Report

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Monthly Macrophyte Surveys of the CEH River Lambourn Observatory at Boxford

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Introduction

Chalk streams

Confined to areas of cretaceous upper chalk, chalk streams are not affected by the hydrological influences of overlying substrates such as clays. This results in high base flows with distinctive physical and chemical properties. They are internationally scarce and in England have been subjected to varying degrees of management from their historic use to power water mills to more recent exploitation as cress beds and game fisheries.

Macrophyte in chalk streams

The macrophyte communities of chalk streams are of great importance both for their ecological value and the effect they have on hydraulic roughness. The relatively stable water temperature, clear water and nutrient levels encourage growth over an extended growing season which enhances the growth of macrophytes. The macrophytes help to trap silt and provide varied habitats and food sources for invertebrates which in turn encourage fish populations. However, in some chalk streams increased nutrient levels and the accumulation of silt due to low flows, have reduced the abundance of macrophytes due to the growth of epiphytic algae (Philips et. al, 1978). The most abundant aquatic macrophyte usually found in chalk streams is *Ranunuclus* which may occur in great profusion. Therefore weed cutting is sometimes carried out to reduce flood risk, lessen the influence of weed growth on flow gauging stations and to enhance fisheries.

Research background

Scientific studies of chalk rivers have generally concentrated on invertebrate fauna (Wright et. al., 1983), the growth and recession of macrophytes in shaded river sections (Ham et. al., 1982;), the effects of marginal shading, (Dawson, 1978) and transport of sediment, weed cutting (Old et. al., 2014) and vegetative material (Dawson, 1980). However, studies of seasonal macrophyte growth are limited. The intention of this study was to address this by monitoring seasonal changes in the growth patterns of the three most common macrophytes in a representative chalk river. Results of this monitoring are presented in this report though further analysis and interpretation will be presented elsewhere.

Study area

Macrophyte surveys were undertaken on the River Lambourn at Boxford. The river Lambourn is a chalk stream situated in southern England. It is a designated SSSI and SAC and is typical of other chalk streams in its clear, nutrient rich water and the associated macrophyte and invertebrate communities. It is a tributary of the River Kennet which itself is a tributary of the River Thames. Being relatively un-modified, the survey site (the CEH River Lambourn Observatory at Boxford) is generally shallow and fast flowing, with accumulations of fine sediments mostly limited to the margins.

Method

The surveys were designed to record both the cover and quantity of the three most common aquatic macrophytes in the stream. These are *Ranucnulus penicillatus ssp. Pseudofluitans* (with *Ranucnulus penicillatus* ssp. *Pseudofluitans x Ranunculus peltatus* hybrid), *Calltiriche platycarpa* (with some *Callitriche obtusanglia)* and *Berula erecta*. The *Ranunculus* and *Callitriche* species were not identified to species level as this is frequently impossible without flowering material and because the study was more concerned with the quantitative behaviour of aquatic macrophytes. Generally, cover of all macrophytes increases through spring and peaks in the summer months, though this pattern is disrupted by weed cuts which usually occurred twice a year in the summer months.

The surveys were conducted every month from March 2009 until October 2014 with one occurrence of missing data due to high flow which prevented accurate (and safe) surveying. When possible the surveys were timed to coincide with monthly hydraulic surveys reported elsewhere.

The surveys were carried out at four points distributed along the length of the channel. These were selected in order to represent a combination of shallow/fast flowing areas and deeper/slower flowing areas, as well as shaded and unshaded reaches. At sites one to three the channel width was approximately 10m, but at the downstream site the width is nearer 14m.

In order to ensure that the surveys were carried out at the same place, stakes were driven into both sides of the bank on the first visit. On subsequent visits a tape was stretched between the stakes and this was used as the centre of the survey.

Macrophyte cover (quadrat surveys)

These surveys were conducted using a 50cm x 50cm quadrat, divided into 25 10cm squares. The quadrat was held over the channel at consecutive 50cm intervals and the number of squares in which each macrophyte could be seen was recorded. This gave each macrophyte a maximum count of 25 at each point, but the total count could be exceeded if vegetation occurred at different heights, e.g. with trailing *Ranunculus* growing over submerged *Callitriche*, in which case counts for both species were recorded. The process was repeated from one side of the channel to the other. The sides of the channel were defined by the water level when surveying was conducted, so the channel width varied according to the water level at the time of survey. Terrestrial/amphibious vegetation at the channel edges such as *Glyceria*, *mentha* and grass species was recorded as Overhanging Vegetation (OHV).

Macrophyte quantity

These surveys were conducted in order to provide more detailed information on the quantity of vegetation. After the quadrat surveys had been completed, the dimension of each stand of vegetation was measured along the centrepoint provided by the tape measure. Wherever any aquatic macrophytes occurred, the water depth at that point and the height of the top and bottom of the stand were recorded. These details were recorded at 30cm intervals until the stand of vegetation ended, and re-started on the next stand. Only macrophytes directly below the tape were recorded.

