NASA MUREP/SMD Ocean Biology and Biogeochemistry Awards (OCEAN)

Title: **Using Hyperspectral Imagery to Assess the Effects of Warming on New England Kelp Forests**

Organization: **University of Massachusetts, Boston**

PI Name: **Dr. Jarrett Byrnes**

Summary: The waters of New England are among the fastest warming on earth. The shallow coastal waters are dominated by kelp, large brown algae that provide homes to lobsters, juvenile cod, and more while also buffering shorelines and shaping whole ecosystems. Diver samples show likely declines, but links to climate, while suggestive, are unclear due to the lack of understanding at scale. Recent advanced in hyperspectral and multispectral imagery, however, have been able to reveal similar kelp beds in other areas down to 8m in depth. It is proposed to use these tools to map kelp forests in New England, validate the work with divers and side-scan sonar, link maps with multiple remote sensing sources of human impacts, and model climate impacts on New England kelp forests at scale. Beyond the science, this work will build multidisciplinary capacity at UMass Boston to carry out future efforts in coastal remote sensing by bringing together a unique team of ecologists, remote sensing scientists, and oceanographers. Further, we will use this project as a framework for multiple teaching and training efforts to engage underrepresented minorities from UMass Boston, an MSI, in NASA work and learn NASA-related skills.

The proposed project is focused on investigation of the effects of global warming on the kelp forest off the coast of New England using a combination of hyper- (DESIS and PRISMA) and multi-spectral imagery (Sentinel-2, Landsat 8), divers' observations, sonars (for bathymetry estimation and identification of kelp presence) and modeling. The main objectives include development of a methodology to use hyperspectral imagery to classify kelps in New England; apply convolutional neural networks (CNN) approaches to calibrate multi-spectral imagery against DESIS to develop time series of kelps in NE, model influence of climate change on kelp abundance. Methodologies and models to map and monitor kelp forests down to 5m deep will be developed, and extensive ground data will be collected to validate the model.