Crowdsourcing Coastal Oceanographic Data

A new wireless instrument for fishing boats to gather seabed temperature

Andrew M Smerdon[1], James P Manning[2] and Elizabeth M Paull[1*]

[1] Aquatec Group Ltd, High Street, Hartley Wintney, Hampshire, RG27 8NY, UK;
*Corresponding author: Ph +44 1252 843072; Fax +44 1252 843074; email: inquiry@AquatecGroup.com

[2] National Oceanic and Atmospheric Administration, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543, USA

Background

Long term seabed temperature records in Northeast US coastal waters have traditionally been gathered by casts from research vessels costing up to US$10-20,000 per day. Although this has yielded almost a century of observations, temporal resolution is poor, with measurements only taken a few times a year.

In 2001, NOAA's Northeast Fisheries Science Center began attaching temperature and depth loggers to some of the millions of lobster traps deployed by fisherman in the region. This dramatically increased the spatial and temporal resolution of temperature measurements, with over 5 million records to date, but data recovery was lengthy and delayed.

This problem was solved in 2011, when NOAA commissioned a new temperature and depth recorder to deliver data to fishermen immediately as the fishing gear surfaced, allowing near real time data transfer to NOAA – the **AQUA*logger* 530WTD**.

Technology cost, readiness and feasibility

The technology is commercially available and proven in the field, both as a fishing aid and scientific instrument. The software supplied allows the user to control the level of manual interaction required, so it is suitable for use both as a scientific instrument, where advanced features can be selected, and for use on vessels of opportunity, where the instrument must be sufficiently automated so as to not interfere with the normal operation of the vessel. The fact that the data is available to view as soon as the instrument is retrieved, with clear benefits to the vessel, means a benefit is seen immediately and there is an increased incentive to participate.

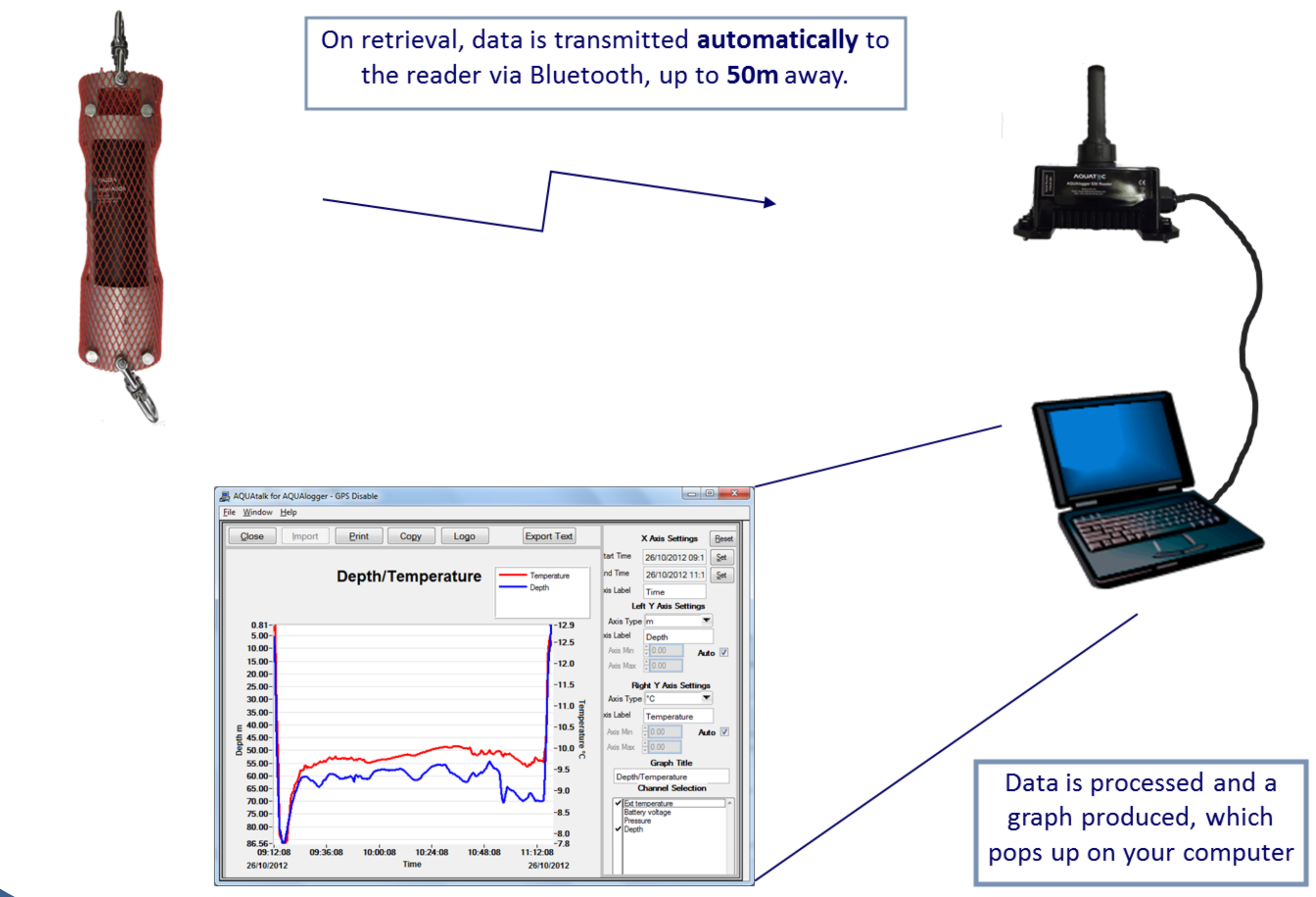
As a precision instrument with advanced data communication capability and automation, it is a low-cost tool to gather data from both commercial and scientific vessels. Depending on the sampling regime selected and frequency of download, battery life may exceed 5 years. The cost per data point collected during this time is tiny.

