ENVIRONMENTAL MONITORING AT WAITOMO CAVES

- Kate Banbury

I have been employed as the Karst Resources Officer by Tourism Holdings Limited since July of last year. My main responsibility is the environmental monitoring of the cave systems (both the Glowworm and Aranui). Other responsibilities include visitor statistics, compliance and resource issues. I have also been trained as a guide and spent the first few months guiding two days a week. Most of my time so far has been taken up with the upgrading of the monitoring system in the Glowworm Cave, entry onto a data base of historical environmental and visitor data, and sorting through the masses of files left by Dave Williams.

As noted in the September ACKMA Journal, the Scientific Advisory Group, first formed in 1978, has been resurrected with the takeover of the Glowworm and Aranui licences by Tourism Holdings Limited. The Group consists primarily of Chris de Freitas, Chris Pugsley, Dave Smith and NIWA. This Group will meet quarterly, and before Cave Management Committee (joint owners committee) meetings so that they may remain updated.

In December the automated monitoring system was upgraded after being reviewed by the Scientific Advisory Group and with ongoing consultation with NIWA (National Institute of Water and Atmospheric Research), the Ruapuha Uekaha Trust, and Department of Conservation. This upgrade was completed by NIWA, who installed the system initially in 1993.

The project was a first for NIWA in terms of the set up. Its uniqueness comes from the use of two data loggers and the distance to the download site. The expansion of the cave environmental monitoring programme necessitated the redesign of the original system that was already working at near full capacity. The purchase price of a data logger with enough channels was scary, so NIWA came up with the solution to network two data loggers as a distributed monitoring network which would allow for current monitoring, including the expansion component, and ensuring sufficient flexibility to meet possible future requirements.

The existing Campbell Scientific CR10 datalogger has been reconfigured as a “slave” datalogger that is continually polled by the new “master” CR10X datalogger using the SDI-12 data protocol. The two dataloggers are separated by a distance of 95 metres within the cave and the various sensors are distributed across the “master” and “slave” dataloggers depending on proximity. With a view to enabling future expansion, the system uses a 12-core data bus throughout the cave to interconnect sensors and includes a series of terminal boxes.

All data is recorded by the “master” CR10X and made available for transfer to computer facilities at the cave ticketing office using a 120 metre RS232/RS485 data link. Through this data link we are able to monitor real-time data from a laptop computer in the ticket office (yes - the ticket office now has a computer - all the tour groups are now entered onto the computer directly by the senior guide instead of onto the booking sheets). In the future we hope to be able to set up an interpretive display linked to the monitoring system so that cave visitors may be able to study climatic variables of the cave in a real-time sense.

After a long search, a carbon dioxide sensor suitable to the cave environment was found. It is of the Vaisalla brand (Finland), has a range of 0-7500 ppm, and is relatively inexpensive. Two of these sensors were installed, one in the Organ Loft and one in the Cathedral. These sensors have been installed as semi-permanent, with extra cable length so that they may be moved to different sites within the cave.

The installation of these sensors was an interesting task in itself. Definitely a big thank-you to Dave Smith (and DOC for letting us steal him for a few days) for abseilling out the end of the Blanket Chamber to install the CO_2 sensor in the Cathedral and his general assistance over the installation period.

The wind speed and direction sensors have been both replaced and relocated. These have been relocated to near the cave door and are more sensitive (0.15 m/s) to the wind speeds in the cave. It is good to see the sensors spinning and not just being cave decorations anymore. The redundant sensors were removed, as well as the people counter (due to erroneous data being produced). With the erroneous data from the people counter, for statistical purposes the data is obtained from the booking spreadsheets at present. Automated people counters are being investigated though that can detect the direction of movement so two way traffic can be isolated. The sensor for outside relative humidity and temperature was also replaced.

The climate monitoring setup at the Glowworm Cave now has eight sites. The system was calibrated both before and after the upgrade, with calibration of all instruments now continuing on a 6-monthly basis. The calibration before the upgrade showed little error in the instrumentation, and where there was, calculations were added to the program to take these into account.

variable	location	frequency of data collection
Carbon dioxide	Cathedral	10 minutes
	Organ Loft	
Windspeed	Entrance	30 minutes
Wind direction	Entrance	
Temperature	Outside	30 minutes
	Tomo	
	Banquet Hall	
	Grotto	
Relative Humidity	Outside	30 minutes
	Tomo	
	Banquet Hall	
	Grotto	
Rock Temperature	Grotto at 2 cm	12 hours
	Tomo at 2 cm	
	Tomo at 8 cm	
Vapour Pressure Deficit	Outside	30 minutes
	Tomo	
	Banquet Hall	
	Grotto	

Location and frequency of recording of the different climatic variables in the cave automated monitoring system.

This monitoring system now provides a comprehensive data set on the climatic conditions of the cave to assist in the management of the cave climate. Specific management concerns where this monitoring system is of assistance include: humidity levels (with the aim to keep them above 90 %); drying out of the cave (both vapour pressure deficit and humidity); CO_2 levels in terms of both licence compliance and dissolution of speleothems; wind speed and wind direction in terms of ventilation control. Once the data set has extended, it will enable more in-depth studies into long-term climatic conditions in the cave and human impact.

I have continued weekly monitoring of the glowworm population, increasing the counts to two sites (one in the grotto and one in the passage leading to the outside jetty). The main colony has remained stable, and finally the outer colony is repopulating the lower walls after being wiped out by an extreme flood 19 months ago.

The fortnightly monitoring of Aranui has been continued, with weta counts, rock temperatures, and ambient air temperatures being recorded. This year sees Nikki Robb, a student of Dr. Ruth Lyons, starting her thesis on radon levels in Aranui Cave.