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UMass Dartmouth Marine Renewable Energy Research and Collaborations

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University of Massachusetts Dartmouth
Marine Renewable Energy Center

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The University . . .

- One of five UMass campuses
- Strong Engineering History
- Strengths in Marine Science
- 9,500 Students
- 380 Full Time Faculty

Main Campus

ATMC

SMAST

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School for Marine Science & Technology

SMAST Resources

- Two departments
- 20 faculty
- 65 graduate students
- Broad spectrum of marine research
- High performance computing facilities
- Other research facilities:

Stakeholders

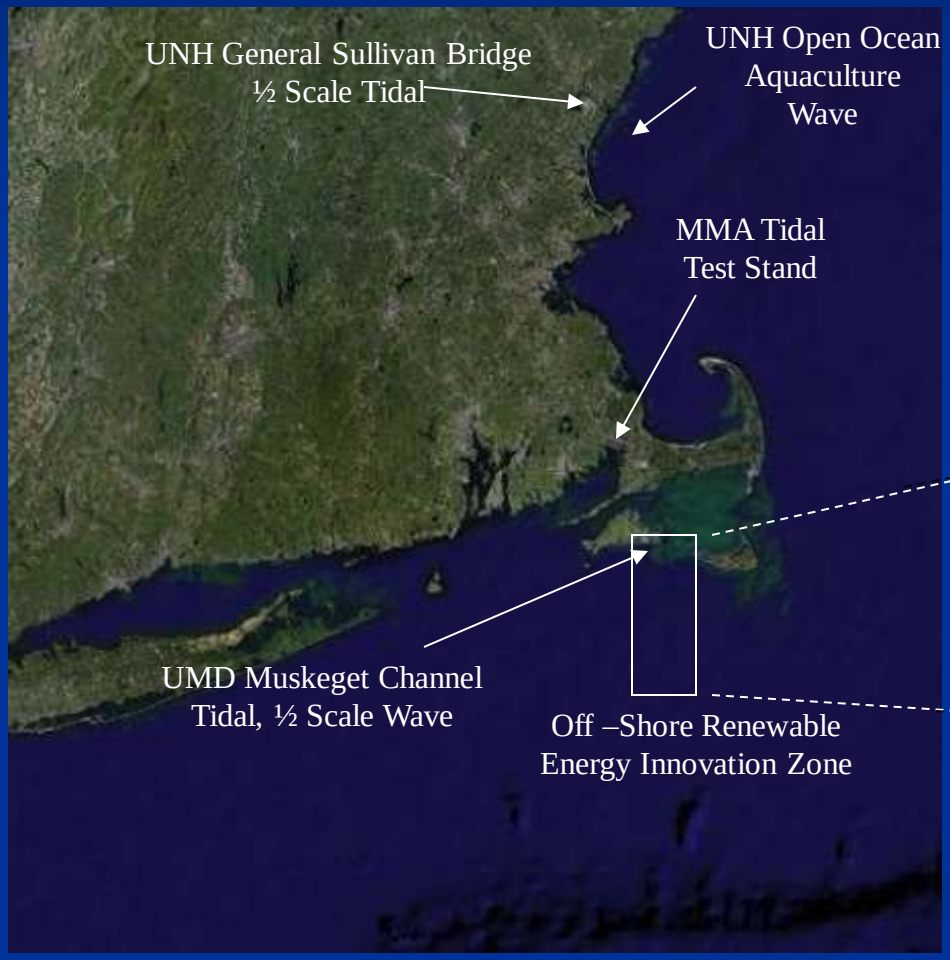
Universities

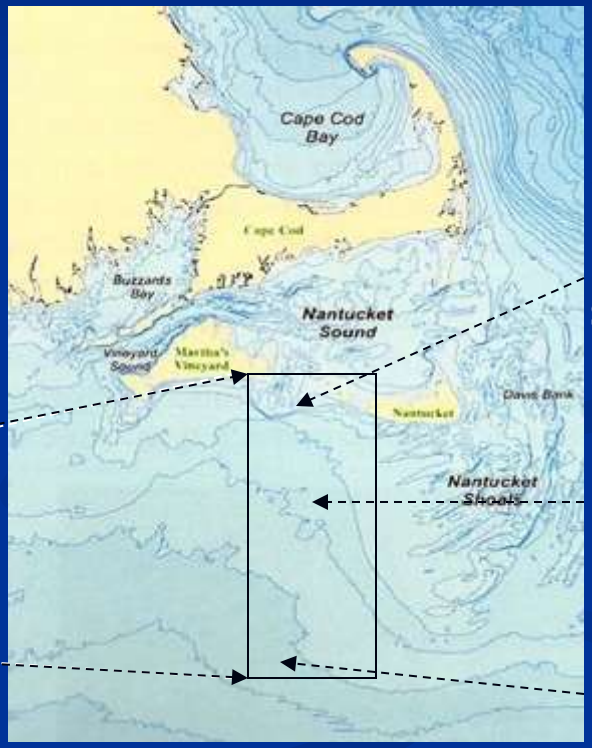
Public Interest

Industry

Government

MREC Efforts to Accelerate Development Ocean Testing Facilities





National Off-Shore Renewable
Energy Innovation Zone
(Proposed)

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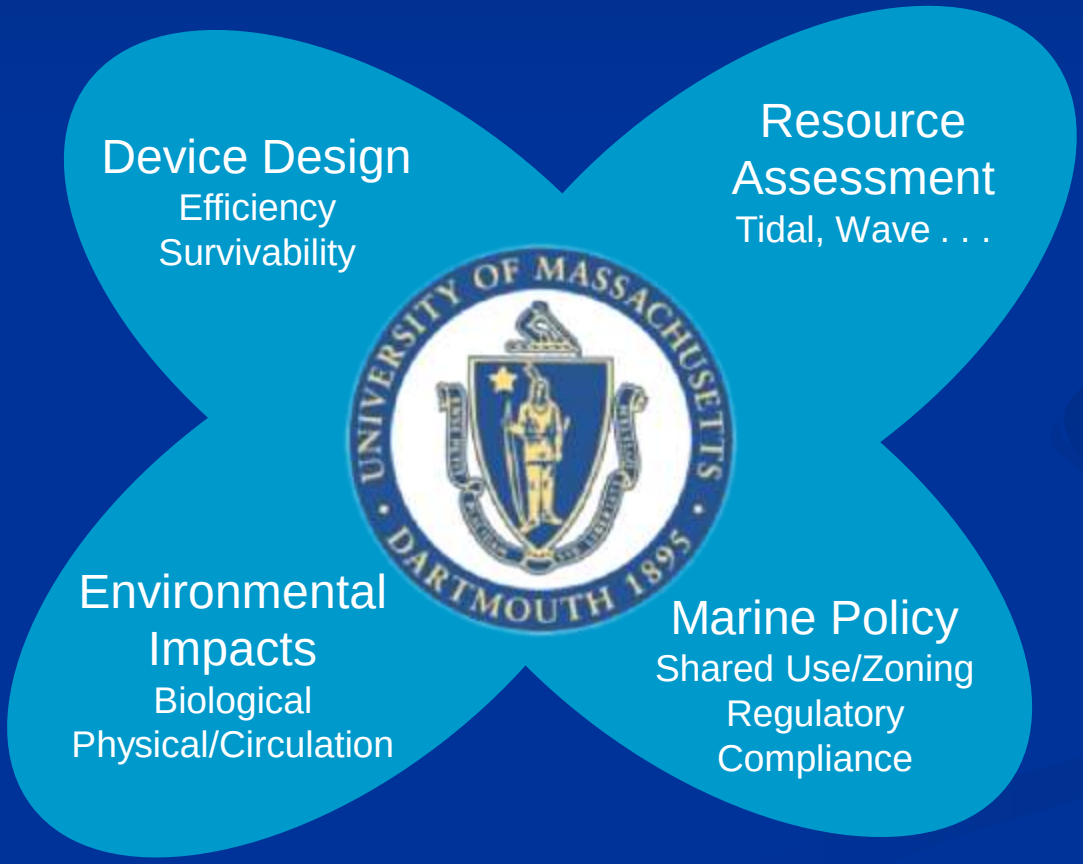
Marine Renewable Research at UMD