Instrument

The **AQUA*logger* 530WTD** is a standalone temperature and depth logger, originally designed to be used on commercial fishing vessels. The innovative design includes the ability to store data and display graphs automatically via wireless technology, negating the need for a cabled connection or manual interaction.

The system consists of a data logger and a reader unit. The logger can be triggered to start and stop collecting data at set depths or times. When retrieved from the water, the logger will automatically transmit the collected data to the reader via Bluetooth, provided there is line of sight and the reader is less than 50m away. The data will then be processed and a graph presented on the connected computer. The process from the start of data transfer to presentation of the graph takes minutes.

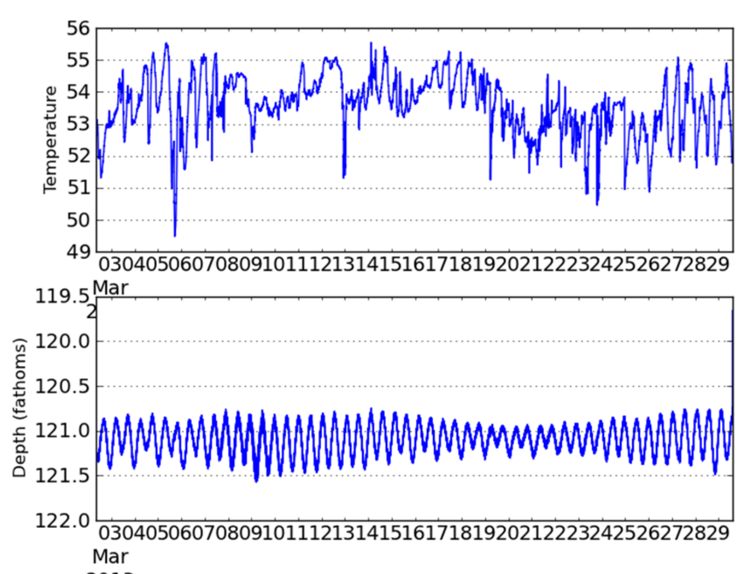
As the instrument was designed for use on commercial vessels, it is durable and has been shock-tested to US standards. It can be attached to lobster pots, nets and other equipment. Providing there is line of sight with the reader, the logger may not need to be detached to download the data.



Data

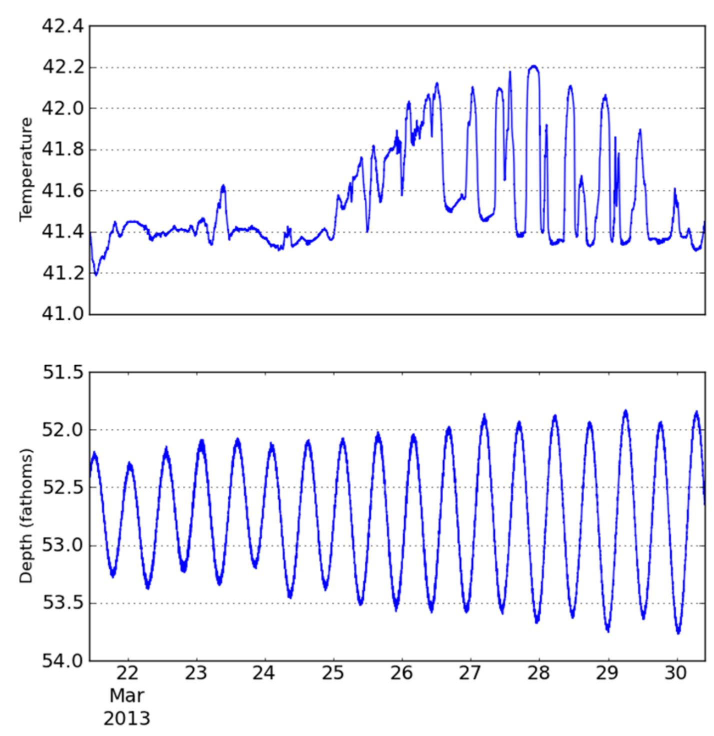
The data collected can be used in near-real time by those on commercial fishing vessels to aid fishing methods and species targeting. The depth of fishing equipment and the physical properties of the water can affect the species caught and consequently the commercial success of a vessel. The data is also useful as a valuable source of temperature data for coastal oceanography.

