

**STREAM Summer School**  
**Water Sampling for Marine Bio Toxins**

**Water Monitoring**

**National Maritime College of Ireland (NMCI)**

**Thursday 13/07/2023 (draft report Ronan Browne and photographs by Simon Patterson)**



Munster Technological University held their first Sensor Technologies for Remote Environmental Aquatic Monitoring School at the National Maritime College of Ireland (NMCI) in July 2023. The STREAM project is an example of how we can use technology to address the challenges of climate change. The project's data will help us better understand climate change's effects on the marine environment and develop strategies to protect coastal communities. The STREAM project is also helping to build capacity in the cross-border region, which will be essential for

addressing climate change in the years to come.

The day began at 10 am with a “Welcome and a Safety” briefing in the NMCI Auditorium which was provided by Paul Shanahan and Mike Griew. These presentations gave an overview of the work the MTU team that they and Dr Ambrose Furey among others are undertaking in order to understanding and mitigate Harmful Algal Blooms (HABs) and their associated biotoxins. Their research involves the development of a customized monitoring platform called SEAMOTE. Additionally, their team is actively working on the advancement of smart pump technology to efficiently sample algal bloom populations and the planning for laboratory work where these toxins can be analysed. MTU’s Dr Naghmeh Kamali et al., also completed “A Review of in Situ Methods—Solid Phase Adsorption Toxin Tracking (SPATT) and Polar Organic Chemical Integrative Sampler (POCIS) for the Collection and Concentration of Marine Biotoxins and Pharmaceuticals in Environmental Waters.”



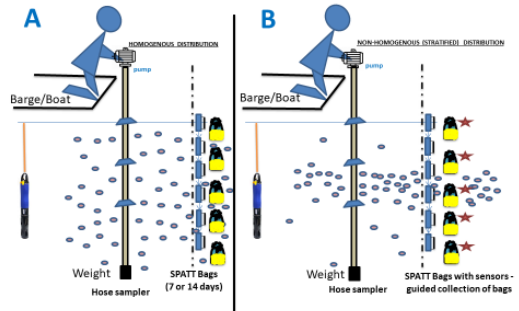
MTU are also undertaking collaborative efforts with Swansea University (SU) in the field of weather monitoring radar systems. By combining their expertise in weather radar technology with our HABs monitoring capabilities, they aim to enhance our understanding of the interplay between weather patterns and coastal communities along with the occurrence of

events such as harmful algal blooms.

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(A) Spatt Bags & (B) SPATT Bags with printed sensors



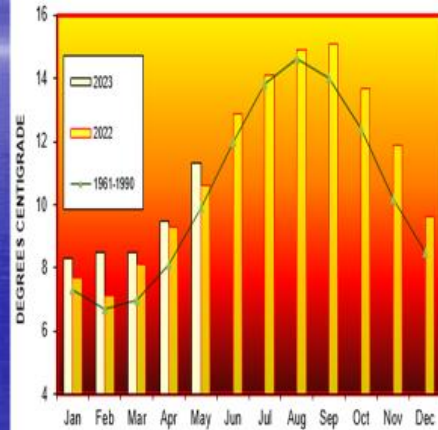
Swansea Universities, Welsh Centre for Printing and Coating Dr Tim Mortensen provided a recorded presentation on printed sensors. In the presentation he spoke about the construction of low-cost 2D printed sensors that had capabilities for monitoring water temperature, conductivity, oxygen levels, and pH. The WCPC have also been designing a waterproof housing solution for the sensor electronics. They have also deployed commercial Sonde's in association with the Centre for Sustainable Aquaculture (CSAR) that are broadcasting live data from Swansea's shores. Tim outlined the need for affordable printed sensors and also the challenges the WCPC are addressing. He spoke about commercial systems that are accurate, but high cost for example a Sonde and sensors can cost about £30k. This prevents widespread monitoring of aquatic environments and can be too costly for single farm adoption. While the printable sensors the WCPC are working on offer a potential for lower cost solutions and their sensors can measure a range of parameters that may be fabricated as an integrated system. But the challenges have been measurement accuracy, for which they have calibrated against laboratory and commercial devices. They have also undertaken a lot of work to ensure the survival of the sensors in harsh environments and they have adopted a novel approach to the working duration of sensors by engineering their system that holds them by engineering them in such a way as they can be easily replaced by a new sensor.