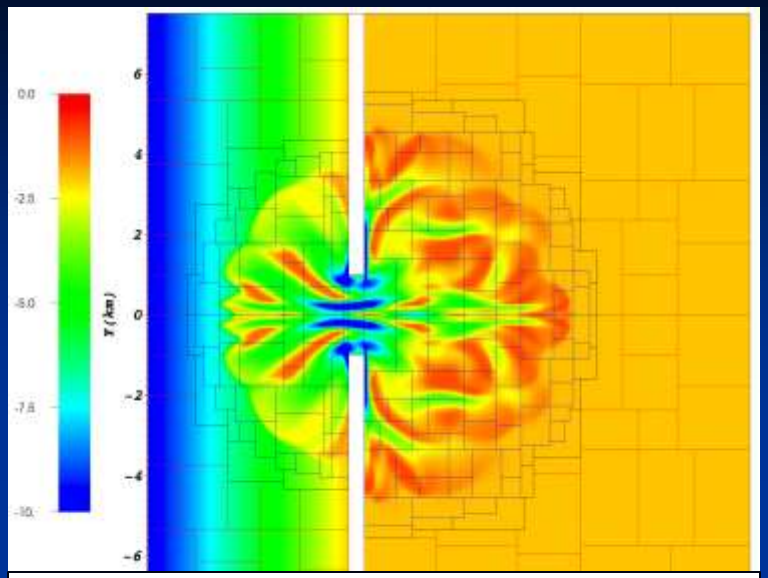
- Field/Observational Studies
- Numerical Modeling
- Laboratory Modeling
- Industry Engagement