Biomass surveys

Biomass samples were taken for the first three years of the sampling (from March 2009 until March 2012).

Three samples were taken from randomly selected stands of *Ranunculus*, *Berula* and *Callitriche* using a 5cm quadrat. All of the plant material rooted within the quadrat was included in the sample, including any trailing vegetation which extended beyond the border of the quadrat. The volume, dry weight, wet weight, leaf area and stem length of the samples were then recorded.

The survey techniques had little impact on the species recorded and the month long gap between surveys allowed recovery from any disturbance. The only obvious damage was to the marginal terrestrial/amphibious vegetation.

Water depths were taken at 50cm intervals across the channel to calculate the total wetted channel area.

A photograph of the sites was taken at each visit.

Results

Key indices were produced to summarise the data and these are presented below.

Macrophyte cover (quadrat surveys) *Ranunculus* (Figures 1 and 2)

Maximum cover of *Ranunculus* usually occurred in August and quantities were noticeably lower in the shaded site 3. Greater seasonal variation in the counts of *Ranunculus* was apparent at site five, the deeper, slower flowing downstream site.

Macrophyte cover (quadrat surveys) *Callitriche* (Figures 3 and 4)

Counts of *Callitriche* were highest and seasonal variation most marked at the shaded site 3. At site counts fell significantly after the first year of survey (2009).

Macrophyte cover (quadrat surveys) *Berula* (Figures 5 and 6)

Like *Callitriche*, counts of *Berula* were highest and seasonal variation most marked at the shaded site 3, though there was a marked reduction in the number of counts after 2012.

Area of submerged macrophytes and wetted channel area (Figures 7-10)

Seasonal peaks are evident, especially at the deeper, slower flowing site 5 though allowance should be made for the wider area of the channel (% of channel occupied shows a less distinct trend).

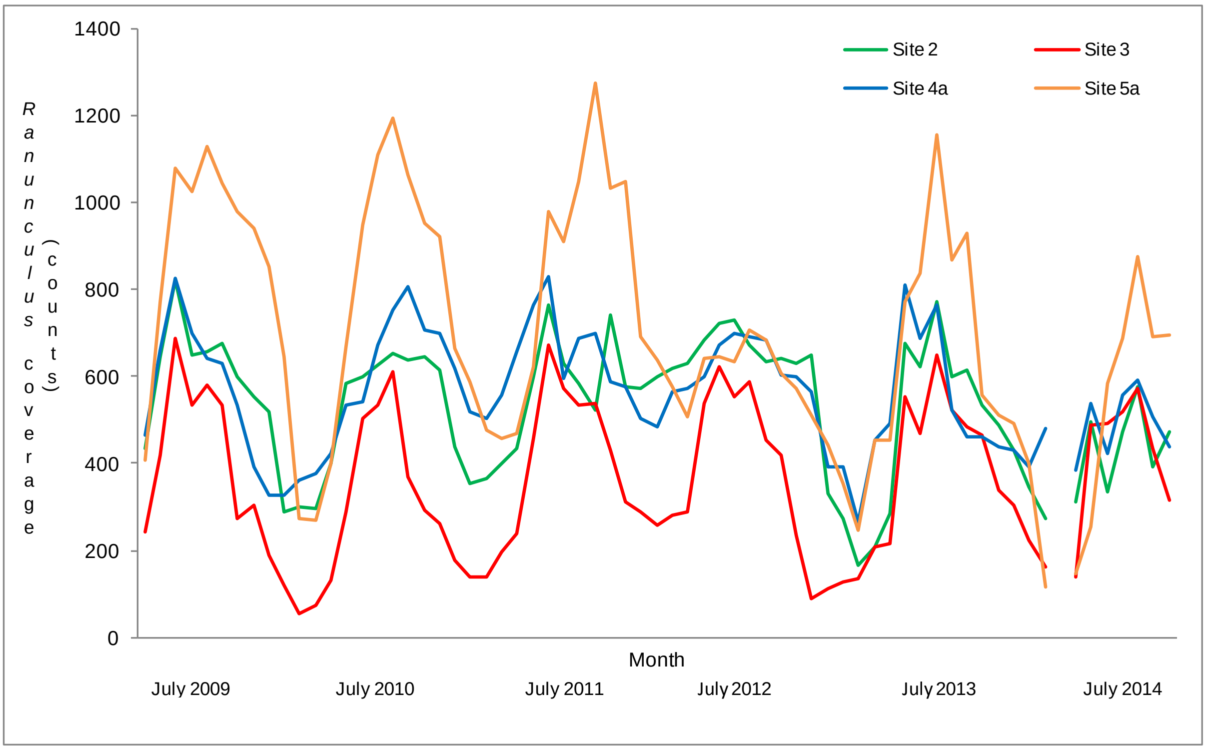

Figure 1 Count of quadrat squares in which *Ranunculus* occurred at four sites (2009-2014

