Culm Community Crayfish Project

CRAYFISH SURVEY REPORT

November 2018




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SUMMARY

- This report presents the results of a crayfish survey of the upper Culm catchment as part of the Culm Community Crayfish Project. The aim was to assess the status of the resident white-clawed crayfish population and assess the distribution of, and risks associated with signal crayfish in the catchment.
- The survey was volunteer led and entailed a combination of manual search and trapping techniques. A total of 53 x 500m river stretches and four ponds were surveyed. Environmental DNA (eDNA) testing was used to survey an additional three sites and confirm field results.
- The survey confirmed white-clawed crayfish to be present along a 5km stretch of the main river Culm. They were recorded 2km farther downstream than previously recorded, however the upstream limit of their range had reduced by 1-1.5km due to the effects of signal crayfish. Signal crayfish were also recorded mixing with white-claws at the downstream limit of the white-clawed range.
- Signal crayfish were found to be abundant in two main tributaries upstream of the white-clawed population: the Bolham Water and Madford River. The latter population was found to carry crayfish plague.
- The white-clawed population is assessed as being under severe and imminent threat of complete extirpation (local extinction) caused by crayfish plague. Longer term negative impacts of signal crayfish presence include degradation of the river ecosystems through invertebrate and fish predation, bioturbation (burrowing, ingestion and defecation of sediment) and riverbank erosion.
- White-clawed crayfish conservation actions should focus on the location and establishment of ark sites using wild caught and captive bred animals as a matter of urgency.
- Monitoring of the progress of each crayfish population is also recommended.
- No effective signal crayfish control methods are currently available though there may be options in the medium term (3 – 5 years).

1 INTRODUCTION

This report presents the results of a crayfish survey of parts of the upper Culm catchment as part of the Culm Community Crayfish Project. This one year project aimed to raise awareness of the plight of the native white-clawed crayfish *Austropotamobius pallipes* on the river through surveys, educational and community engagement work.

1.1 Background

White-clawed are the UK's only native crayfish and were once widespread in England and Wales; in Devon they occurred on the rivers Clyst, Creedy/Yeo, Culm, Axe and Otter. They have declined by 80-90% since the 1970's through the effects of the invasive American signal crayfish *Pacifastacus leniusculus,* including out-competition and crayfish plague *Aphanomyces astaci,* a fungal pathogen carried by signal crayfish which is fatal to the native white-clawed crayfish.

Signal crayfish were introduced to the UK for aquaculture in the mid 1970's and have spread throughout the UK including most river catchments in Devon and Somerset. In addition to impacts on native crayfish, they can have major adverse effects on ecosystems through predation of fish and invertebrates, consumption of detritus and vegetation and siltation/ecosystem engineering though their burrowing and bioturbation actions.

The River Culm supports one of two remaining populations of white clawed crayfish in Devon. It had been believed to be extinct on the river but was 'rediscovered' in 2006 and was found to be present between the villages of Culmstock (ST 09173 13579) and Hemyock (ST 13543 14037). The invasive American signal crayfish was recorded at the upstream end of the white-clawed crayfish population in 2008 and has been slowly expanding since then. Additional populations had been reported but not confirmed on the Madford and Bolham rivers and in a pond close to the Sheldon Stream, tributaries of the Culm (Figure 1.).

In recent years lack of funding meant very little crayfish monitoring occurred, so the status of both species was unclear, though limited monitoring recorded a decline in the abundance of white-clawed crayfish between 2012 and 2016. Anecdotal reports, together with the river's failure of Water Directive Framework ecological quality standards, indicate a potential reduction in water and/or habitat quality over the same period.

1.2 Aims & Objectives

The aim of the survey was to establish the status of both native and non-native crayfish on the upper Culm catchment and main tributaries. This entailed surveying the main stem of the river beyond the known up and downstream extent of white-clawed crayfish plus the three largest

tributaries (Figure 2). Ponds within these areas which could act as sources of signal crayfish were also surveyed where possible.

A further aim of the survey was to involve the local community in the survey effort in order to raise awareness of the issues and create a volunteer resource for future activities.