PI: Geoffrey Cowles
gcowles@umassd.edu

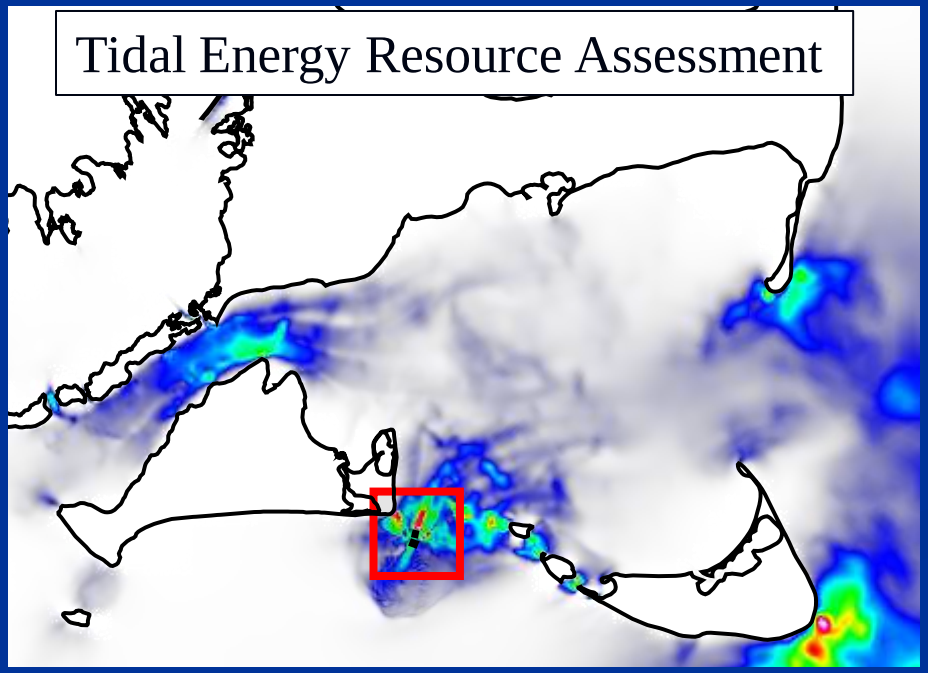
Computational Methods Laboratory

Active Research

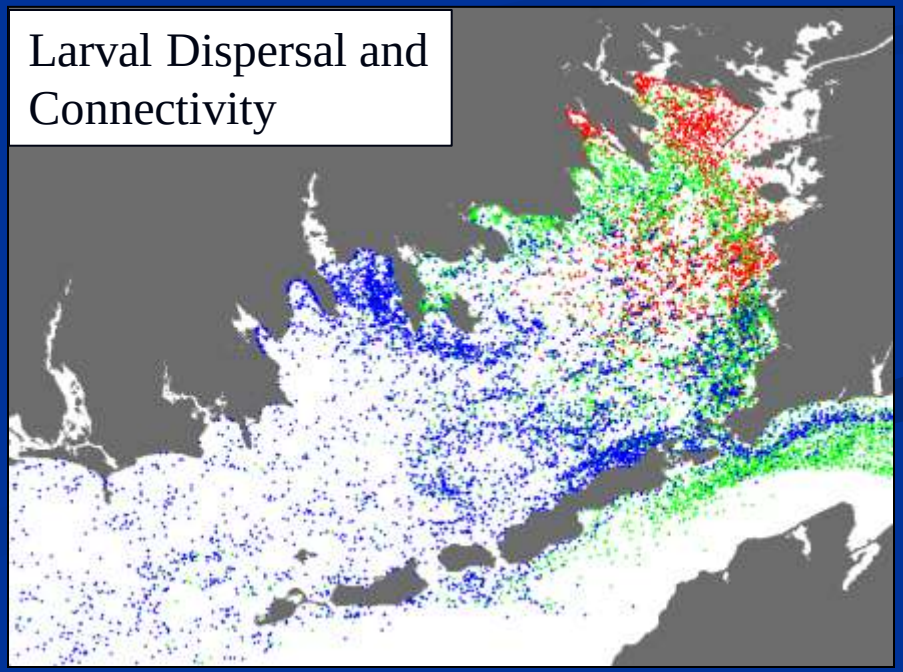
- Adaptive Mesh Refinement
- Morphodynamic Modeling
- Larval Dispersal
- Tidal Energy Resource Modeling