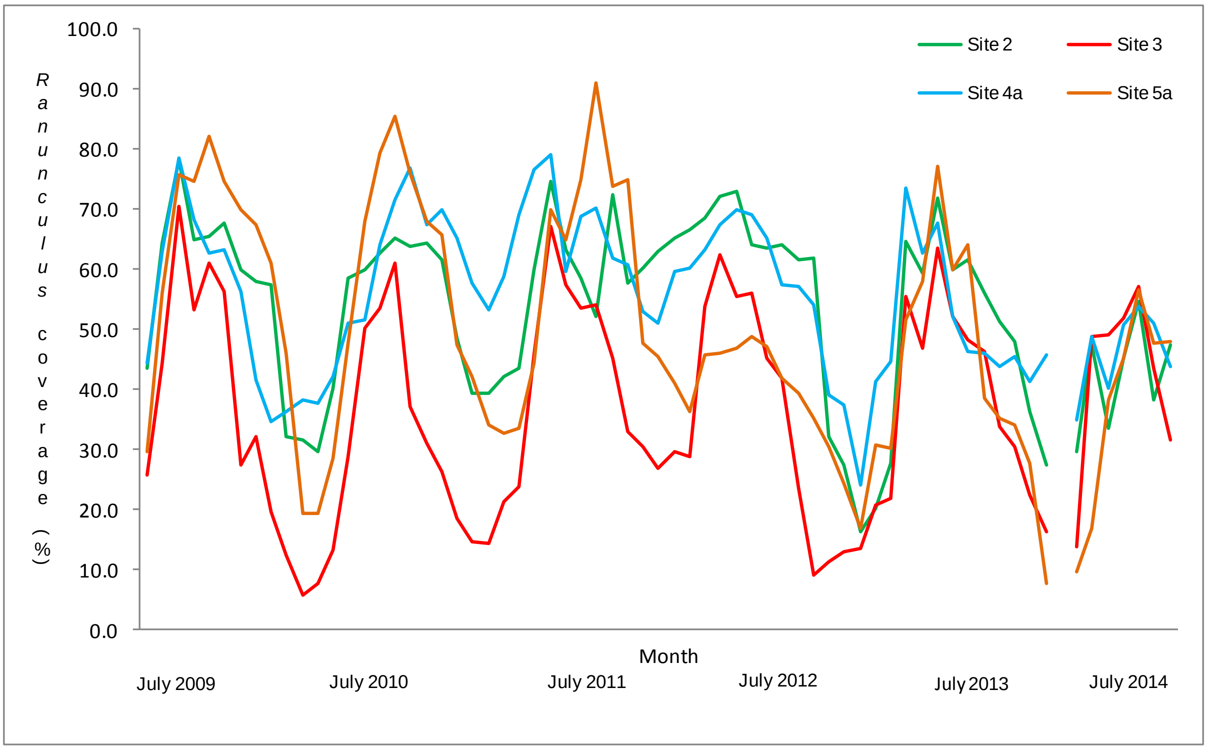

Figure 2 Percentage cover of *Ranunculus* within the quadrats at four sites (2009-2014)