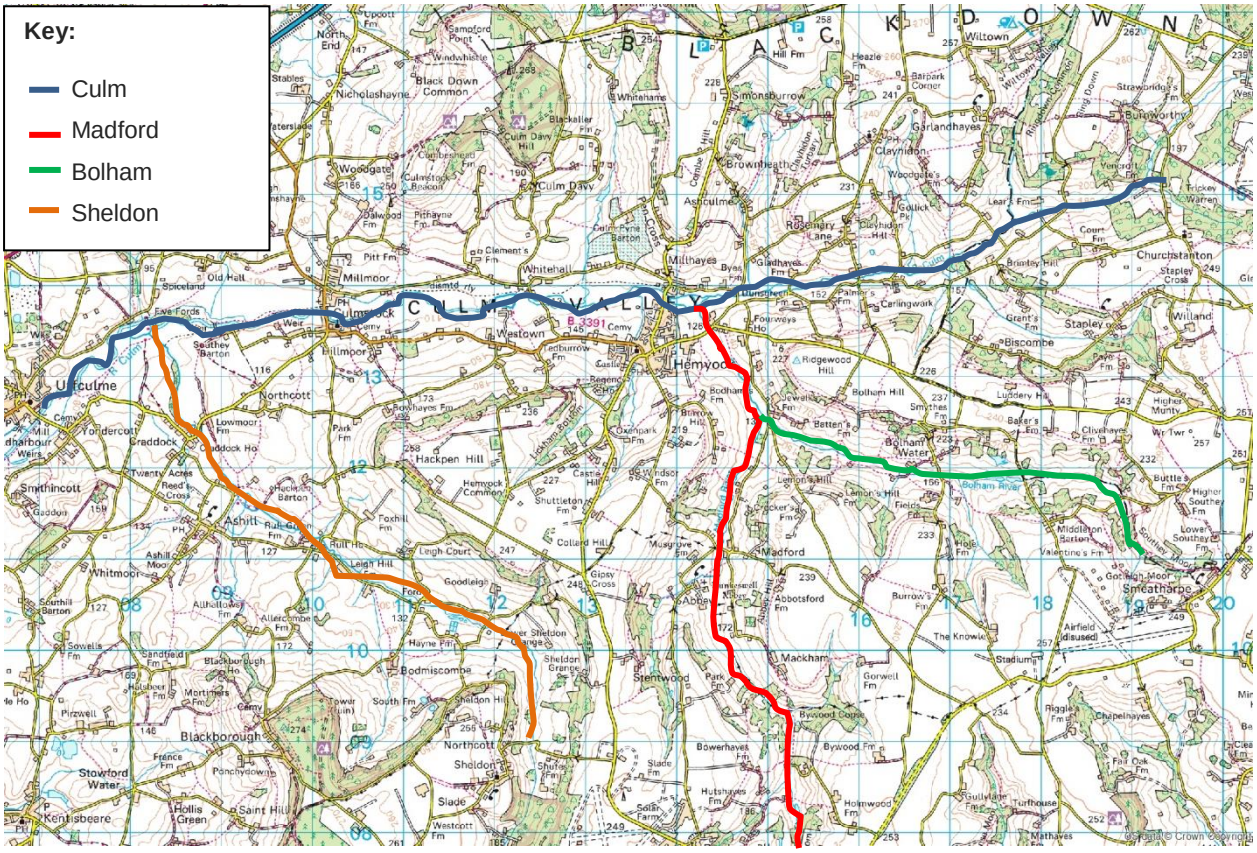


Figure 1. Upper Culm River and main tributaries

2 SURVEY METHODOLOGY

2.1 Desk Study/previous survey

Historical records for all crayfish species was gathered from the Devon Biodiversity Records Centre and the Environment Agency. In addition, the area of known white-clawed crayfish distribution was surveyed in 2017 as a precursor to this survey. This data was collated and is presented in Figure 2 (Section 3.1).

2.2 Recruitment and Training of Volunteers

Volunteers were recruited through promotion of the project via the Blackdown Hills AONB website and local media. Two training days were held on 24th March and 12th April 2018. The training sessions consisted of a morning classroom, health and safety and biosecurity session followed by a field visit to set and empty traps in the afternoon. A total of 48 volunteers were trained during these sessions whilst ongoing training was also provided in the field by the Project Manager and Crayfish Specialist.

