

## SALMON ADVISORY SUBPANEL REPORT ON ECOSYSTEM INDICATORS

The Salmon Advisory Subpanel (SAS) appreciates the Integrated Ecosystem Assessment (IEA) Team's annual State of the California Current Ecosystem Report (SCCE Report) provided to the Pacific Fisheries Management Council (Council). This report has allowed the entire Council family to clearly follow physical and chemical ocean conditions through time and see how these factors affect the food web and ultimately the health and abundance of Council managed fisheries. We encourage the Council to inform the Fisheries Science Centers that their annual report is of great value when considering both management of Council fisheries and our understanding of the California Current large marine ecosystem (CCLME).

In addition to presenting the SCCE Report to the Council during the March 2016 Council session, Chris Harvey and Toby Garfield from the Fisheries Science Centers gave a similar presentation to the SAS. Many of their ecosystem indicators directly affect Council-managed salmon fisheries. Trends in the basin-scale snow-water equivalents, Pacific Decadal Oscillation, El Niño – Southern Oscillation, and the “warm blob” provided a clear physical and chemical basis for trends in multiple levels of the food web including plankton, forage fish, salmon, and the competing predators, marine mammals, and seabirds. Because so many of the indicators impact salmon health and abundance, the SAS, Salmon Technical Team and all sectors of salmon fishery management greatly benefit from the annual SCCE Report.

Results of studies often lead to new questions. The Ecosystem Work Group's Initiative 2 asks Council advisory bodies, management teams, and the public to suggest new ecosystem indicators to improve the utility of the SCCE Report to benefit Council fisheries management. To this end, the SAS provides the following list of indicators that might improve our knowledge of the CCLME and salmon management:

Sea surface temperature has been a valuable indicator. However, there is limited information on vertical temperature profiles. The SAS suggest the establishment of temperature depth profile sampling stations at strategic locations to learn more about the relationship between temperature and salmon distribution.

Records of river discharge into the Pacific Ocean could be an indicator of nutrient input and overall productivity. The SAS suggests monitoring discharge from major West Coast rivers and documenting relationships between discharge and productivity in adjacent ocean areas.

Many pharmaceutical products and other contaminants are discharged into rivers. Quantities may be sufficient to affect some marine life and especially fish with an anadromous life history. The SAS suggests monitoring chemical contaminants in major West Coast rivers and relating these data to the health of anadromous fish occupying these rivers and to marine organisms living near the river mouths.

Upwelling of cold nutrient rich water is a significant factor in the productivity of the CCLME. However, information presented in the 2016 SCCE Report demonstrated that some upwelling waters are warm and some contain dangerously low concentrations of dissolved oxygen. The SAS

suggests developing an indicator of upwelling quality by season and coastal zones and relate this indicator to productivity.

The SAS is aware of the considerable variation in some salmon sibling relationships and suggests that in addition to jack number, jack length and body condition be added to the sibling relationship models for predicting adult abundance.

The SCCE Report provides seabird richness information for the southern California Current Ecosystem. The only seabird index reported for the northern CCE was that of the common murre “wreck.” The SAS would like to see an index of seabird species diversity and density for the northern CCE in the SCCE Report and relate that information to abundance and condition of salmon populations.

Some Council-managed Chinook salmon stocks spend much of their adult life in the waters near Alaska. The SAS would like to have the existing Bering Sea Ice Index considered as an indicator of abundance for north-migrating Chinook stocks.

PFMC  
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