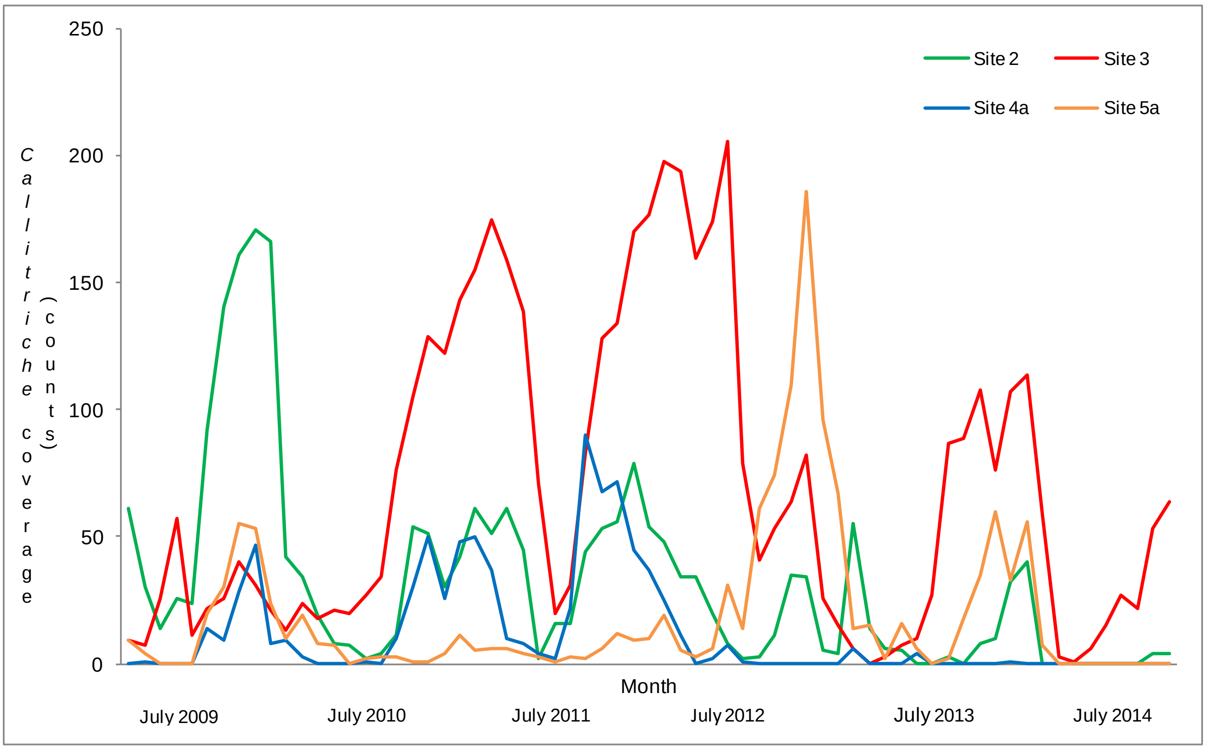

Figure 3 Count of quadrat squares in which *Callitriche* occurred at four sites (2009-2014)

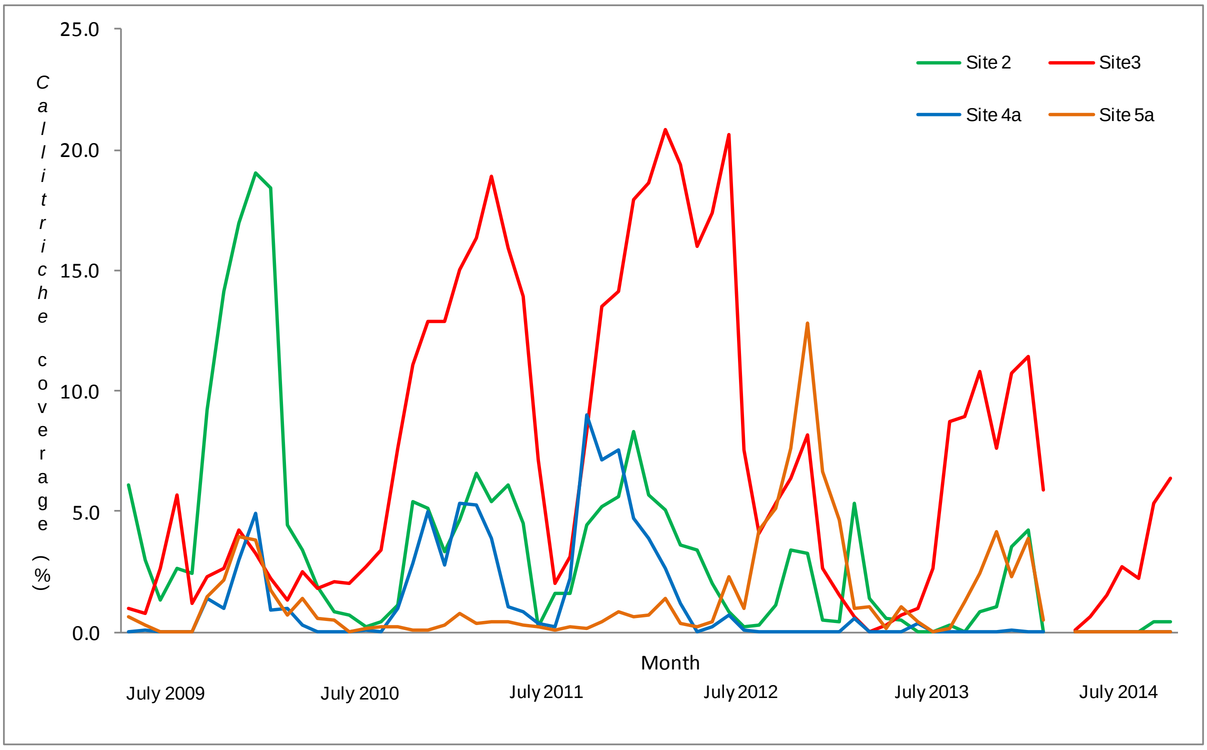

Figure 4 Percentage cover of *Callitriche* within the quadrats at four sites (2009-2014)