2.3 Licensing

Consent from the Environment Agency is required to trap native or non-native crayfish, so prior to the commencement of the surveys Environment Agency trapping consents for the river stretches and ponds was obtained and the traps fitted with tags denoting that consent. White-clawed crayfish are listed as Schedule 5 species under the Wildlife & Countryside Act 1981 (as amended) and a licence from Natural England is required to survey and handle them. The surveys were supervised by the license holding Crayfish Specialist and all volunteers were fully trained in handling and identifying crayfish.

2.4 Field Survey

The survey method was designed to cover a large area of river in a short time whilst still being rigorous and reliable. The aim was to record crayfish presence/absence only rather than to attempt to assess population size. It involved two approaches: manual search techniques such as hand searching the riverbed, kick sampling and searching for other evidence of crayfish; and trapping using Artificial Refuge Traps (ARTs) on rivers and Baited Traps (BTs) in ponds. Artificial refuge traps are not enclosed and can be left for long periods of time between checks. They capture a wide size range of animals and are most suitable for shallow water, rivers and streams. Baited traps are most effective in deeper, still or slow moving water and are biased towards large male crayfish. They require checking every 24 hours for animal welfare reasons.

(A) (B)

Figure 2. Baited (A) and artificial refuge trap (B)

Rivers were divided into 500m sections or survey reaches. On the first visit the survey team would undertake a risk assessment followed by a manual search as described above. If no crayfish were found the surveyors would then set 20 ARTs in suitable locations at roughly 25m intervals. The location description, tag number and GPS reading where possible were recorded on a site map. The traps were then left in situ for a minimum of one week to allow them to 'bed in', and then checked up to three times for the presence of crayfish. As soon as crayfish were found the traps would be removed (the exception to this was on the main River Culm where white-clawed crayfish were found - traps were checked 3 times before removal) ; if no crayfish were found after three checks the reach was recorded as negative for crayfish. Any crayfish caught were sexed and measured to the nearest mm carapace length and signs of disease such as porcelain disease were recorded on a survey form. Any signal crayfish found were humanely destroyed in accordance with the relevant legislation (Wildlife & Countryside Act 1981 as amended).

Ponds were surveyed by again carrying out a risk assessment on the first visit then setting up to 20 baited traps per pond depending on the size of the pond. The pond owners were asked for any information held on crayfish sightings, prior fish stocking, angling activities etc. as signal crayfish were frequently accidentally moved with fish in the past. A visual assessment of the pond to look for signs such as burrows and crayfish remains was also conducted. The traps were baited with cat food and left overnight before retrieval. Again this would be repeated three times if deemed necessary.

Environmental DNA sampling was also undertaken, either in areas the field survey did not cover or to ground truth the survey results and check for the presence of crayfish plague.

Strict biosecurity was observed in order to prevent the transfer of crayfish plague and other diseases. Surveys proceeded in an upstream direction and all equipment was thoroughly

disinfected when moving between rivers or ponds. Health and safety practice was also observed with full training in safe working in or near water, risk assessments and river level checks prior to entering the river.

Surveys took place two days per fortnight on average, plus additional weekends, the total number of volunteer days spent being 226.

2.5 Survey Limitations

The original aim was to survey the main Culm from Uffculme (ST 06940 12641) to the source, or as far up as was practicable, plus the three main tributaries: the Madford River, Bolham Water and Sheldon Stream (Figure 2). Due to time and resource constraints it was not possible to survey the Sheldon Stream and 1km of the upper Culm, but this was surveyed using environmental DNA at a later date. Similarly not all ponds could be surveyed due to time constraints. A section of the Culm between Culmstock and Hemyock that had been surveyed in 2017 was omitted from the survey. Three sites on the upper Culm were surveyed in October using eDNA analysis, again due to time constraints.

Only three survey days were cancelled, either due to bad weather or a shortage of volunteers. Despite the large number of volunteers trained not all took part in the survey regularly. However additional volunteers came forward during the survey season and a small core group of regular attendees ensured that there were nearly always sufficient volunteers.

3 RESULTS

3.1 Desk Study

The desk study provided no additional crayfish records to those already known, though encouragingly white-clawed crayfish were recorded in reasonable numbers throughout the lower extent of their known range during the 2017 survey.