- Tidal Energy Impact Modeling
- High Performance Computing



Adaptive Morphodynamic Model



Tidal Energy Resource Assessment



Larval Dispersal and Connectivity

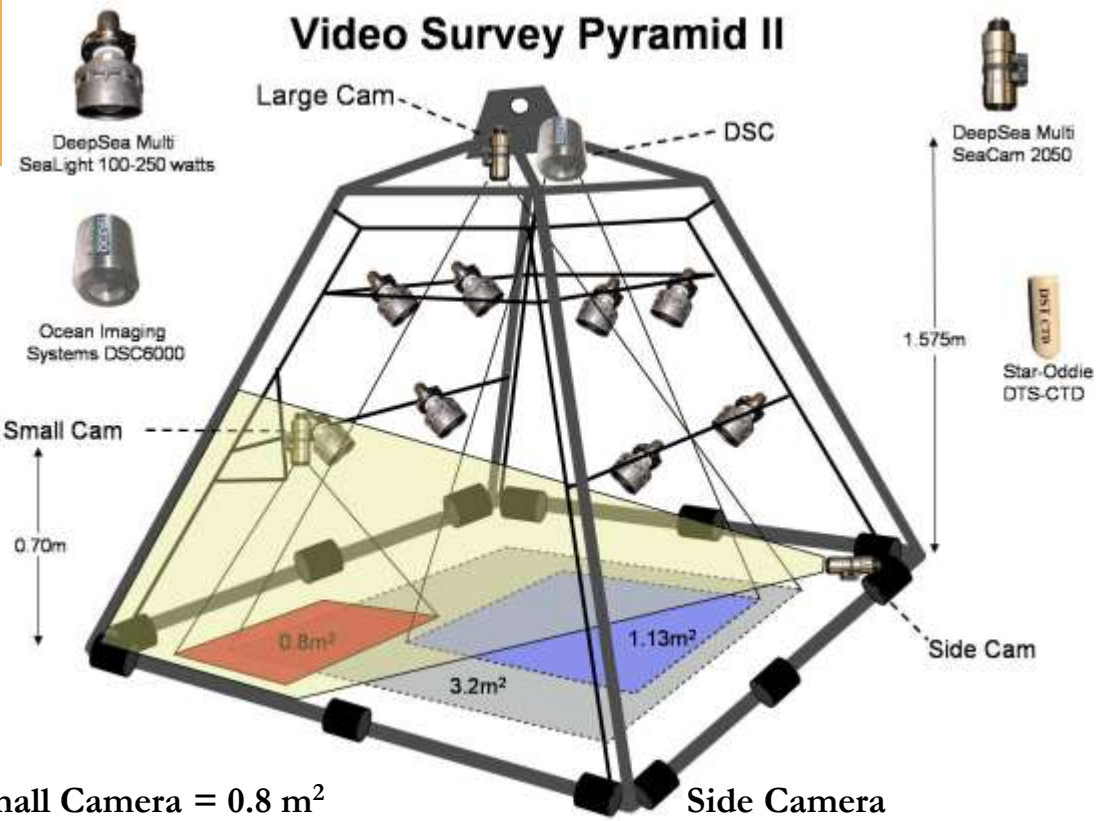
Fish Behavior and Conservation Engineering In Marine Capture Fisheries