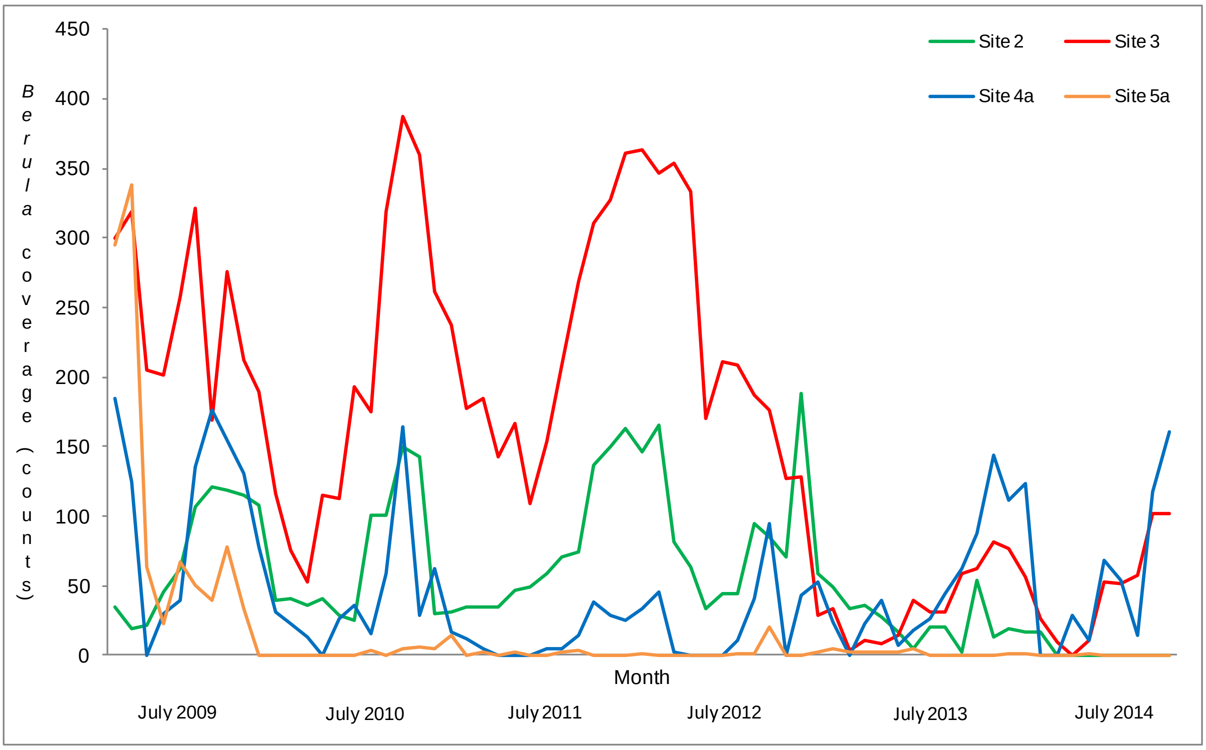

Figure 5 Count of quadrat squares in which *Berula* occurred at four sites (2009-2014)

