PROJECT SUMMARY

Overview:

This proposal unites eight Rhode Island institutions, including five PUIs, to create the RI Consortium for Coastal Ecology, Assessment, and Modeling (RI C-AIM), which will provide new insight into how anthropogenic stressors impact coastal ecosystems, and develop innovative models that integrate biocomplexity to predict complete ecological changes and socio-economic activity. Understanding, predicting, and enhancing the ecological health of coastal environments is vital to workforce development (WFD), economic growth, and coastal resilience in RI, as with all coastal States in our nation. Increasing anthropogenic stressors, such as global warming, sea level rise, and pollution, negatively impact coastal environments. These impacts yield complex and evolving biological interactions that respond to and influence ecosystem function. Predicting changes in ecosystem function and identifying biogeochemical markers that correlate with harmful events will enable us to devise and implement plans to mitigate these effects with intervening technologies or through changes in environmental policy and human behavior. RI C-AIM will (1) build an autonomous networked sensor array, coupled with a RI Center for Data Discovery that transitions research and student-learning from the laboratory to the field; (2) create sensor platforms to enhance environmental monitoring with greater spatial and temporal resolution; (3) implement actionable coastal ecosystem models that will inform, and be informed by the sensor arrays and platforms; and (4) build infrastructure that enables high-throughput biological and ecosystem studies. Our research goals drive WFD, which will address State and federal needs of training and retaining a diverse STEM workforce skilled in communication, collaboration, and data analytics in coastal/marine fields.

Intellectual Merit :

RI C-AIM has created interdisciplinary teams with the core expertise needed to answer the following research questions: How do interactions between natural and anthropogenic stressors impact ecologically and commercially important organisms? How can spatial/temporal detection of pollutants and stressors be enhanced, and data made more accessible, to better understand biological and ecological complexity and to improve coastal ecosystem models? How does the environment affect humans and how can human behavior and responses be modified to improve coastal and economic sustainability? These questions will be answered through three Research Thrusts: (1) Assessing Biological and Ecosystem Impacts, (2) Predicting Ecosystem Response Through Integration, and (3) Enabling Technologies for Improved Detection. Our approach is transformative, developing community-wide metagenomics and bioinformatics tools to identify new biological and ecological processes, integrating models over disparate spatial/temporal scales to yield new ecological insight, and creating nano- and micro-structured non-living and living sensors enabling high-throughput analyses. Furthermore, by combing ecological and socio-economic models, RI C-AIM will create tools that allow decision makers and companies to envision how their decisions will affect the citizens of RI and how their actions will support sustainable economic growth in RI. A Cross-Cutting Aim - Visualization and Imaging - will aid scientific discovery and enable stakeholder communication and engagement.

Broader Impacts :

We will increase RI's research competitiveness and sustain these activities beyond the proposed NSF EPSCoR project through new infrastructure and WFD, strategic investments in emerging research directions, and PUI engagement. Our strategy for WFD is guided by a new RI C-AIM Integrated Research and Mentoring Initiative (IRMI) and our Diversity and Sustainability Plans, which begin with high school computer training, integration of research and education, and annual student fellowships for research and training. IRMI extends to the career development and mentoring to graduate students, postdoctoral fellows, and junior faculty, and includes substantial seed funding across institutions. Emphasis is placed on increasing diversity, particularly in the number of underrepresented minorities participating in RI C-AIM through recruitment and retention efforts guided by a Diversity Action Committee and RI C-AIM leadership. Translation of research and WFD will be achieved through a new Academic-Industry-Community Partnership (AICP) that will inform needs and challenges to economic development, guide commercialization, and identify internship and employment opportunities.