Pingguo He, Principal Investigator

- Understand principles and measure swimming capacity of fish in the laboratory and in the field
- Observe and monitor fish behavior near fishing gears, turbines and other structures
- Design fishing gears to reduce bycatch of fish and protected species
- Design fishing gears to minimize injury and mortality of those escaping from fishing gears

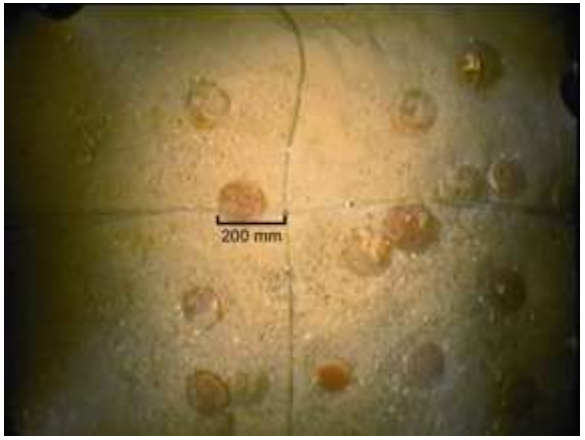
SMAST Cooperative Sea Scallop Video Survey

Kevin Stokesbury, Principal Investigator



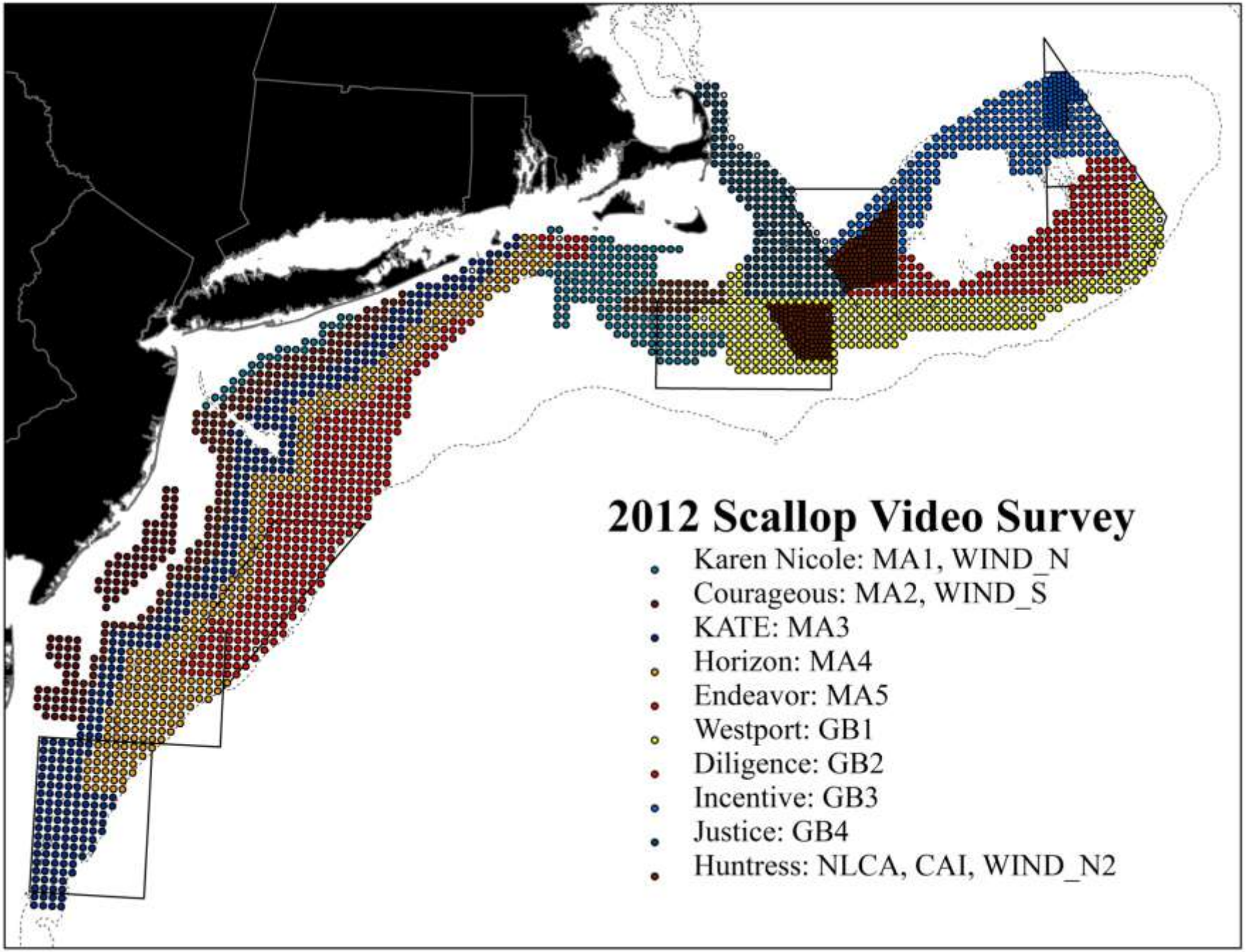
Digital Still Camera = 1.13 m^2

Large Camera = 3.2 m^2



Small Camera = 0.8 m^2

Side Camera


2012 Scallop Video Survey
Karen Nicole: MA1, WIND_N
Courageous: MA2, WIND_S
KATE: MA3
Horizon: MA4
Endeavor: MA5
Westport: GB1
Diligence: GB2
Incentive: GB3
Justice: GB4
Huntress: NLCA, CAI, WIND_N2

Coastal Systems Program (CSP)
Marine Renewable Energy Research Areas:

Brian Howes, Principal Investigator

The SMAST-CSP is using its field and laboratory resources to cost effectively provide high end, research quality scientific service to advance the marine renewable energy sector (Nationally & Internationally).

1. ***Site Assessment and Optimization*,**
2. ***Technology Related Environmental Impacts*,**
3. ***Development of New Tools and Innovative Application of Existing Instruments for Environmental Assessment and Permitting***
4. ***Scientific Support to MREC and the National Offshore Renewable Energy Innovation Zone*.**

Smast
University of Massachusetts Dartmouth
The School for Marine Science and Technology

Coastal Systems Program
SMAST
UMass Dartmouth
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New Bedford, MA 02744
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Coastal Systems Program

- Marine Renewable Energy

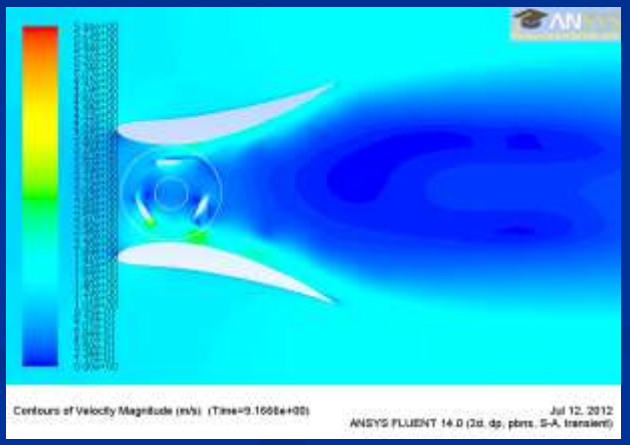
  Providing scientific service to municipalities, industry, the University and the Commonwealth for the development of marine renewable energy (ocean/tidal currents and wave)