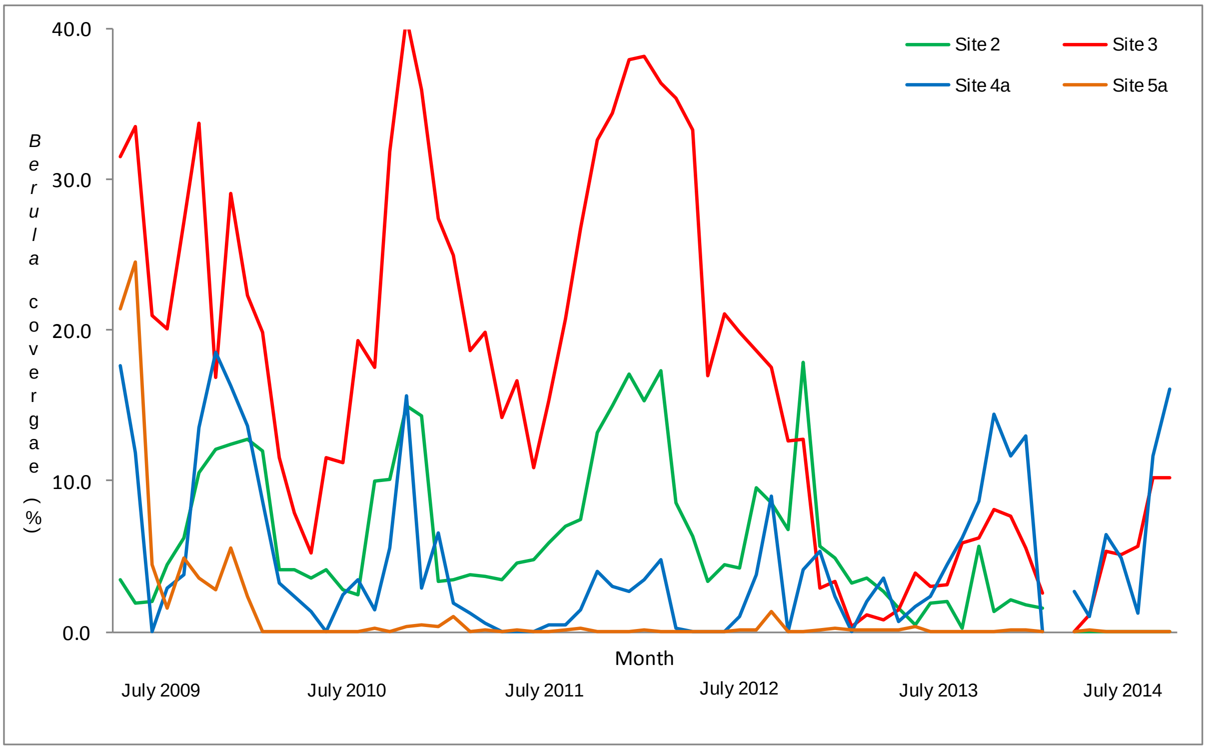

Figure 6 Percentage cover of *Berula* within the quadrats at four sites (2009-2014)