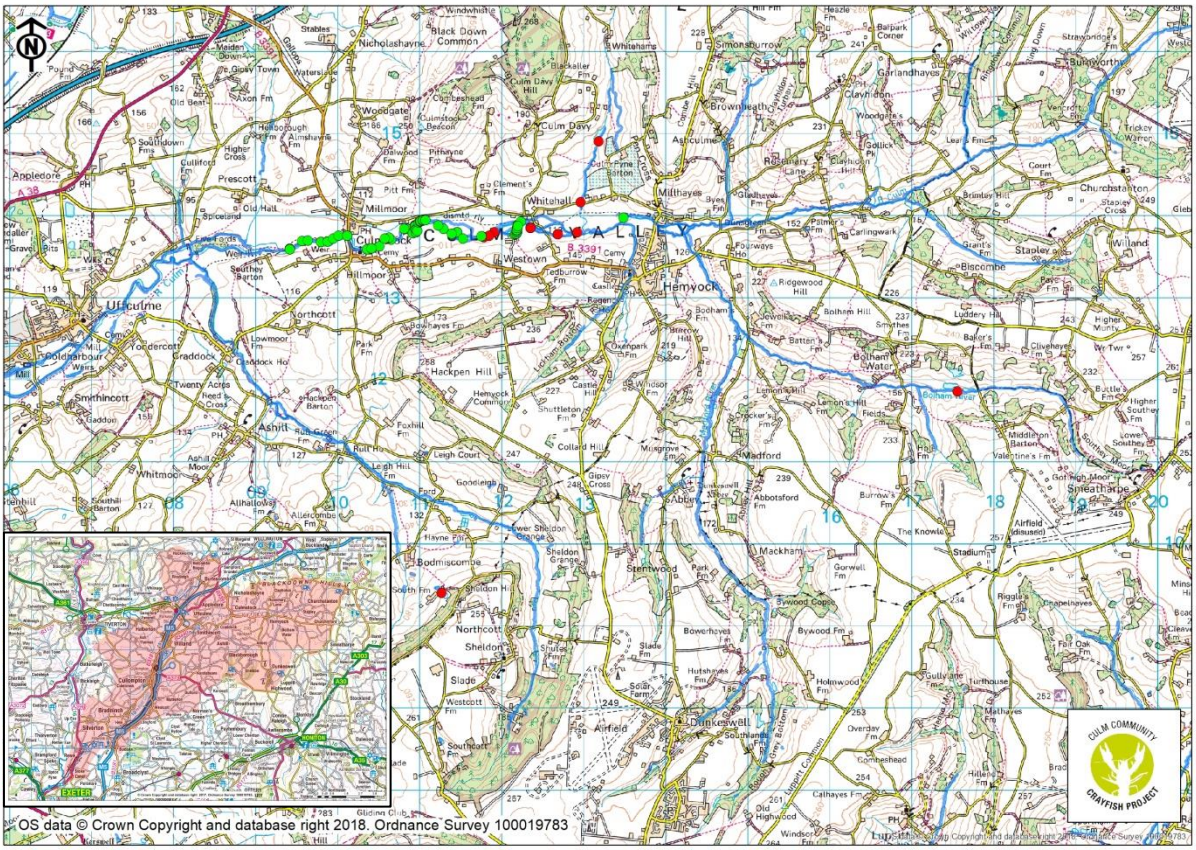


Figure 2. Upper Culm crayfish data to Oct 2017 (catchment map inset)

3.2 Field Survey

A total of 27km of river (53 survey reaches) was surveyed between mid-April and late October, covering 12.5km of the Culm, 8km of the river Madford and 6.5km of Bolham Water. The surveys ended in the headwaters of each watercourse when they became too small and shallow to survey. Only four ponds were surveyed (see *Limitations,* Section 2.5) though several other crayfish sightings in ponds were confirmed after talking to the landowners.

3.3 River reaches

3.3.1 *River Culm*

The survey confirmed the continuing presence of white-clawed crayfish, being recorded in an additional four sites extending 2km farther downstream than previously recorded; unfortunately a new population of signal crayfish was also recorded in the Uffculme area at this downstream

limit of the population, albeit in low numbers. An eDNA survey of the Sheldon Stream, which enters the river Culm just upstream of this population, was negative for both signal and white-clawed crayfish. At the upstream end of the population it was found that white-clawed crayfish had disappeared from 1km of river, being replaced by signal crayfish whose population has expanded roughly 1.5km up and 1km down river. They were also found to be in a leat that runs parallel to the main river in this area.

