Supporting integrated surveillance of foodborne pathogens & pathways

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Understanding sources, pathways and endpoints is essential for robust and effective surveillance. However, existing monitoring programmes for foodborne disease (FBD) do not maximise the use of diverse data and analytical techniques required for a fully-integrated framework. One objective of the Pathogen Surveillance in Agriculture, Food and Environment (**PATH-SAFE**) programme is to identify prevalence and transmission pathways of pathogens implicated in FBD, to support development of an efficient and effective national surveillance system.

INTRODUCTION

Pathogen sources and pathways are complex and vary both spatially and temporally; therefore, successful implementation of mitigative measures requires routine detailed observation and analysis. To examine this spatiotemporal variability, Cefas is conducting pilot studies at the river catchment level under Workstream 2a of the PATH-SAFE programme.

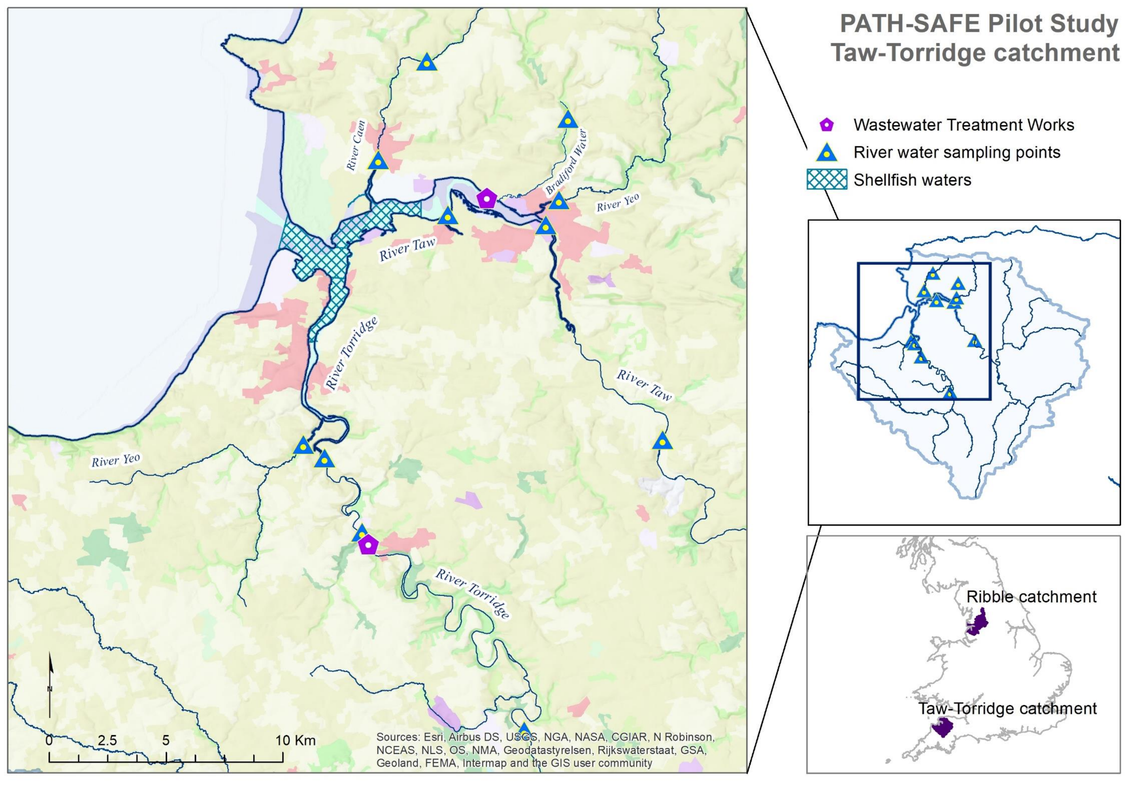
The pilot studies focus on two river catchments, the Ribble (Lancashire) and the Taw-Torridge (north Devon), both of which are associated with important shellfish growing and harvesting areas where Cefas has, historically, conducted sanitary surveys for the Food Standards Agency (FSA). Both catchments provide a variety of environmental characteristics, ranging from rural/agricultural areas (including livestock farming) to more densely populated conurbations, with associated wastewater outflows.

Both agriculture and urban populations can contribute to microbiological contamination of watercourses, affecting water quality and food safety in shellfish growing areas. A detailed river catchment study is examining prevalence and variability (both spatial and seasonal) of norovirus, *Listeria monocytogenes* and *Salmonella* spp., identified by the FSA as high priority pathogens of concern with respect to FBD outbreaks. *E. coli* is being used as an indicator organism for potential presence of faecal contamination.

FIELD SAMPLING & LABORATORY TESTING

Pathogen prevalence and whole genome sequencing analyses are being carried out on weekly samples of wastewater, river water and shellfish collected from strategic locations across the Taw-Torridge catchment, over two discrete 3-month periods (Jan-Mar & Jun-Aug 2023). The aim is to capture potential spatial and seasonal variations in levels and diversity of the pathogens of interest.

Wastewater was sampled from 2 principal wastewater treatment works; river water was collected at 11 locations across the catchment; mussels were harvested from designated shellfish waters within the estuary.



MODELLING & STAKEHOLDER INPUT

Models have been constructed for the Ribble and Taw-Torridge catchments. The Ribble model (underpinned by currently-available surveillance data) is being used as a baseline against which the Taw-Torridge model (supplemented by field sampling results) can be compared. This comparison will help determine the benefits of higher resolution surveillance to the assessment of FBD risk, and the value of models in assessing transferability of results to different locations.

An interactive tool is being developed to allow stakeholders to rank pathogen transmission risk based on local and/or expert knowledge. Inputs will be used to refine risk weightings, and to improve model accuracy and transferability.

OUTCOMES & APPLICATIONS

Desired outcomes and applications of these pilot studies are:

- to gain a better understanding of likely spatial and temporal hotspots for disease outbreaks arising from identified high-risk foodborne pathogens and pathways;
- to improve our ability to predict likelihood of foodborne disease outbreaks in the human population arising from these high-risk pathogens, and to introduce preventative, rather than reactive, measures;
- to be able to identify and react quickly to emergent pathogens, or pathogens of increasing concern, through a more fully integrated surveillance network;
- to support more cost-effective targeting of control measures, providing economic savings for government and industry;
- to lessen the burden on national and community health services by reducing the risk of foodborne illnesses.

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Cefas