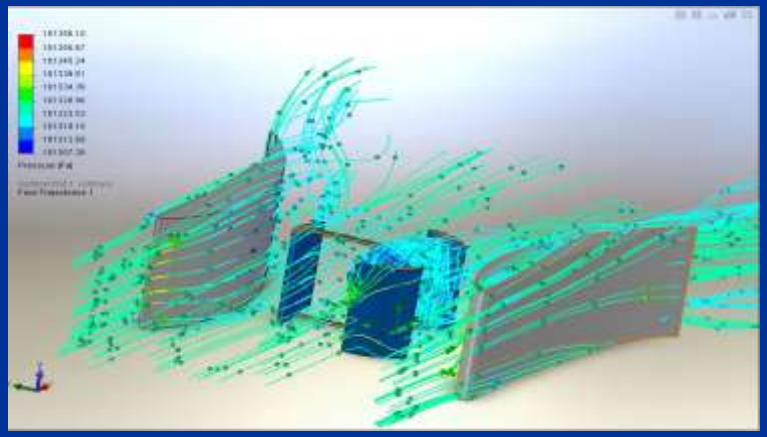
  1. Site Assessment for Ocean Renewable Power Company
     Grid Connected Tidal Project, Maine (2007-2010)
  2. Site Assessment and Ecological Research
     MREC-NOREIZ, MA. (2008-present)
  3. Demonstration Project – Tidal Turbine
     FreeFlow, Muskeget Channel, MA. (2011)
  4. Site Assessment for HG&E Utility
     Tidal Turbine Testing, MA. (2011-2012)
  5. Demonstration Project – Tidal Turbine
     FloDesign, Muskeget Channel, MA. (2012)
  6. Environmental Assessment – Wave Energy Converter
     EcoWave Power, Israel (2013 - pending)

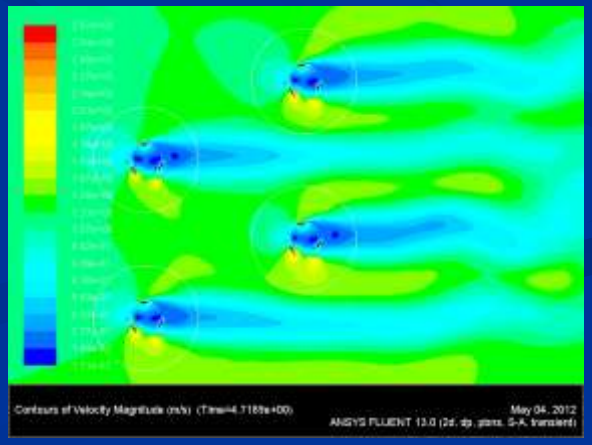
Points of Contact: Dr. Brian Howes (bhowes@umassd.edu), Dr. Roland Samimy (rsamimy@umassd.edu)

ANALYSIS OF A DIFFUSER-SHROUDED HIGH-SOLIDITY VERTICAL AXIS TURBINE USING COMPUTATIONAL FLUID DYNAMICS

Raymond Laoulache, Principal Investigator







Coastal Engineering & Fluid Mechanics

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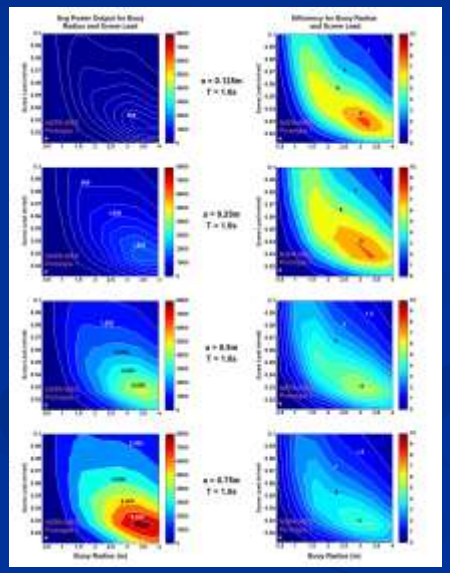
Dan MacDonald, Principal Investigator

Nearshore WECs

- Development of nearshore / fixed infrastructure wave energy converters.
- Co-location of wind and wave energy extraction.
- Working with industry on WEC testing.

