

## Proposed Topic for the ESMWG

### **Practical Methods for Adaptive Risk Management & Decision-Making under Uncertainty:**

Given NOAA's mission to reduce uncertain harms from the impacts of extreme weather and water events (2018-19 SAB Work Plan), the ESMWG proposes to explore recent advances in incorporating uncertainty into adaptive ecosystem management and decision support. This initiative would synthesize approaches for decision support under *deep uncertainty* to evaluate and suggest practical tools that NOAA may wish to use or transfer to local decision makers.

*Deep uncertainty* is characterized by an inability to make useful future projections of a system state, based on past data and understanding (e.g., historic storm frequency and intensity). Such uncertainty undercuts the ability to cost-effectively manage risk, and decision support tools are being developed (and adopted by the private sector) to guide choices that are robust and responsive to unpredictable system dynamics. For example, the Bering Sea (AK) has experienced rapid rates of ocean warming and winter sea ice loss, which is transforming the marine ecosystem and affecting commercial fisheries, subsistence harvests, and threatened or endangered species. Because these changes occurred more quickly than predicted, managers had to re-assess management plans and strategies. Emerging methods to address challenges of this type expand upon traditional risk assessment to examine a range of possible futures, be responsive to new information and assess the degree to which management options achieve their goals under diverse scenarios. The proposed work is potentially relevant to many types of scientific inquiry and modeling that support NOAA's activities, including fisheries management, coastal resilience planning, offshore and shipping activities, and support for the blue economy. These methods can also be used to reveal data gaps and establish research priorities.

This topic has broad support from the NOAA line office representatives who have reviewed and commented on this proposal (NOS, NMFS, OAR). As part of this comment and review, they suggested several specific ideas of how such information would be useful

- Assisting coastal (small) communities in assessing and managing erosion and storm surge risk by evaluating the conditions under which plans fail to generate net benefits
- Developing and prioritizing vision areas for the R&D plan
- Balancing fisheries catch limits with ecosystem conditions that support the blue economy (recreation, jobs) under changing weather
- Advancing the current use of risk tolerance in fisheries portfolio management
- Providing recommendations for how to potentially improve stock assessments, IEAs, Section 7 consultations, etc., to accommodate deep uncertainties.
- Improving communication of uncertainty in all types of ecosystem management

We propose to develop a brief report with recommendations for the line offices for incorporating uncertainty into decision support research. Recommendations are expected to take the form of descriptions of a set of practical methods in use, approaches to tailoring those methods to NOAA's needs, and suggestions for "right-sizing" the resources devoted to uncertainty analysis to the size of proposed investments and the potential consequences of underestimating risk. The report would further assess the usefulness of some existing tools (including ones used by the private sector, academia, and other federal agencies) and evaluate their utility and potential transfer to NOAA. This effort would be led by ESMWG member Lisa Wainger, with assistance from other ESMWG members and in coordination with ESMWG contacts from multiple NOAA Line Offices (e.g., NMFS, NOS, OAR).