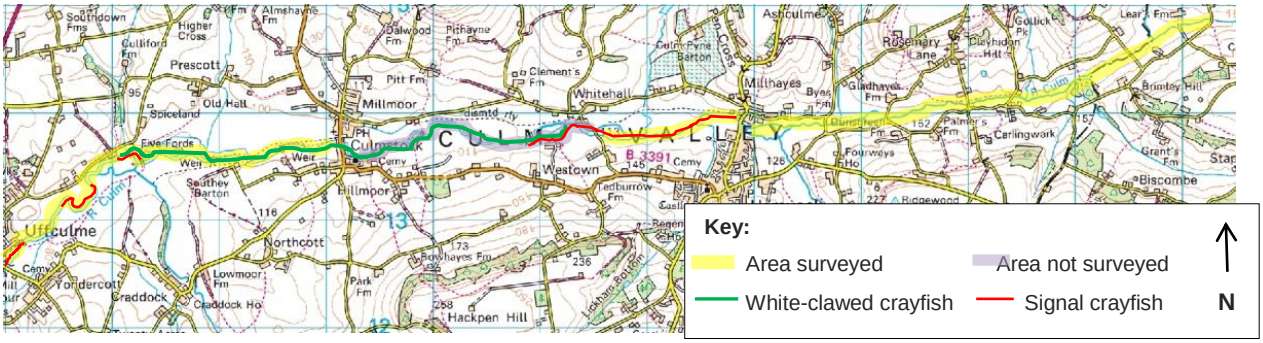


Figure 4. Survey results River Culm

3.3.2 *Madford River*

The Madford river was found to support signal crayfish in six of 16 survey reaches (approximately 3km length), with the most downstream occurrence being roughly 1.5km from the confluence with the Culm and 250m from the confluence with the Bolham Water. One source of the population is believed to be an old trout farm , now a carp fishery at ST 14602 11837, consisting of five ponds adjacent to the river (Figure 5). The owners reported seeing crayfish amongst bought-in trout fry some 30 years ago. This source is located towards the downstream extent of the population; since crayfish tend to spread more rapidly downstream than up there may be a second source of crayfish farther upstream. This population was eDNA tested and crayfish plague DNA was recorded. The watercourse tested negative for white-clawed crayfish eDNA.

