Development of Temporal Monitoring Techniques for Benthic Habitat Impacts of Tidal Energy

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Introduction:
Monitoring of the marine (benthic) environment

A review of sublittoral monitoring methods in temperate waters: a focus on scale

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Abstract
A plethora of methods to monitor shallow sublittoral benthic habitats and communities are available to the marine researcher today. The most widely used methods are reviewed and evaluated, with reference to the spatial scale at which they operate. For ease of comparison, methods are categorised as operating over broad (>1km), meso (10m–1km) and fine scales (<10m). A measure of efficiency and data resolution are the extent of compliance with a predetermined standard or the degree of deviation from an expected norm.” Monitoring has also been defined as: ‘sampling in time with adequate replication to detect variation over a temporal range from short and long time periods, done at more than one location,’ (Kingsford and Battershill, 1998). Ecological monitoring programmes are specifically designed to detect trends, or changes from normal
Introduction:
Monitoring of the marine (benthic) environment

Introduction:
Tidal Energy (Benthic) Monitoring Challenges
Project objectives:
“Testing of temporal monitoring techniques for benthic habitat impacts from tidal power developments”

1. Evaluate a suite of acoustic survey techniques (multi beam sonar, sidescan sonar) to measure temporal changes in seafloor characteristics over short (inter-tidal) and longer (inter-annual) time periods [BROAD-SCALE MONITORING TECHNIQUES]

2. Test novel backscatter classification methods (QTC Swathview and Geocoder) for the objective measurement and detection of change in backscatter characteristics over these temporal time-frames at selected case study sites. [BROAD-SCALE MONITORING TECHNIQUES]

3. Determine and develop the most appropriate sampling methods for monitoring changes in benthic assemblage structure (both epifaunal and infaunal assemblages). [MESO- and FINE-SCALE MONITORING TECHNIQUES]

4. Provide recommendations on the most appropriate monitoring techniques (physical and biological) for assessing change in benthic ecosystems in connection with deployment of TISEC devices.
Broad-scale monitoring: Technological advances – Multibeam Sonar

Multibeam Sonar Surveys

bathymetry
Broad-scale monitoring:
Technological advances – Multibeam Sonar
Objective 1 and 2: Repeat surveys - comparison of bathymetric and backscatter data sets over different temporal time frames

i.e. How successful/useful/sensitive is the approach for detecting changes in geomorphology, sediment composition and benthic habitat change in seafloor habitats?
Study Sites

Location Map
Showing Multibeam Bathymetry

Survey Sites
Annapolis Basin
Bay of Fundy
Broad-scale monitoring

Site 1 – Bathymetry
Broad-scale monitoring

Site 1 – Backscatter
Broad-scale monitoring

Bathymetry comparison

2012: Site 1 – Survey 1

2012: Site 1 – Survey 2
Broad-scale monitoring:
Technological advances – backscatter analysis methods

Signal-based segmentation
e.g. Angular range analysis (ARA); E1-E2 etc.

Signal-based analysis (GeoCoder)
Broad-scale monitoring

Challenges of using backscatter data for monitoring...

Van Rein, Brown, Quinn, Breen and Shoeman (2011) An evaluation of acoustic seabed classification techniques for marine biotope monitoring over broad-scales (>1 km²) and meso-scales (10 m² - 1 km²) Estuarine, Coastal and Shelf Science. 93: 336-349.
Broad-scale monitoring

Backscatter comparison
Fine-scale monitoring

4699 individuals comprising 129 taxa were recorded from the 12 benthic grab samples.

255 individuals comprising 26 taxa were recorded from the 252 seafloor photographs (54 stations).
Next stages...


2. Collection and analysis of repeat underwater video and seafloor photographs for benthic epifaunal community monitoring – inter-annual comparison (November 2013)

3. Collection of repeat acoustic data at the four test sites (multibeam and sidescan sonar) (November 2013)

4. Completion of inter-annual and inter-tidal analysis/comparison of automated backscatter analysis methods for monitoring change (Fall/Winter 2013)

5. Final Report - Provide recommendations on the most appropriate monitoring techniques (physical and biological) for assessing change in benthic ecosystems in connection with deployment of TISEC devices (April 2014)

6. Additional methods, strategies and data sets will be explored and analysed to augment the OERA project through MSc project at MUN (Dimitri Tzekakis) – Object Based Image Analysis (OBIA) methods
THANK YOU!

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