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Challenges in Marine Statistical Ecology

Coastal nations like Canada have always depended on the ocean for their food security, economic activity and cultural well-being. Ocean activities today range from fishing, to tidal power, offshore oil and gas, sea bed mining, and marine pharmaceuticals. Human development of the ocean is poised to massively expand in the next few decades.

Statisticians are making meaningful contributions to advancing our understanding of the oceans. This information will be critical for the sustainable management of ocean resources, especially in the face of environmental shifts like global climate change. Herein we present three such projects, in each case providing details of the scientific question of interest, the statistical methodologies required and the results obtained.

The first project involves the estimation of critical population dynamics of young north Atlantic cod using multivariate state space models. The second presents a general formulation for mixed effects hurdle models that yields accurate estimates of abundance of critically endangered hammerhead sharks. Finally, the third project discusses new and exciting opportunities for the development of appropriate statistical methodologies for use within the Ocean Tracking Network (OTN), a global project that aims to establish a new and unique ocean observation system, centered on scientifically documenting marine animal movements, habitat use, and survival, in relation to changing chemical and biological ocean conditions.