NEWSLETTER Viraqua

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An update on our progress...

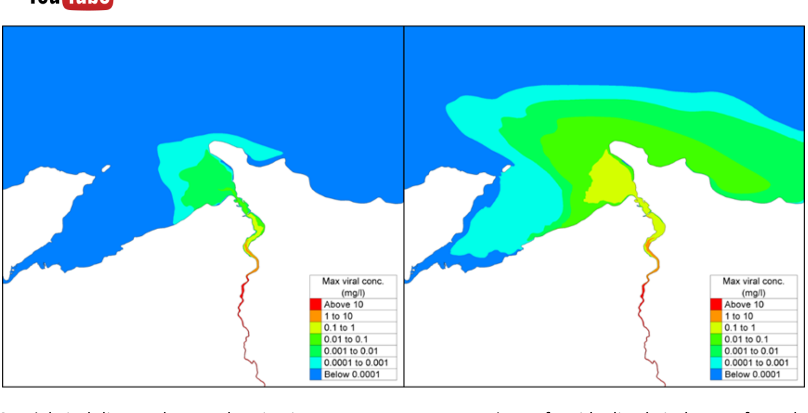
By Professor Davey Jones, Bangor University

The NERC and FSA funded VIRAQUA project is designed to improve our understanding of how viral pathogens move through the water environment, how we might be exposed to viral diseases and finding potential ways to control our risk of exposure. Our project is now in its second main year of study and research activity is at full speed. The first year of VIRAQUA saw the establishment of robust methods to extract and quantify a range of human pathogenic viral pathogens from fresh and coastal waters. We are now using these standard methods to understand how long it takes for viruses to be transported from sewage treatment works, through the river network, how they disperse in the coastal zone and how long they can remain infectious to humans. Our focus is still on the potential risks to consumers of shellfish, bathers and recreational water users. As part of the work we will also be evaluating how beach users and consumers of shellfish understand the risk of getting sick from virus exposure. Work is continuing on looking for better indicators of viral contamination in water and shellfish to run alongside the current bacterial indicators for water pollution. Lastly, the planning for the final dissemination workshop in London has started, so save the date for this forum to be held on 14th March 2018.

Modelling Virus Transport

By Dr Peter Robins, Bangor University

A big unknown in coastal water quality studies is how viral concentrations in rivers disperse once they enter the estuary. This is because estuaries respond to a combination of input forces – tides, surges, and waves 'pump' viruses landwards, whereas opposing river flows 'flush' viruses seawards. In response, local bed features and the overall estuary shape itself are continuously changing. Sophisticated models used in conjunction with rigorous field surveys are therefore required to characterise the likely viral dispersal pathways – ultimately gaining insight as to whether terrestrial viral events pose a heightened offshore water quality or food security risk. We have developed an estuarine model, which is also coupled to a catchment water quality model, to simulate these processes in the Conwy estuary and the surrounding waters of northwest Wales. The model has so far helped us understand that small or steep catchment-estuary systems like the Conwy – of which there are many throughout the UK – are sensitive to short-duration heavy rainfall events, whereas larger systems will respond to long-term and sustained frontal weather systems. Importantly for up-scaling nationally, these contrasting systems require different modelling techniques and data resolutions. Following an intensive year-long water quality survey in the Conwy, together with CSO data retained from Dwr Cymru (Welsh Water), our modelling objective is to simulate this period to better understand the controls of, and natural seasonal variability in, viral dispersal through the river-estuary-coastal continuum. We can then use the model to investigate specific extreme events during other periods, or realistic-but-idealised events, in more detail; hence, generate spatial 'risk maps' that can be interpreted back to water quality managers. All the animations produced by the project showing simulations and predicted transit of viruses can be viewed on our YouTube channel.