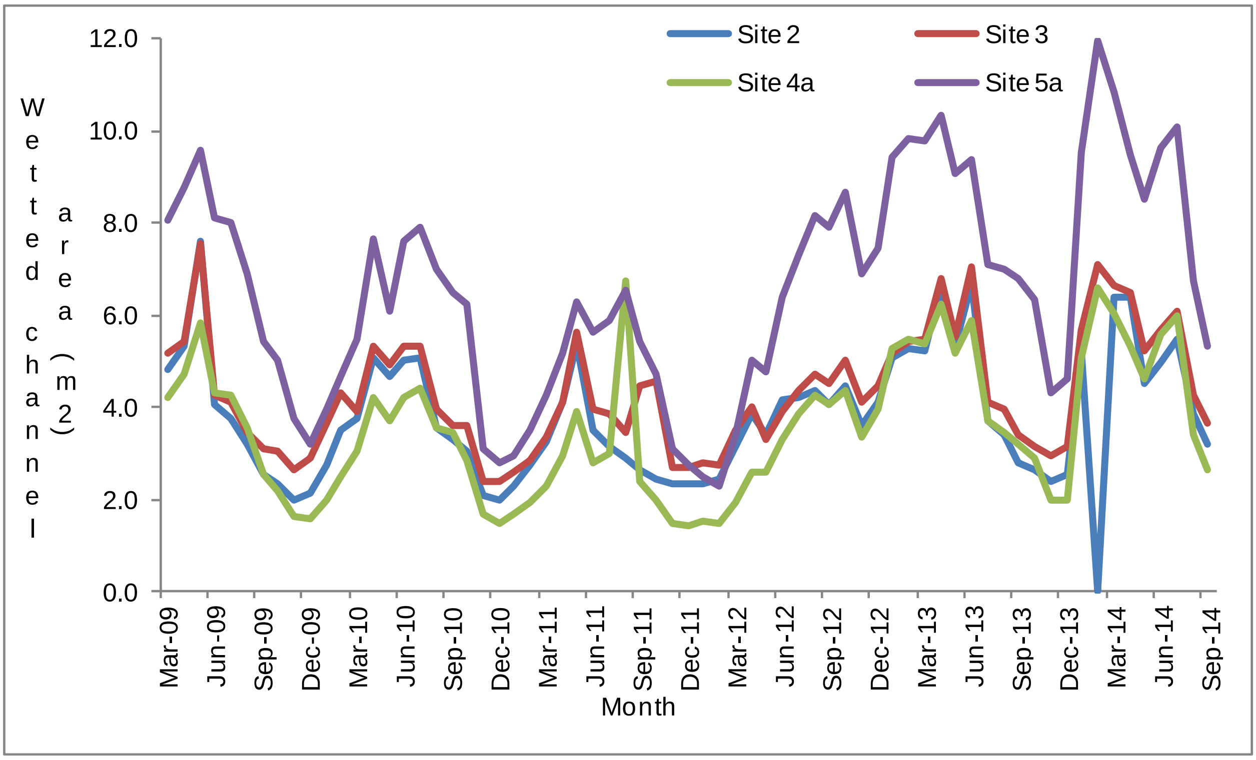

Figure 7 Wetted channel area 2009-2014

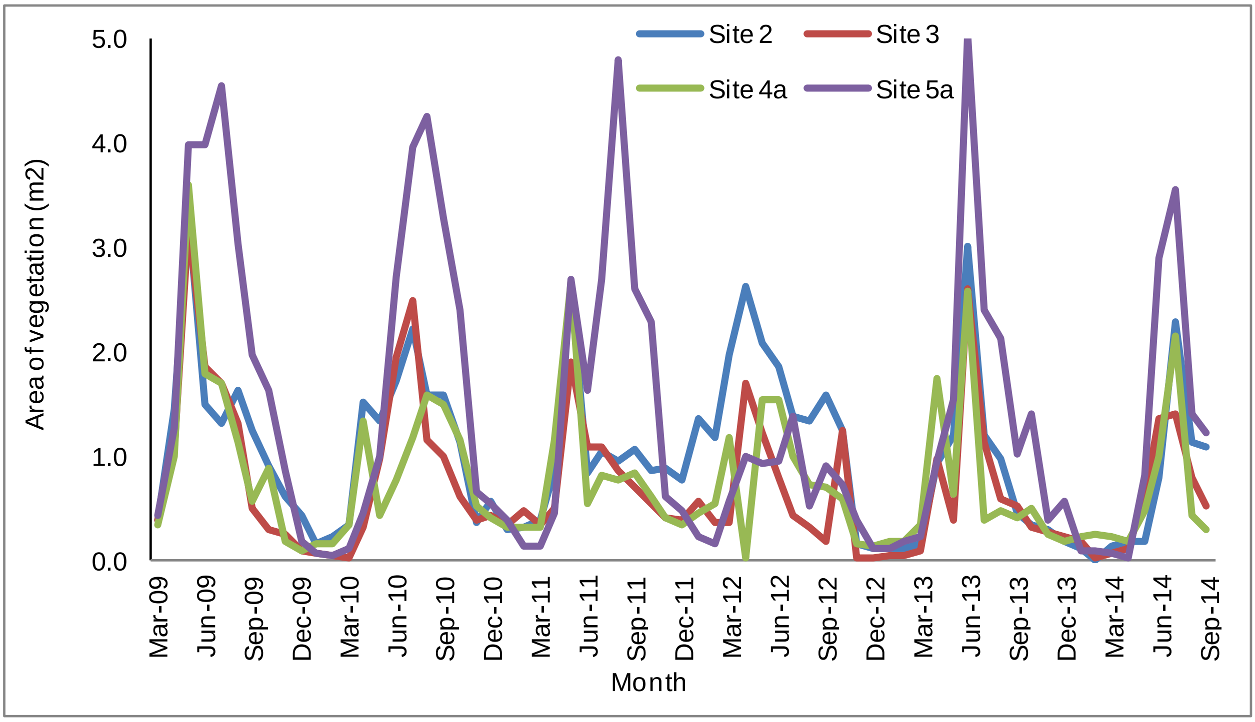

Figure 8 Area of all vegetation types 2009-2014

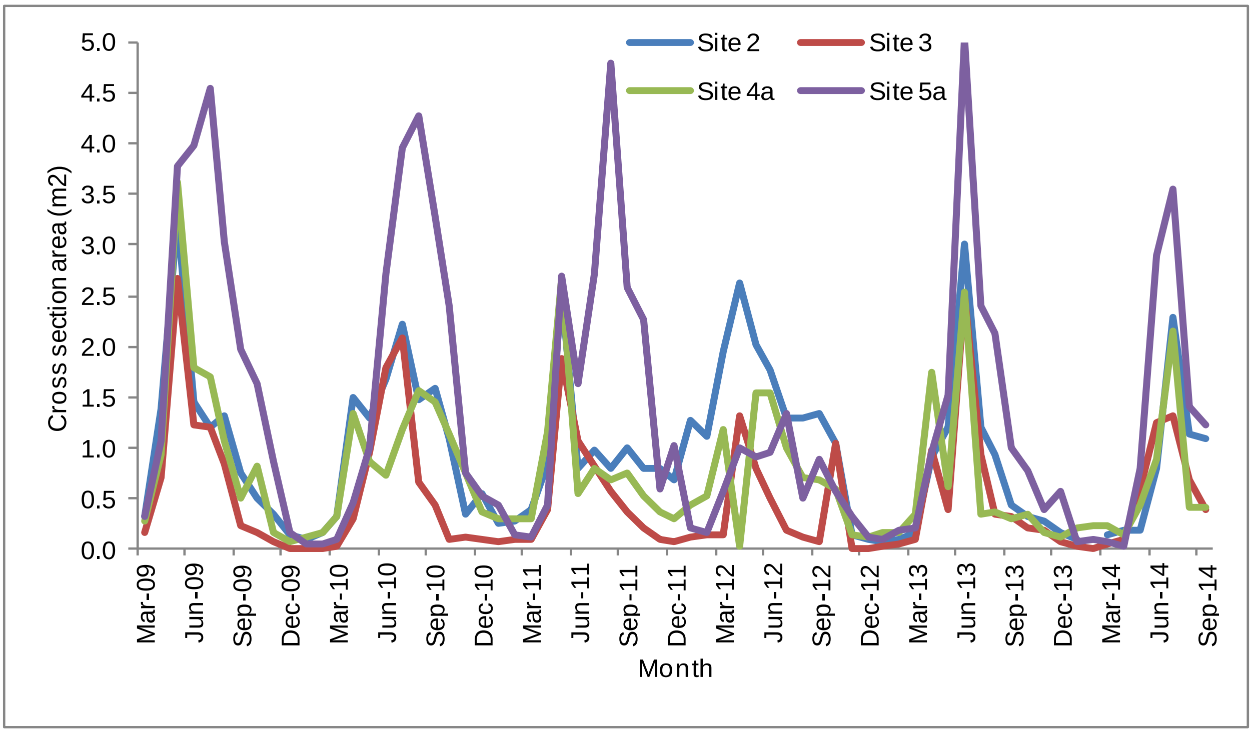

Figure 9 Cross section area occupied by Ranunculus 2009-2014

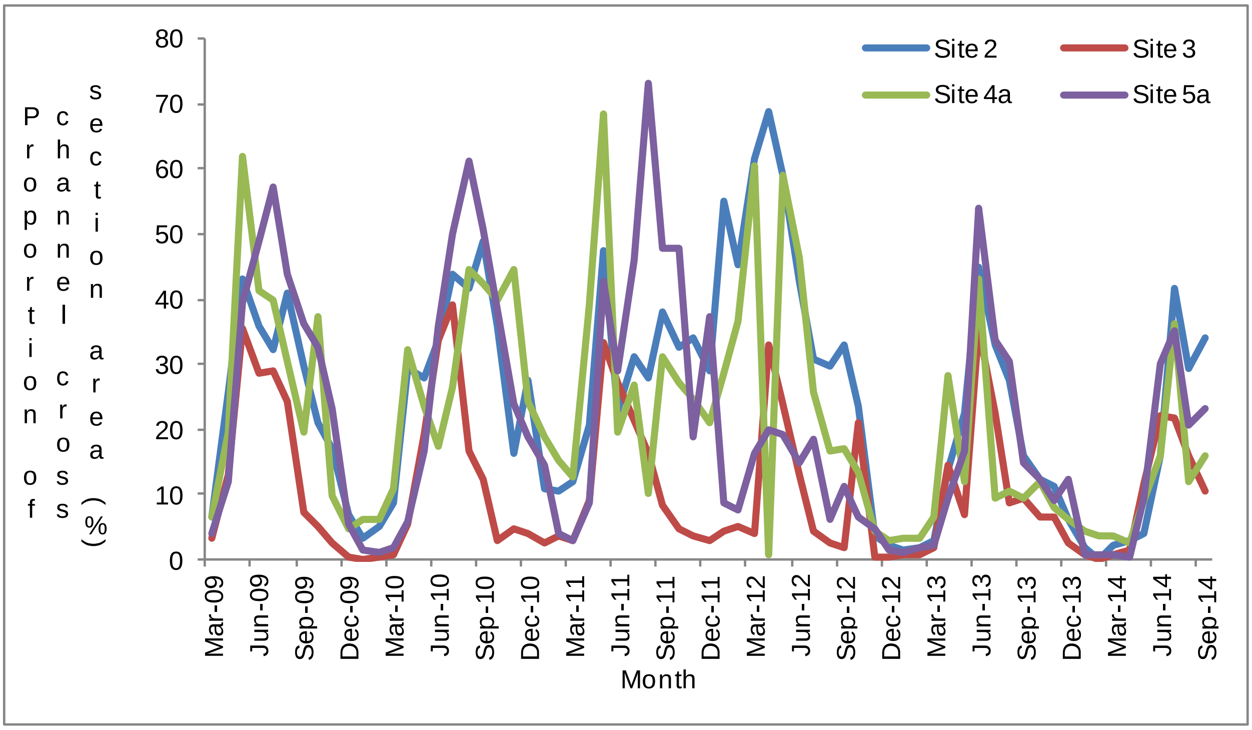

Figure 10 Channel cross section occupied by *Ranunculus* 2009-2014

Concluding remarks

This study has resulted in the collection of a unique dataset of seasonal macrophyte growth over a six year period, encompassing extreme levels of flow both high and low. Although not analysed the results of the surveys are presented in this report. The data collected would enable subsequent investigation of the impact of weed cuts on the composition, density, cover and recovery time of these species and the relationship between macrophyte growth, hydraulic roughness, flow regimes and sediment transport/deposition.

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