Coastal oceanography



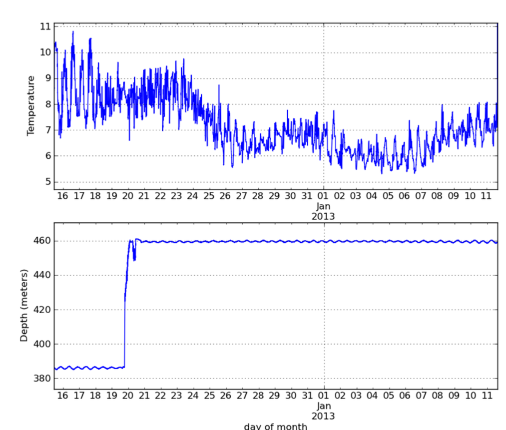
The depth record in Figure 1 shows a clear tidal cycle with spring-neap variability. Interesting events can also be observed, such as the significant drop in temperature on 5th March with no corresponding change in depth or water level.

Figure 2 shows a transition from a neap tide to spring tide, with a variation of approximately 1m in water level at high tide. The first 3 days of the record show little variation in temperature with the tides, whereas the end of the month shows much larger variation. Peaks in the depth record (high tide) correspond with peaks in the temperature record, with the difference between temperature at high and low tide reaching a maximum of 0.8°F.



Fisheries

Figure 3 shows the temperature and depth record from a logger attached to a lobster trap. On 20th December, the lobster trap moved from a depth of 385m to 460m, most likely by a strong surface current. No immediate effect was observed in the temperature record as a result, showing consistency in the physical properties of the water column at these depths. The temperature then dropped over 4 days, with the average dropping from ~8.5°C to ~6.5°C. Oscillations with a period of approximately 12 days can be seen in the temperature record, superimposed on the tidal variability.



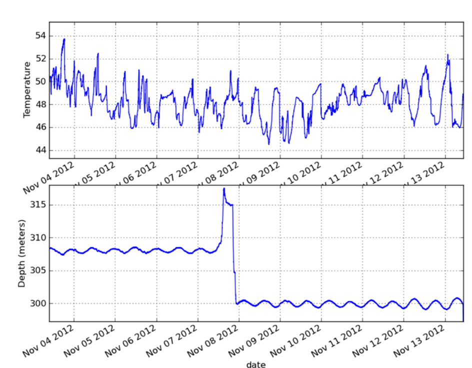
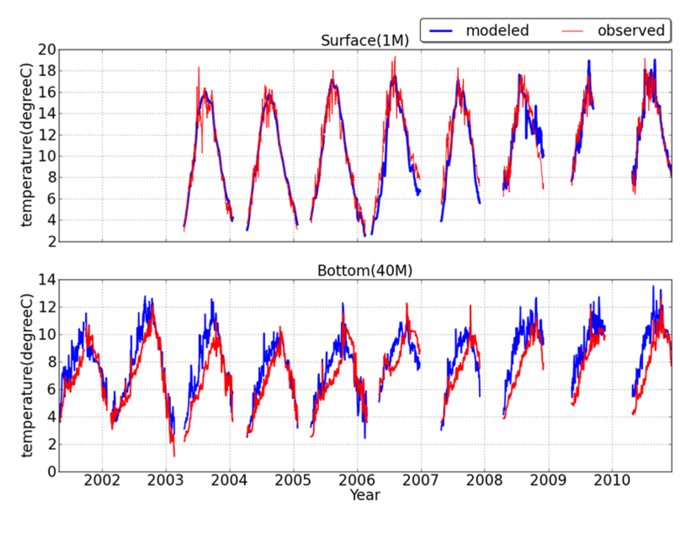


Figure 4 shows the opposite effect, with a lobster trap moving into shallower water (300m), following a brief descent into deeper water (317m). This again is the likely result of a strong surface current. Oscillations can be seen in the depth record, representing the tidal cycle.

Models



One key benefit of this addition data is the improvement of models. Models generally perform well at the surface, where there is generally more data available to validate and calibrate the models. Performance at depth is less reliable – more data can help improve models such as the one shown in Figure 5.

The future

With the considerable expense of using research vessels to collect data and the growing need for information, instruments such as the AQUA*logger* 530WTD can help increase temporal and spatial variability at minimal capital and operational cost. Using vessels of opportunity can build relationships between commercial users of the seas and oceanographic researchers. New technologies such as this data logger maximise the opportunities that vessels of opportunity offer, with minimal training and manual interaction required for successful operation.