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Bathing water disease risk may increase under climate change

Climate change may increase the amount of pathogens entering bathing waters in some areas, finds a new study. The research, carried out in a lagoon in the Baltic Sea, found that, although higher temperatures can reduce microorganism populations, this is likely to be outweighed by contamination due to runoff caused by increased rainfall. The authors are currently developing a system for alerting local authorities and the public to potentially hazardous bathing water.

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Even when bathing waters meet the microbiological standards of the EU's Bathing Water Quality (EBWQ) Directive[1], many potentially disease-causing microorganisms could still be present, and may thrive under climate change.

This study, conducted under the EU GENESIS project[2], focused on the Szczecin lagoon, in the southern Baltic Sea. Tourism is the main source of income in the area, but the lagoon is a pollution hotspot, and dangerous waterborne microorganisms have forced beaches to close.

The majority of these closures were due to *E. coli* and *Enterococci* bacteria from poorly treated sewage. The situation has improved following €288 million of investment in sewage treatment plants and continued monitoring, but beach closures still occur. This highlights the need for a system to alert authorities and the public to hazardous waters. More generally, understanding how climate change might affect pathogenic microorganisms and bathing water quality is of increasing concern.

The researchers modelled the effects of local rainfall and river floods on pathogen contamination in the lagoon. They considered different climate change scenarios, including heavy local rains, river floods and warming of 2°C. The study focused on two bacterial indicators from the EBWQ of faecal pollution - *Enterococci* and *E. coli*.

The model indicated that under flood conditions more *E. coli* would be washed far into the lagoon. This would cause water quality to drop, even at beaches distant from the river mouth. This was partly due to increased runoff from city surfaces and agricultural land.

Agricultural runoff water after heavy rains contains high concentrations of faecal bacteria from local cattle farming. This water enters the lagoon rapidly without much die-off of bacteria, and although such events would be short-term, they are hard to predict.

A rise in water temperature of 3°C would reduce the survival of both bacteria, especially for *E. coli*, however the reduction is not substantial. This model suggests that the other negative effects of climate change, such as increased rainfall and river floods, are likely to have a greater impact. These are also predicted to become more frequent in this region in the future.

The researchers used the model to develop a prototype of a local alerting system for use by local authorities and the public. They hope to combine their model with local environmental data, such as wind speed and physical sensors, to predict pathogen levels in the rivers. This would allow automatic online updates of predicted bathing water quality to safeguard the public, and could be communicated via email or newsletter.

Further research is needed to examine whether these results are replicated in different areas; however, the model developed in this study could be used for this analysis and would also provide a valuable starting point for regional alerts systems, say the researchers.

1.http://ec.europa.eu/environment/water/water-bathing/

2. Groundwater and Dependent Ecosystems: New Scientific and Technological Basis for Assessing Climate Change and Land-use Impacts on Groundwater (GENESIS) was supported by the European Commission under the Seventh Framework Programme. See: http://www.bioforsk.no/ikbViewer/page/prosjekt/hovedtema?p_dimension_id=16858&p_menu_id=16904&p_sub_id=16859&p_dim2=16860