding with this Fishery Ecosystem Plan (FEP) Initiative through a two-step process: (1) a short-term review of the indicators in the present Report for any needed revisions or supplements; and (2) an annual science-and-policy process to develop new indicators or analyses…" This report addresses step one, with some remarks about how the Report can contribute to step two.

The EAS met jointly with members of the EWG and the Scientific and Statistical Committee (SSC) Ecosystem Subcommittee on September 13, 2016 for presentations by members of the Integrated Ecosystem Assessment (IEA) Team on their progress developing indicators since the March meeting. The EAS members appreciated this opportunity and found the presentations and discussion very useful. The EAS continues to be impressed by the work, and we again commend the IEA Team and the many scientists whose studies underpin this system-level perspective.

The recommendations in this report are consistent with, and build on, points we made in our March 2016 report: Agenda Item D.1.b, Supplemental EAS Report for the Council meeting.

2.0 Development and Use of the Report

EAS members agree with the EWG in supporting the Report as an informational report rather than a document intended to provide specific quantitative information directed at particular management decisions. The Report, even with its appendices, cannot represent all of the potential applications of indicators and analyses to the Council's work. It is highly valuable, nonetheless, as a summary document whose brief length, plain language, and graphics make it accessible to diverse audiences.

In meeting its primary purpose as an informational report, the Report also could serve to invite deeper discussions about how some indicators—through additional development and analyses—might be used to inform specific future management decisions. The EAS suggests that an additional narrative section be added to the report to highlight emerging opportunities that clearly link the science with management decisions, where applicable. Stock assessment analysts could participate in authoring this section.

The Report has evolved quickly in response to the Council's direction and discussions with your advisory bodies. This in itself is a good indicator of people's interest in the Report and its importance to future management actions. The EAS recommends a routine process be established to present and discuss the Report with the Council's management teams and advisory bodies. The joint meeting of the IEA Team with the SSCEC, EWG, and EAS this week was productive and efficient. Additional collaborative meetings like this might be held as webinars.

Thinking longer term, the EAS encourages the Council, EWG, and the IEA Team to make the Report a more forward-looking document by building on status and trends data to provide projections of future ecosystem conditions. This would improve on the current discussion-based approach to applying status and trends data to future decisions. We recognize challenges associated with this recommendation, among them:

- Projections need to be presented in ways that indicate confidence in the data and analyses; and,
- Projections will require more data verification and model validation, which are time consuming tasks.

Consequently, an evolution towards projections will take time, but we have been encouraged by the rapid development of the IEA and Report to date, and we expect that some projections could be developed more easily than others.

Beyond the Report and annual discussion process, a more thorough FMP-by-FMP look at how to apply ecosystem information to stock assessments and other management tools would provide the Council with additional guidance on risks arising from changes in the ecosystem. The current Agenda Item D.2 will provide an additional opportunity for the EAS to comment.

3.0 Additional Comments on Indicators

Optimal spatial scales: The Report has called attention to data that support widespread observations from scientists and fishermen that the system is changing in ways that cannot be explained by our existing understanding of interannual or decadal-scale variability in ocean conditions. In some cases, there are tight associations with biological responses; but the physical and biological changes are not consistent across the system, revealing the importance of understanding responses at finer spatial scales and over longer time frames.

Recognizing that finer scales of resolution could be useful, the EAS asks whether static or dynamic boundaries are more appropriate for reporting and visualizing ecosystem processes. Static boundaries are useful in consistently reporting and displaying data over time, but they may miss important processes that operate on different scales. Dynamic boundaries may capture a greater range of processes but make comparisons across scales more difficult.

Forage indicators: As an example of how ecosystem information relates to Council actions, the Coastal Pelagic Species FMP includes a goal to "provide adequate prey for dependent species." The recent unusual mortality event in California sea lions and increases in wrecks of common murres and rhinoceros auklets highlight the need to consider ecosystem information alongside fishing pressure when setting management measures and catch limits. The Report for 2016 notes that high energy forage fish (sardine and anchovy) in the central California Current have remained at low levels, and that there has been a downward trend in high energy forage fish

abundance in the southern California Current. Similarly, the report calls attention to the cyclical shift from northern, high energy copepods to less lipid-rich southern species. Shifts to southern copepods have been correlated with lower Columbia River salmon returns.

Given the value of these sorts of data, the EAS supports ongoing efforts to expand data collection on forage fish and zooplankton and bring more existing, long-term data sets into the Report. We recognize these efforts face challenges, from acquiring proprietary data to establishing new long-term monitoring studies.

In addition, the role of seabirds as indicators should be reconsidered. Our understanding is that *seabird diversity* is the indicator presented in the annual State of the California Current Ecosystem report, but seabirds are also great aggregators of ecosystem information, and they should be examined as indicators of the abundance and availability of forage species. EAS members suggested brown pelican nesting success be examined as such an indicator for the southern California Current, and other seabird species may offer similar opportunities in other parts of the system.

Phytoplankton and Harmful Algal Blooms: Primary productivity is not currently an indicator, in large part because it is highly variable in space and time, thus not lending itself to presentation on an ecosystem scale. Nonetheless, primary production is likely to change in response to climate. Moreover, harmful algal blooms are important stressors that are predicted to increase in frequency, intensity, and duration with climate change. Consequently, the EAS recommends that we find a way to incorporate data on chlorophyll concentrations and harmful algal blooms into the reported indicators.

Latitudinal shifts: The EAS would like to see more information about latitudinal shifts in target species and protected species within the ecosystem, so that managers and fishermen can anticipate where the target stocks will be available and the potential for interactions with protected species are low. The IEA Team presented some examples where monitoring ocean conditions intensively could support models that predict where target and protected species will occur, making it possible to establish voluntary practices or management rules that reduce the risk of bycatch. Analyses to support these dynamic ocean management concepts are beyond the scope of the annual Report, but it would be beneficial to cover persistent, longer-term trends in species distributions in relation to fisheries-derived data like landings.

Seafloor disturbance: The 2016 Report (Section 5.2) introduced a new indicator for seafloor disturbance in the form of "seafloor distance disturbed by fishing gear." The EAS questions the utility of this indicator, because the actual impact on the seafloor is determined by parameters other than "distance disturbed," including the seafloor type and the gear and practices used. The IEA website now displays the data by seafloor type, but biogenic habitats—where impacts are of most concern--are not included as a type. The EAS recommends looking for other indicators of interactions between fisheries and seafloor species, such as observer data for coral and sponge bycatch, that would provide a better estimate of the impact bottom-contact fishing has on the ecosystem.

Changes in fishing behavior as indicators: Developing indicators for the human dimensions of the ecosystem is challenging. (See sections 6.1 and 6.3 in the 2016 Report.) Fishermen and processors make adjustments to their business behavior for many reasons, and behaviors evolve

in response to changes in fisheries production, fisheries management actions, ocean condition, markets, and other variables. This leads EAS members to question what observed shifts in fisheries behaviors "indicate." The EAS suggests further development of human dimensions indicators be made in collaboration with the industry and other concerned parties. This is likely to require deeper social science research that includes, but goes beyond, fisheries economics. Meanwhile, presenting fishery economic data—such as ex-vessel values by fishery and geography--alongside ecosystem information in the Report may reveal associations between the two.

4.0 Closing Statement

The EAS supports the application of the IEA to fisheries management by reporting on ecosystem indicators. We recognize value in the Report and offer the comments above in the spirit of improving the product over time.

PFMC
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