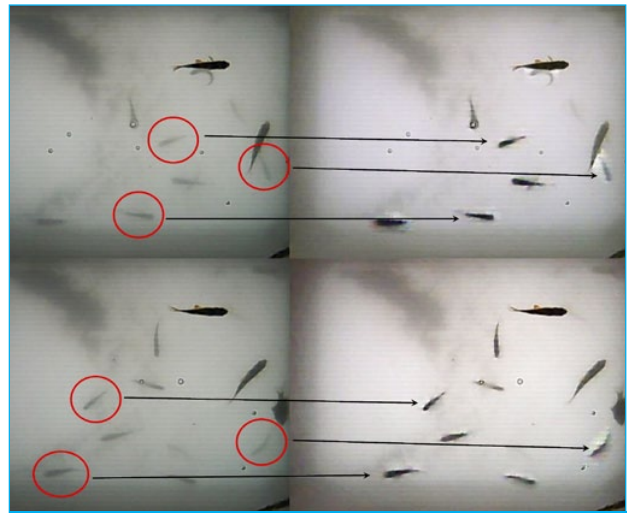


# Fish sentinels of Singapore's water supply

An automated system that monitors fish for unusual behaviour alerts operators if there are changes in water quality



**Fig. 1:** Researchers install a Fish Activity Monitoring System (FAMS) to monitor raw water quality at the Johor River Waterworks



**Fig. 2:** Video enhancement software improves image quality (right) to ensure that fish monitoring is possible in cloudy water

A tank full of fish can make an excellent early warning system for contaminants in the water supply, researchers in Singapore have shown. Like the canaries once carried by miners to warn of dangerous gases in coal mines, fish change their behaviour at the first sign of chemical or biological contamination in water being passed through their tank. By carefully observing the fish, contaminants can quickly be detected.

PUB Singapore exploits this fish behaviour using the Fish Activity Monitoring System (FAMS), a device that combines video cameras with image analysis software to automate the fish-monitoring process. FAMS is now being further developed by Kok Eng Liaw, CEO of ZWEEC Analytics, Singapore, How Lung Eng, a scientist at Singapore's A\*STAR Institute for Infocomm Research, and their colleagues.

"FAMS is a first line of defence, an early warning detection system," Liaw explains. "The moment the fish start to deviate from normal behaviour, the software can

recognise that, and give an early warning." As the fish become sicker, the level of alert escalates. The software can track up to 20 individual fish in a tank, and if they start to die, it will alert the operator to respond accordingly—shutting off the water supply, if necessary.

Liaw and Eng have developed the technology into a stand-alone unit that can operate in remote places and send data to operators in a centralised control centre. PUB Singapore already has 35 FAMS units in place to monitor treated water supplies, and the researchers are now pilot-testing a device that can monitor raw water supplies. This system will allow operators to detect contamination events even before the water enters the water treatment plant (Fig. 1).

The cloudiness of raw water, however, makes it more challenging to use the video technology. As a workaround, the researchers developed low-maintenance filters to remove some particles from the water before it enters the fish tank. They

have also enhanced the video analytics software to handle water with much higher levels of suspended solids (Fig. 2). Roll-out of the enhanced FAMS for raw water monitoring in Singapore is due to begin in 2013.

"We are already moving into the next phase of R&D for the next-generation system," Liaw adds. The researchers have been assessing whether specific contaminants trigger particular, recognizable behaviours from the fish. The early results look promising, Liaw says. "We are looking to identify around 10 of the most common contaminants through the behaviour of the fish."

## Researchers and affiliations

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