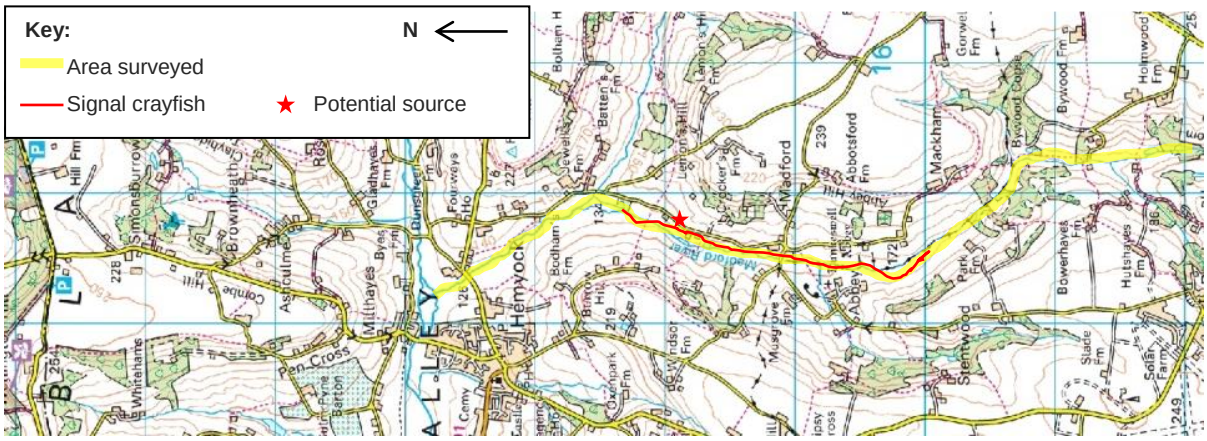


Figure 5. Madford River survey results

3.3.3 *Bolham Water*

Signal crayfish were recorded along the majority of the Bolham Water, being recorded at 9 of 13 reaches surveyed. The population extends to within 2km of the confluence with the Culm and 1.2km of the confluence with the Madford (Figure 6). It is likely that there are two sources of this population. One is a fishery roughly in the mid-point of the population whilst farther upstream the crayfish reach very high density, implying that there is a secondary source higher up the catchment, and there are two ponds in the area that may have acted as a source. This population was eDNA tested and no white-clawed crayfish or crayfish plague DNA was recorded.

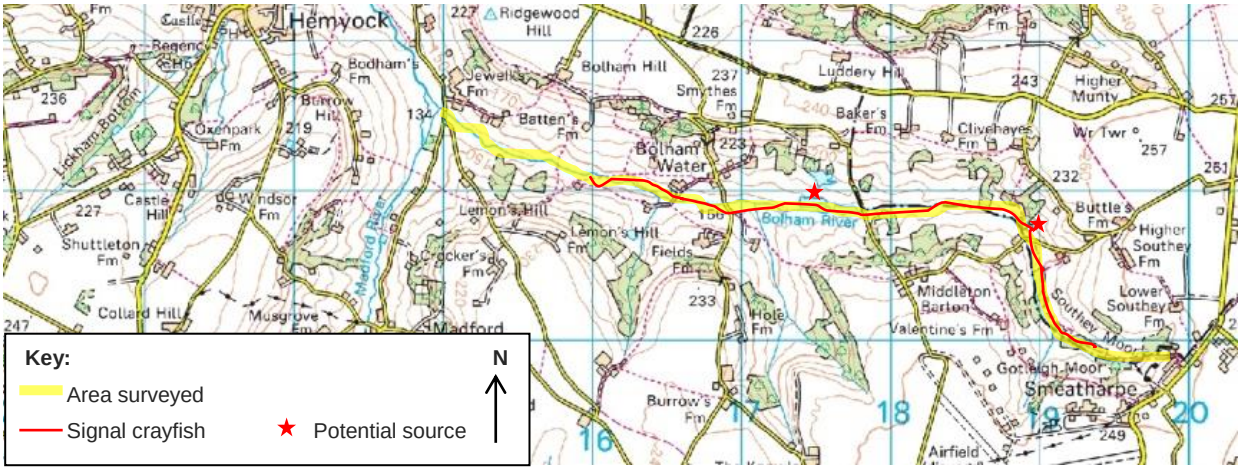


Figure 6. Bolham Water survey results

3.4 Pond sites

Due to time constraints only four ponds at two sites were surveyed. These were at Lakeview Manor, at the headwaters of the Madford River (ST 15133 07777) and at the Kingsmead Centre on the Willtown tributary (ST 18129 16716), a potential ark site (refer to Section 6.1). In both cases the first trapping session was negative and after discussing the matter with the site owners it was decided that the presence of signal crayfish was highly unlikely.

4 Discussion

It is clear that the white-clawed crayfish population is under severe and imminent threat. Signal crayfish are mixing with and replacing the population at its upstream limits whilst a second population is expanding upstream and mixing with white-clawed crayfish at the downstream end of its range (Figure 4). Furthermore there are two additional populations in tributaries which are expanding downstream towards the main river, one of which carrying the crayfish plague pathogen (refer to Appendix 1 for a summary of all data).

White-clawed crayfish are highly susceptible to crayfish plague and usually suffer 100% mortality within days of becoming infected (Holdich et al, 2009). Consequently, once they become infected the white-claw population will become extinct on the River Culm. Crayfish plague can be transmitted directly from crayfish to crayfish, and it is possible that within 3-5 years, infected crayfish from the Madford River will be in the main Culm and in contact with, and thereby infecting, the signal crayfish at Hemyock and white-clawed crayfish immediately downstream. The pathogen is also spread on fish and via spores into the water released by host animals (Strand et al 2014), so infection could occur at any time.