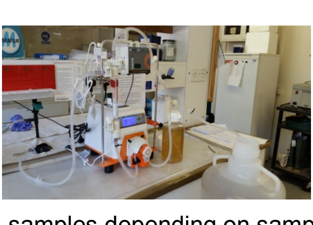


Spatial viral dispersal maps showing instantaneous concentrations of an idealised viral event from the Conwy catchment. The left panel shows the viral dispersal several days after the event, where the event occurred during spring tides. The right panel shows a similar scenario, only the event occurred during neap tides. Its clear that the landward 'tidal pumping' effect was stronger during spring tides than neaps, meaning that the viral concentration was more retained within the estuary.

Metagenomics - Summer 2017 intensive sampling campaign

By Dr Kata Farkas, Bangor University and Dr Evelien Adriaenssens, University of Liverpool

The use of metaviromics-based methods allows us the identification of novel virus species and pathogenic strains without any information on the target. In this novel approach, genetic information of all viruses in a community is extracted and investigated with next-generation sequencing. In our pilot dataset, we have found a novel norovirus strain, diverse rotaviruses and picobirnaviruses and fragments of other human enteric viruses (astrovirus, hepatovirus) in wastewater samples derived from the Llanrwst wastewater treatment plant (Conwy, North Wales). These preliminary results further verified the usefulness of metaviromics in environmental and public health studies. In June a comprehensive sampling was carried out in the Conwy area during which large quantities of sediment (200g), shellfish (10 kg), wastewater (1L) and surface water (200L/site) were collected. The methods developed during the Viraqua project allowed the 10-10000-times concentration of the samples depending on sample type. These concentrates will then be subjected to metaviromic analysis to identify known or novel pathogenic viruses and to track their presence and diversity in the Conwy river basin.



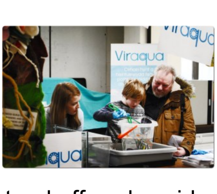
Cross Atlantic visit to Food and Drug Administration Labs

By Dr David Walker, Cefas

The use of coliphage (viruses that infect E. coli bacteria) is becoming widely accepted as a suitable indicator of enteric virus contamination in environmental samples including water and bivalve shellfish. Cefas use coliphage as a surrogate for norovirus infectivity, and frequently measure coliphage levels in bivalve shellfish flesh for research purposes. During a recent trip to the USA to attend the International Water Microbiology Conference in May this year, I took the opportunity to visit the Food and Drug Administration laboratories in Dauphin Island, Alabama where Capt. Kevin Calci has developed an alternative method quantifying coliphage in bivalve shellfish flesh. This method is now used widely in the USA as part of the national shellfish sanitation programme. My trip to Dauphin Island allowed me to see first-hand a method that has been streamlined to be used for routine testing of shellfish in a medium throughput environment similar to that at Cefas. It is hoped that the lessons learnt from this laboratory visit will allow Cefas to develop a robust method for coliphage testing to be applied to shellfish testing in the UK and beyond. This trip has also helped us to build on our existing working relationship with our partners across the pond.

Bangor Science Festival – 'Hidden Worlds'

By Dr Emma Green, Bangor University



VIRAQUA participated in the Bangor Science Festival on March 11th 2017, hosted by Bangor University as part of British Science Week. We had several 'hands on' activities on offer including pathogen painting and bugs in bivalves which we used to explain what a virus was, how they can move through the environment and how these might be accumulated within shellfish. The stand offered a wide range of information for families to research professionals who have an interest in the project about the project background, aims and what we have achieved so far, available bilingually and on information sheets to take away. The event was very well attended with over 1100 attendees participating in the festival. We also used the event as an opportunity for project collaboration and invited Jennifer Holden, lead researcher on the RESERVOIRS project to come and join in the days activities. The RESERVOIRS project, based at The University of Warwick is also water based and is investigating the drivers of antimicrobial resistance within the Thames catchment, fitted in perfectly with the 'Hidden Worlds' theme. Participants whom engaged in our activities were presented a 'Young Microbiologist' certificate from both the projects, and evidence suggests that one is never too old to be a young microbiologist.

