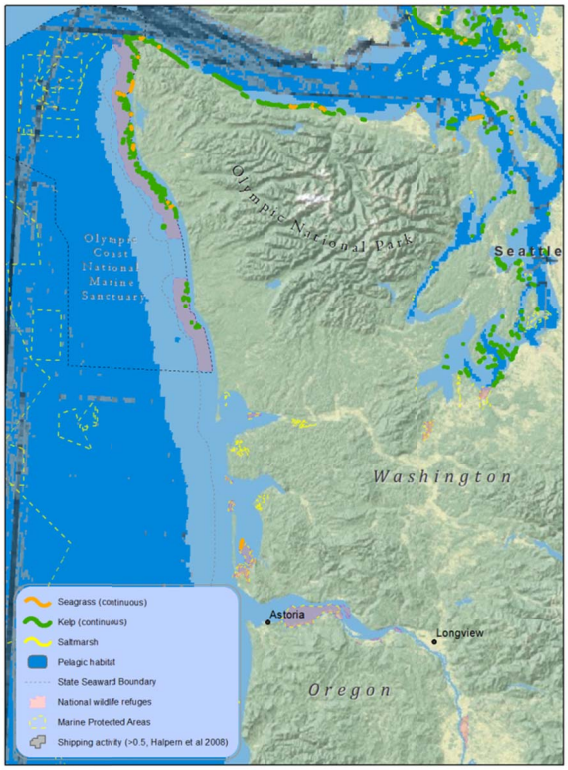
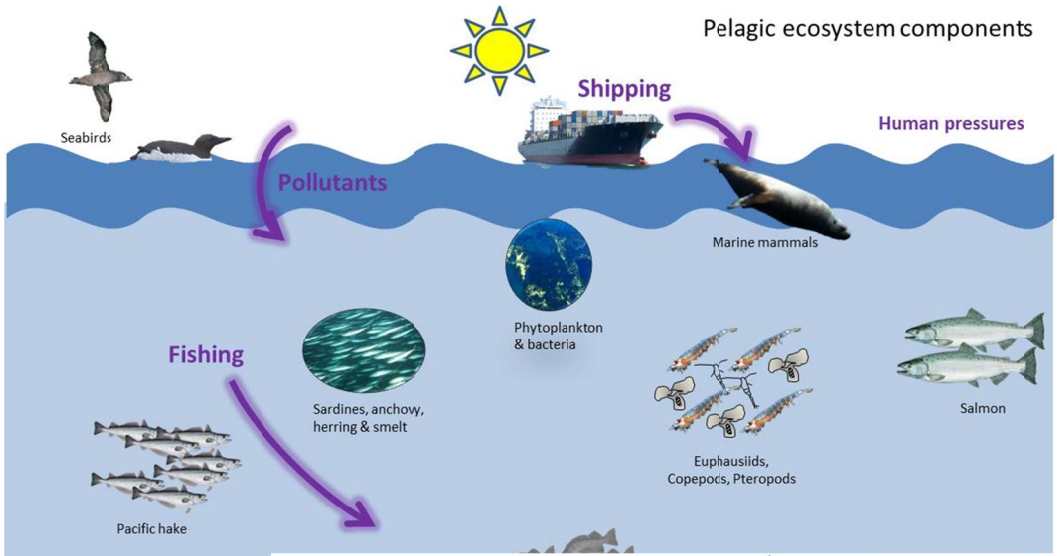
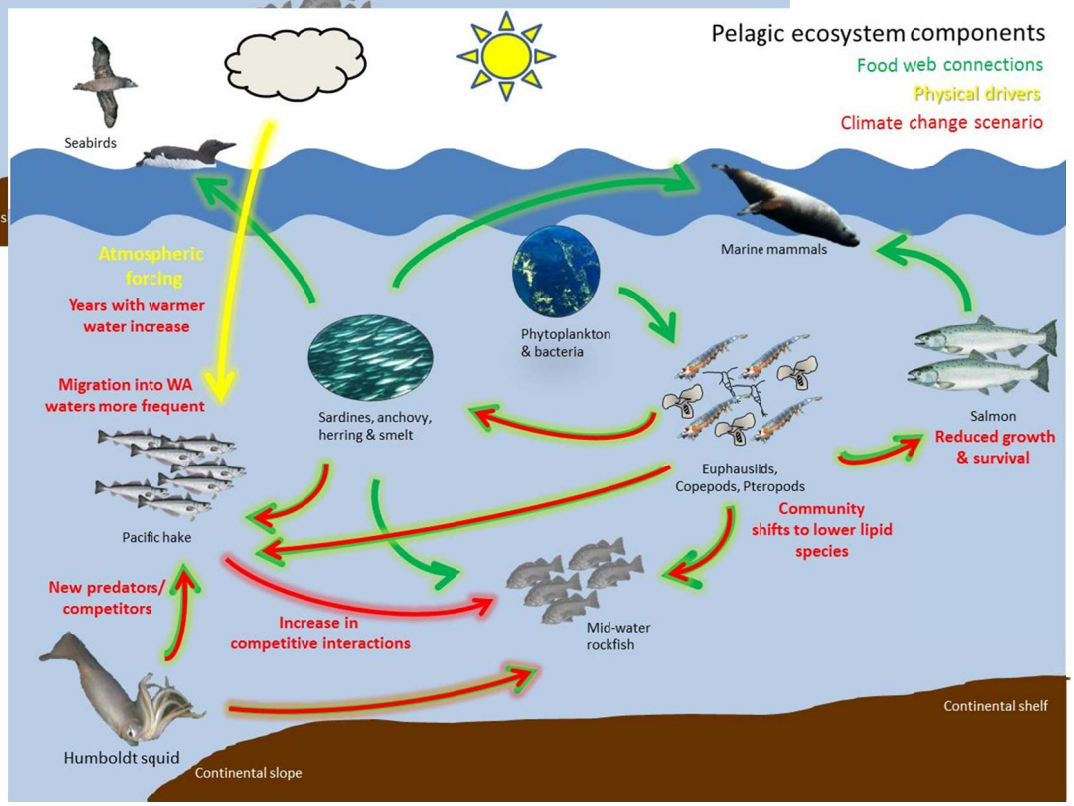
ECOLOGICAL INDICATORS FOR MARINE SPATIAL PLANNING IN WASHINGTON STATE