Crayfish plague is frequently spread on clothing and angling equipment so its presence in the Culm catchment also presents a risk to other populations of white-clawed crayfish through being spread to other areas as a result of recreational activities such as angling. The current level of angling and biosecurity practices at the potential source site on the Madford (Figure 5) are unknown, but movements out of this site could present a considerable biosecurity risk.

In the absence of plague infection, white-clawed crayfish will slowly be lost to out-competition with the expanding populations of signal crayfish as is already being observed. As crayfish from the Bolham and Madford expand into the main Culm the greatly increased population will cause increased losses through out-competition and predation. In addition the increased density of signal crayfish will stress these animals, making them more likely to release plague spores and cause an outbreak.

The presence of signal crayfish is also likely to have detrimental effects on the ecosystems of the catchment over the long term. These effects include loss of invertebrate biodiversity and biomass, direct and indirect impacts on fish and increased siltation and bank collapse as a result of burrowing activities.

6 CONCLUSIONS & RECOMMENDATIONS

6.1 Ark sites for white-clawed crayfish

In the absence of a quick and effective method of signal crayfish control (Section 6.3) the best way of securing the future of the Culm white-clawed crayfish is to establish populations in safe locations away from the river – ark sites. Luckily a small number of animals from this population have been captive bred and a broodstock is currently held at Bristol Zoo. New populations can be established using both captive bred and wild caught animals (providing the latter have not been exposed to crayfish plague).

Ark sites can be a still-water such as a pond, flooded quarry or a river or stream. Among the criteria required are suitable water quality, good habitat, adequate food supplies and a lack of invasive crayfish and predatory fish. They must also be safe from alteration or changes to ownership in the long term. An ark site in a pond was established nearby and stocked with white-clawed crayfish taken from the Culm in 2011. The crayfish thrived until 2018 when it became apparent that carp *Cuprinus sp.* had been introduced. Monitoring in autumn 2018 failed to find any crayfish so it is assumed that the population has been predated by the carp. Initial investigations of small, headwater tributaries of the Culm catchment have found water quality and/or habitat to be unsuitable. In addition the risk of crayfish plague being moved upriver by fish or otters could be considerable. However there are large numbers of ponds in the catchment that may offer suitable conditions for ark site establishment.

It is recommended that work commences as soon as possible on locating and assessing potential ark sites. Ideally at least two ark sites should be established in the event of one or more failing as has been the case to date. Funding will be required to cover the cost of the assessments which includes water quality monitoring, fish, crayfish and invertebrate surveys and habitat assessment/enhancement, plus the support of captive breeding efforts at Paignton and Bristol Zoos.

6.2 Monitoring

Regular annual monitoring of the signal and white-clawed population is also recommended. This should cover the downstream edges of the Madford and Bolham signal crayfish populations to monitor and hopefully predict their rate of downstream expansion. Additionally the current up and downstream limits of the white-clawed crayfish population should be monitored for signs of further decline, plague infection and the upstream migration of signal crayfish from the Uffculme area. This population of signal crayfish should be surveyed, working

downstream, in order to establish the source. It is possible that the animals encountered are the upstream edge of a population expanding upstream from lower down on the main Culm. Careful timing and high levels of biosecurity will be required to prevent the spread of plague between the various populations.