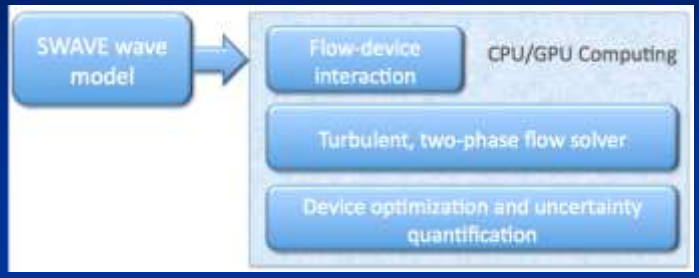


Flume Studies

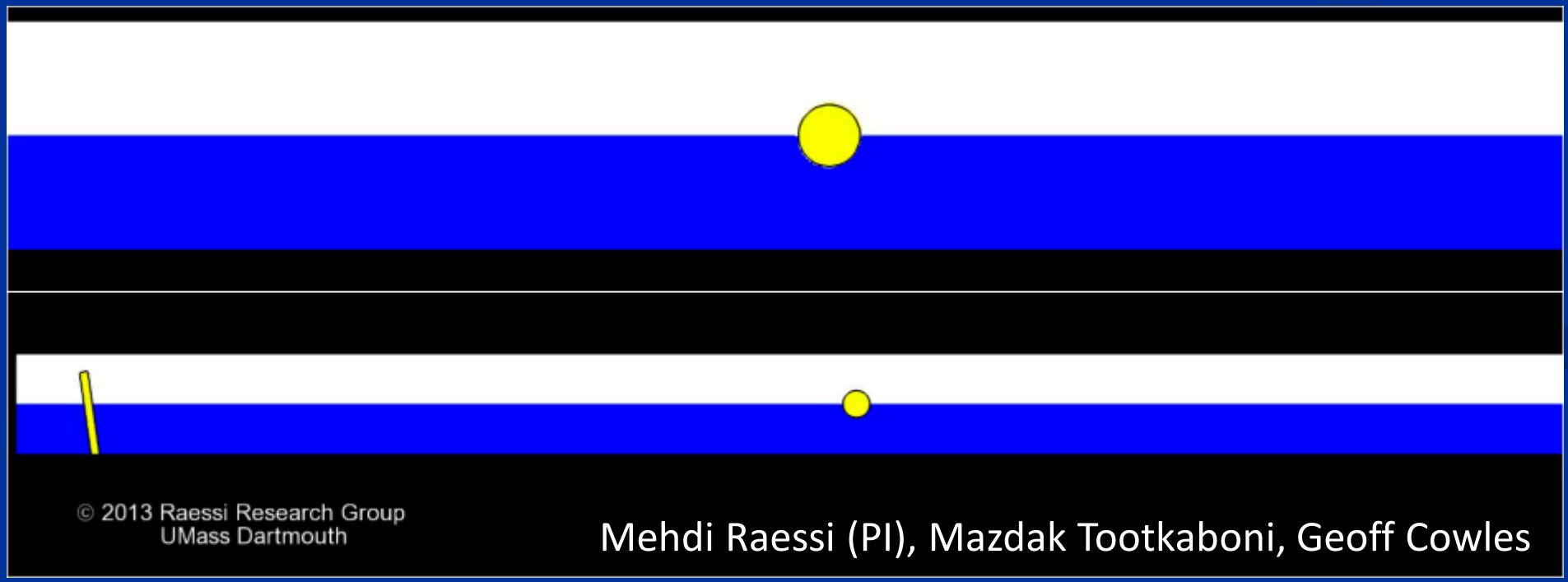
- Hydrodynamic evaluation of various MRE technologies.

Computational tool for analysis of wave energy converters

- Advanced computational framework for analysis & optimization of ocean wave energy converters.
- Complement & leverage experimental results.
- Accelerate R&D efforts in the area of MRE.



Interaction of a buoy with waves generated by an oscillating flap



Mehdi Raessi (PI), Mazdak Tootkaboni, Geoff Cowles

UNDERWATER BUOYANT OIL JETS

Underwater buoyant oil jet
Jet velocity: 5 m/s
Jet diameter: 2.54 cm
20 cSt Silicone oil in water

$$\Delta\rho = 50\ \mathrm{kg/m}^3$$

Re = 6350
Ri = 0.0005
Bo = 15
We = 30000

Grid size: 256^2 x 512
MPI sub-domains: 32
(GPUs & CPU cores)
Acceleration factor: 3x

Mehdi Raessi, Principal Investigator

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Looking Ahead to Productive and Successful UMassD/MREC – OERA Collaborations!