Tool kit 6. Utilising Meteorological and Water Quality Sensor Readings for Climate Change Planning in Coastal Communities

Climate change poses significant challenges to coastal communities, impacting various sectors such as fisheries, aquaculture, agriculture, and public well-being. Over half of Ireland's population lives within 15 km of the coastline (Devoy, 2008). Typically, Atlantic swells and cyclones originate from the western side of the North Atlantic Ocean, spreading eastward towards Ireland's coastline, making Ireland's wave climate somewhat energetic and variable. From a climate change perspective, it is crucial that any shifts in the dynamics of the prevailing waves are considered, and their impacts on activities such as fisheries and aquaculture are assessed.

Human influence has been linked to changes in the ocean such as warming, more frequent marine heatwaves, ocean acidification, and reduced oxygen levels. These changes have a significant impact on ocean ecosystems and the individuals who depend on them. According to the IPCC report, these changes will persist throughout the century.

The discharge of wastewater can have significant environmental effects, and an aspect of this project were to examine anthropogenic influences on the species being studied. They are also of relevance to this report as discharges of nutrients and pathogens can have a direct impact on aquaculture and inshore fishery activities. Integrating data from water quality sensors into climate change planning enables informed decision-making and proactive adaptation strategies. Involving fishers, aquaculture operators, farmers, and the general public enhances community resilience and sustainable development. Here's how water quality sensor readings can be utilized effectively:

1. Enhancing Climate Change Awareness:

- Public Outreach: Share explained sensor data through accessible platforms, such as community meetings, workshops, or online portals, to raise awareness about climate change impacts on local water bodies.

2. Fisheries and Aquaculture:

- Temperature, Salinity (conductivity) and Oxygen Monitoring: Monitor temperature, salinity and oxygen levels to predict shifts in fish behaviour and migration patterns. Share this information with fishers to aid in adjusting fishing strategies and protecting fish stocks.

-Establish links between molluscan species health and physiochemical parameters along with human health assessments.

3. Agriculture:

- Rainfall and salinity: Use rainfall and salinity data to inform optimal fertilisation practices for coastal agriculture. Ensure farmers are aware of changing rainfall patterns to adjust crop selection, land use and management plans.

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- Nutrient Management: Monitor nutrient levels to prevent agricultural runoff, which can contribute to water quality degradation. Collaborate with farmers to implement sustainable nutrient management practices for arable, dairy and beef production.

4. Public Health and Recreation:

- Bacterial Contamination: Monitor nutrients, rainfall and salinity as a proxy (by developing historical data and models) for bacterial levels to protect public health by identifying potential contamination events in recreational water bodies.

- Temperature, nutrients and chlorophyll and Algal Blooms: Detect rising water temperatures, nutrients and chlorophyll levels that may lead to algal blooms. Educate the aquaculture and fishing industry about the importance of food availability for shellfish and also about the development of harmful algal blooms.

5. Collaborative Adaptation Strategies:

- Community Engagement: Organise workshops or focus groups involving stakeholders to educate them about the parameters that sensors are measuring and where necessary co-create adaptation plans based on sensor data. This will help empower community members to contribute their insights and concerns.

- Early Warning Systems: Develop early warning systems using sensor data to alert stakeholders about impending climate-related events such as storms, temperature changes, or algal blooms.

- Decision Support Tools: Develop user-friendly decision support tools that synthesise sensor data into actionable information for various sectors. These tools could assist in making informed choices on fishing seasons, crop selection, and aquaculture strategies.

6. Policy and Regulation:

- Evidence-Based Policies: Advocate for policies based on sensor data, which can support sustainable resource management and strengthen the resilience of coastal communities.

- Adaptive Management Plans: Collaborate with local authorities to integrate sensor data into adaptive management plans that respond to changing conditions and prioritize community well-being.

- Incorporating water quality sensor readings into climate change planning empowers coastal communities to anticipate and respond to environmental shifts. By involving fishers, mariculture operators, farmers, and the general public, these efforts promote collective action, enhance community resilience, and foster sustainable development in the face of climate change challenges.

Conclusion

Monitoring weather and the qualities of seawater is crucial for the various reasons outlined above. With the help of meteorological and seawater sensors equipped with telemetry, scientists and environmental agencies can obtain real-time information on various parameters such as temperature, salinity, pH, dissolved oxygen, and pollutant levels. This data can be broadcasted to monitor trends and set electronic alerts for early detection of anomalies or potential ecological threats.

Seawater sensors also play a significant role in evaluating the overall health of marine ecosystems. Regular data broadcast can help identify stressors affecting marine life and aid conservation efforts to protect vulnerable species and habitats. Moreover, they can assist in tracking the dispersion of pollutants and contaminants, allowing authorities to respond swiftly to pollution incidents and implement measures to mitigate their impact. This, in turn, holds industries accountable for adhering to environmental regulations.

Continuous and long-term data streams from seawater quality sensors in association with laboratory analysis of water samples can also support scientific research, such as studying ocean dynamics, climate change impacts, and ecological processes. Accessible data can promote scientific collaboration and support the development of predictive models, aiding our understanding of marine systems and their role in global environmental processes.

Data and trends from seawater quality sensors also provide a basis for evidence-based policy development and decision-making. Regulatory agencies can use this information in association with laboratory-analysed samples to assess the water quality standard of an area and develop management strategies for terrestrial freshwater inputs.

Selected reference

Devoy, R. J. (2008). Coastal Vulnerability and the Implications of Sea-Level Rise. Journal of Coastal Research, Vol. 24, No. 2, , 325 to 341. Retrieved from: http://epa.ie/pubs/reports/other/events/oclr/adaptationworkshop/R%20Devoy%20Coastal%20Vulnerability%20Paper1.pdf

Acknowledgements

Wexford County Council - Brendan Cooney

EPA – Dr Robert Wilkes

BIM - Brian O'Loan

BIM Shane Begley - Weather Station and Barge (Castletownbere), Dave Millard, Regional Development Officer

Marine Institute -Dave Clarke and Jonathan Kelly

Tramore Coast Guard

Dunmore East Harbour - Monitoring sites

Waterford City River Rescue - Monitoring sites

Southern Regional Assembly - Breda Curran

Report

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The STREAM project is part funded through the ERDF Ireland Wales Programme