A report from our M degree student

By Vanessa Kienmoser, Bangor University

I was part of the Viraqua team for my M- degree research project. Focusing on the quantification of, and optimal extraction method for enteric viruses in shellfish (*Mytulis edulis*) and sediment collected from Conwy bay. Although, I only had little experience working in the laboratory when I started, the great supervision of Dr Kata Farkas helped me to quickly understand the necessary techniques and processes involved. Providing me with a better understanding of microbiology, working in the field and presenting (e.g. Poster, Seminars). Recovery percentages of spiking experiments with shellfish and sediment were used to determine the most efficient method for virus extraction.

2017 Publications

Listed below are the most recent publications by project members in the area of foodborne and waterborne enteric viruses :

Farkas, K., Peters, D.E., McDonald, J.E., de Rougemont, A., Malham, S. K., and Jones, D. (2017) Evaluation of Two Triplex One-Step qRT-PCR Assays for the Quantification of Human Enteric Viruses in Environmental Samples. *Food and Environmental Virology*. http://link.springer.com/article/10.1007/s12560-017-9293-5

Hassard, F., Sharp, J. H., Taft, H., Le Vay, L., Harris, J. P., McDonald, J. E., Tuson, K., Wilson, J., Jones, D., Malham, S. (2017) Critical Review on the Public Health Impact of Norovirus Contamination in Shellfish and the Environment: A UK Perspective. *Food and Environmental Virology* http://dx.doi.org/10.1007/s12560-017-9279-3

All references are available on the website (www.viraqua.uk). For full text PDFs please contact k.farkas@bangor.ac.uk

To unsubscribe please contact emma.green@bangor.ac.uk

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The Viraqua Project Newsletter is a quarterly publication offering partners and stakeholders an insight into the impact of the project and findings to date.

For more frequent updates, please visit out website www.viraqua.uk or connect with us on social media:

NEWS:

Save the date!

The VIRAQUA team are very pleased to announce that we have set a date for a forum to discuss viruses in UK waters. We will present findings from the VIRAQUA project as well as providing the latest knowledge and thinking on viral risk management to initiate discussions and an exchange of ideas on science, risk and future policy options. The meeting will be held at the **Royal Geographical Society on Wednesday 14th March 2018**.

International conference

In May two of our researchers, Dr Kata Farkas (Bangor University) and Dr David Walker (CEFAS) attended the 19th International Symposium on Health-Related Water Microbiology in Chapel Hill, North Carolina. The one week event provided the opportunity to present the main aspects of the VIRAQUA project and to seek international collaboration.

Goodbye's and welcomes

We were sad to say goodbye to Julie Webb, Lisa Cross and Deok Song Kim who have left the project, but warmly welcome James Lowther, David Walker and Emma Green to the VIRAQUA team. David and James join the molecular virologist team in the Food Safety group at the Cefas Weymouth laboratory and Emma takes over from Julie as the project support officer at Bangor University.

VIRAQUA Survey

The VIRAQUA team are currently in the early stages of survey development which will be designed to quantify perceived risk of microbial contaminants by stakeholder groups in the context of other risks. The questionnaire is being developed in conjunction with Dr William Gaze from the European Centre for Environment & Human Health at the University of Exeter. We hope to circulate the survey soon.

A student's perspective

We asked our undergraduate intern student Harry Riley about his experiences:

"I've had a really good time working on the VIRAQUA project over the past month, it's given me great experience in lab and field work and has definitely made me think more about how viruses are transferred throughout the environment! This experience has piqued my interest in this field and I will certainly be thinking about this as a possible career path. Would definitely do again!"

Congratulations!

All of us at VIRAQUA would like to congratulate Vanessa on her PhD acceptance. She will begin a doctoral training partnership at the University of East Angelia to research how microalgae can affect climate change.

We welcome interns!

We can offer an exciting opportunity to join VIRAQUA as a science intern, to gain biological and environmental science experience within an active research team. Please note, the placement would be unpaid. For more details please contact emma.green@bangor.ac.uk

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