Dr Ronan Browne (SETU) provided an introduction to water sampling and the equipment that can be used. This included the sampling for nutrients, plankton and dissolved metals in seawater. His talk also contained recent information on the impacts of climate change on the waters that surround Ireland. These dramatic increases in temperature are obviously of worldwide concern and there is a great need for monitoring to occur so that we better understand and can manage the effects on a local basis. Ronan echoed many of the points that Pau made at the outset of the school and reiterated the four main objectives of STREAM as being:



AVERAGE MONTHLY SEA TEMPERATURES AT MALIN HEAD COMPARED TO THE 30 YEAR AVERAGE (1961-1990).



- A monitoring system for safeguarding the marine environment.
- An online portal connecting a diverse user community to raise awareness about climate change's effects on nutrients, marine ecosystems, and biodiversity.
- Toolkits for coastal communities to enhance their resilience against climate change impacts.
- Improved ICT and sensor development expertise in the cross-border region, focused on economically viable marine monitoring and adaptation strategies.

After the sessions in the NMCI auditorium the group proceeded to the NMCI Jetty where Mike and Ronan gave a practical water sampling demonstration with all of the appropriate PPE. As part of this demonstration representatives from the Irish navy and the other STREAM participants were shown how to collect water samples at discreet depths using Van Dorn/ Van Veen bottles that can be triggered to close using weighted messenger bottles.



As part of practical demonstration the participants were also shown how to label their sample bottles and complete a STREAM field sheet.



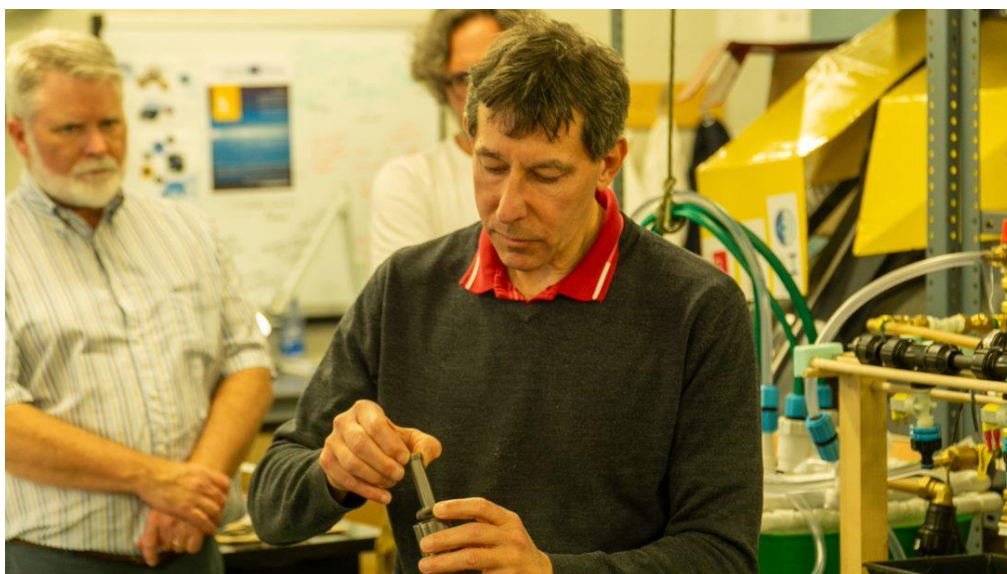
General Field Sheet							
STREAM Site Name	Attach label if needed		Latitude	Longitude	High tide date and depth	Tide	Depth m
			Coordinates		Water species etc.		
Local weather conditions	Wind to 100m at	Wind Year to	Wind Force	Wind Direction	ATMOS. sensor Number Label	Result Depth m	
Sampling method - Bottle, No. (no. Sample)	12.5 A 6.0 E 8 5 TO	1000	10	10	Depth of site (m)		
Water Chemistry	Pre-Calibration	Calibration Standard used	Peak Calibration	Field Calibration (check date)	2. Site Profile	Surface	Bottom
Depth (m)					Depth (m)		
Depth (ft)					Temp (C)		
pH					Salinity (ppt)		
SPC or Conductivity					DO (mg/L)		
ORP (mV)					pH		
Turbidity (NTU)					DOH		
DO (mg/L)					DO (mg/L)		
DO (%)					DO (%)		
Transmittance (200nm)							
DO (mg/L)							
DO (%)							
SPC and DOH data downloaded?	Yes / No				Date of monthly calibration		STREAM 01st January 2020
Security calibration done? (date?)	Yes / No						

The demonstration included the use of plankton nets for collecting zoo and phytoplankton.





