Fishing meets science with waders and smartphones

February 29 2016

Location in the Dutch countryside where researchers tested their prototype waders. Credit: Tim van Emmerik

Dutch and American researchers have developed waders equipped with

temperature sensors that enable fly-fishers to find the best fishing locations while collecting data to help scientists study streams. The research is published today (29 February) in *Geoscientific Instrumentation, Methods and Data Systems* (GI), an open access journal of the European Geosciences Union.

"As scientists, we hope these data help us better understand where groundwater enters streams and where streamwater drains away to the groundwater," explains Rolf Hut, a hydrologist at the Delft University of Technology and lead author of the study. "Furthermore, fly fishers themselves could benefit from knowing local stream temperature to find optimal fishing locations."

The team's idea, which emerged from a conversation between Hut and Scott Tyler from the University of Nevada, is simple: equip waders with low-cost sensors that measure water temperature and send the readings to the wearer's GPS-equipped smartphone via Bluetooth. Anglers could use this data right away and move to locations in the stream likely to have more fish. At the same time, the phone can upload both GPS location and temperature information to a central database, making it available to hydrologists.

"In just the USA alone, an estimated 27 million recreational anglers regularly fish in freshwater streams and lakes," says Tim van Emmerik, a hydrologist at Delft University of Technology and co-author of the GI study. "Imagine if they were all equipped with a temperature-sensing wader! This would mean a constant supply of new, accurate data, which can be used to estimate water quality and quantity, fish 'hotspots', and overall state of the ecosystem."

Since interactions between ground- and surface water are complex and vary widely between different streams, scientists need sensors measuring hydrological data at various points along various streams to better study

them. "Ultimately, good understanding of stream dynamics helps us advise policies that better balance multiple use of streamwater: as a natural habitat for plants and animals, and as a human drinking resource and place for recreation," explains Hut.

After walking around in prototype temperature-sensing waders at a poster hall of the European Geosciences Union General Assembly last April, Hut and his colleagues did precise field and lab experiments to test and calibrate their waders.

Hut walked around a stream in the Dutch countryside with the prototype and compared the water temperature measured by the sensor in his waders to that collected by a reference thermometer. Back in the lab, the team tested how long it took for the waders to change temperature when exposed to a drop or rise in temperature, and how heat emanating from the wearer's leg would influence the measurements.

"We have now demonstrated that this prototype is capable of measuring the type of temperature changes we are interested in," says Hut. "It works!"

The next step is to discuss with manufacturers of waders how to best incorporate sensors in them. The team also want to reach out to fishing enthusiasts, conservation groups and school students to get as many people as possible to wear the temperature-sensing waders.

"This work really is an example of how relatively simple measurement devices can be fused with existing equipment to actively involve communities in gathering scientific data," concludes van Emmerik. "It's becoming a trend to find ways to incorporate 'alternative' communities in science. Whether it's school kids or fishermen, studies like ours demonstrate that everyone can be a scientist."

More information: Rolf Hut et al. Proof of concept: temperature-sensing waders for environmental sciences, *Geoscientific Instrumentation, Methods and Data Systems* (2016). DOI: 10.5194/gi-5-45-2016

Provided by European Geosciences Union