Members of the California Current IEA team are currently developing conceptual models and indicators of biological components, physical drivers and human pressures for the waters off the coast of Washington State. This is part of a collaborative effort with the Washington Department of Natural Resources' marine spatial planning process. Evaluation and selection of indicators is heavily based on work performed by the IEA Team for the California Current Large Marine Ecosystem (e.g. Levin & Schwing 2010). This initial work is being done to support an Ecological Indicators workshop held in mid-May.

We divided waters off the coast of Washington into five primary habitat types: Intertidal rock shores, intertidal sandy beaches, kelp forests, seafloor, and pelagic zone. A conceptual model is being developed for each habitat independently, and this work is in progress. Each model is based on defining the primary biological components of the community, prominent food web interactions, physical drivers, and human pressures acting upon each habitat. These conceptual models form the basis for identifying indicators of key ecosystem components.

THE WASHINGTON COAST

On an annual basis, this system is primarily driven by cold, nutrient-rich waters upwelled onto the continental shelf when spring and summer winds drive surface waters offshore. This nutrient-rich water drives phytoplankton growth which feeds the zooplankton community (e.g., euphausiids, copepods, pteropods) and subsequently forage fish, salmon, pacific hake, and mid-water rockfish populations. The waters off the coast of Washington are highly productive feeding grounds as evidenced by the large number of marine mammals and seabirds that migrate through this region. Because of these highly productive waters, fishing is a major anthropogenic pressure on this system, with all major fish assemblages being targeted (i.e. coastal pelagics, pacific hake, mid-water rockfishes, salmon). Commercial shipping activities and the deposition of atmospheric pollutants are other anthropogenic pressures in this region. At larger temporal scales, these waters are heavily influenced by the Pacific Decadal Oscillation. During years where warm water intrudes from sub-tropical regions, the zooplankton community goes through a shift from lipid-rich species to lipid-poor species. This transition reduces the productivity of this region and is generally a sign of poor conditions for many marine species, particularly salmon.

These graphics show the primary food web interactions, physical drivers, and human pressures on the pelagic ecosystem off the coast of Washington State. The set of indicators for the pelagic ecosystem must represent the principle components described briefly above. Indicators have been evaluated through primary criteria based on peer-reviewed literature searches. We are in the process of mapping specific indicators for ecosystem components.