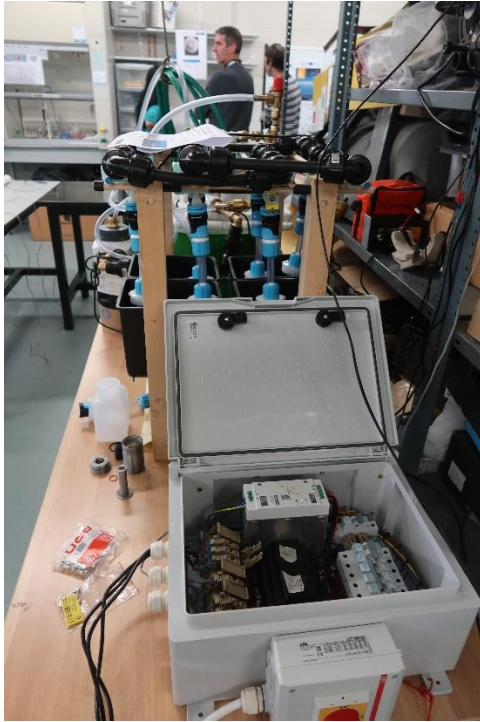
After the demonstrations on the pontoon lunch was held and then Mike Grew showed the various sampling devices and how they operated focusing on Smart pump systems for biotoxin pre-concentration and plankton microscopy.



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Dr Naghmeh Kamali a researcher that used to work on the STREAM project then gave a great overview of Marine biotoxin concentration and LC-MS analysis.

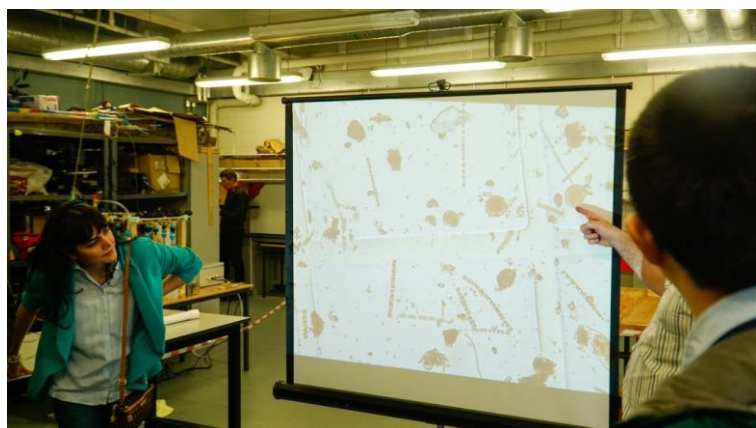
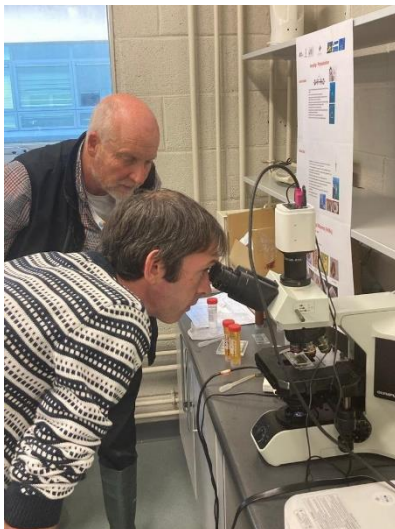


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Concerns about the effects of biotoxins and the identification of the precise type of toxin are on the rise. Biotoxins present a challenge in determining their metabolites and concentrations. The examination based on liquid chromatography-mass spectrometry (LC-MS) provides for their precise identification and quantification.



Ronan and Neil then gave an overview of plankton microscopy where a fixed (Lugo's Iodine) sample collected on the NMCI was examined and the participants provided with field keys for the identification of phytoplankton and zooplankton.



The school day was rounded up by an interesting tour of the college's facilities.

**Thank you to all that participated in the event and a special thanks to Simon Paterson who kindly provided the majority of the photographs used in this report.**





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