6.3 Control of signal crayfish

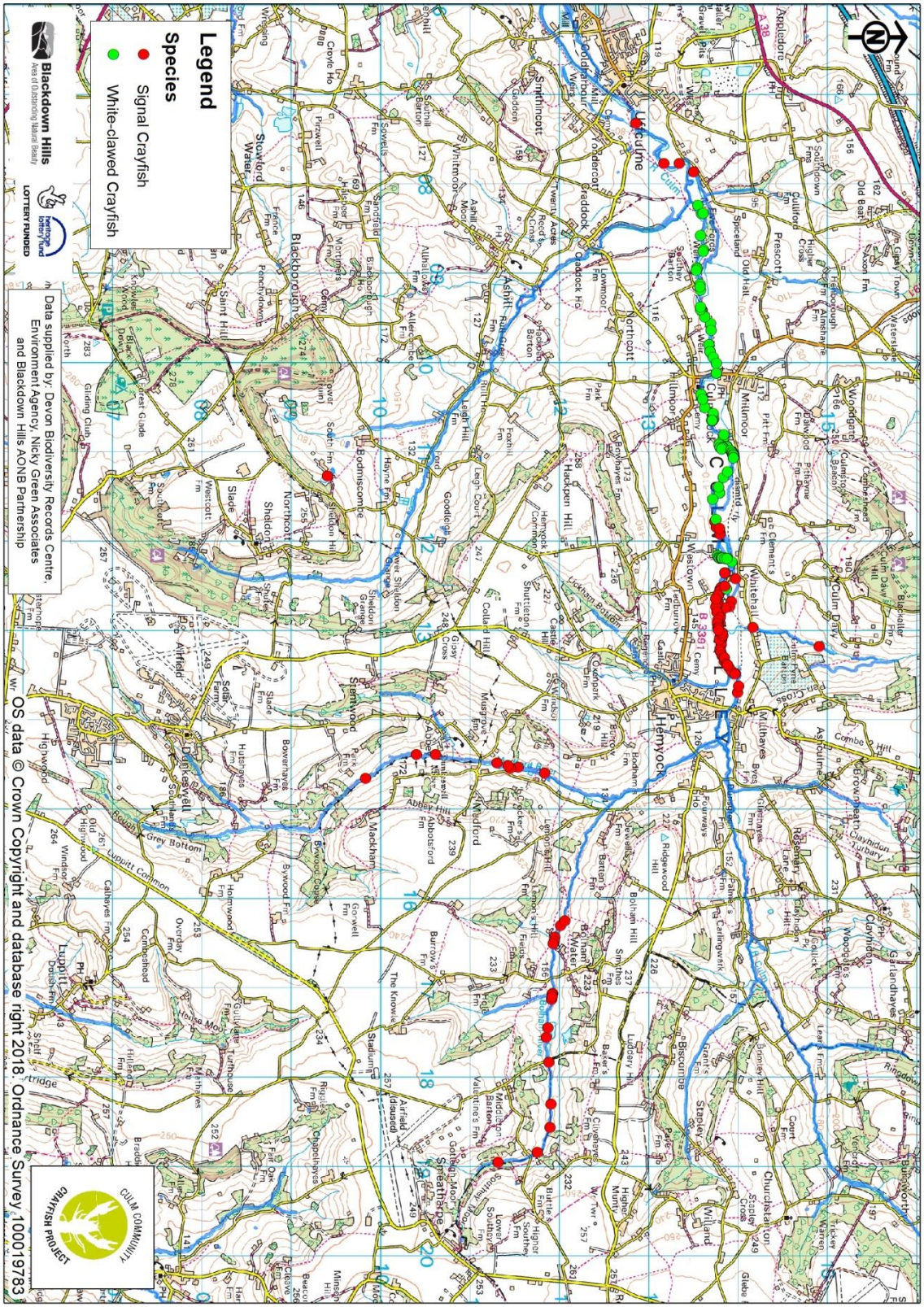
Various methods of signal crayfish control have been trialled with limited success; however research is ongoing and a suitable method may be available in the short to mid term. One option is a biocide being developed by the Centre for Environment, Fisheries and Aquaculture Science which may be available within 2-3 years and could be applied to the Bolham and Madford populations but not the Culm itself as the chemical would also be lethal to white-clawed crayfish. Another is the sterilisation of large males, which is still undergoing trialling but could potentially be applied to the leading edge of the Madford/Bolham population to prevent it moving further downriver, or to signal crayfish at the up and downstream limits of the white-clawed population to prevent further losses through competition. This option would require a time commitment of at least 5 years.

7 REFERENCES

Holdich, D. M., Reynolds, J. D., Souty-Grosset, C., & Sibley, P. J. (2009). A review of the ever increasing threat to European crayfish from non-indigenous crayfish species. *Knowledge and management of aquatic ecosystems*, (394-395), 11.

Strand, D. A., Jussila, J., Johnsen, S. I., Viljamaa-Dirks, S., Edsman, L., Wiik-Nielsen, J, & Vrålstad, T. (2014). Detection of crayfish plague spores in large freshwater systems. *Journal of Applied Ecology*, *51*(2), 544-553.

APPENDIX 1 – Crayfish distribution October 2018


Legend
Species
Signal Crayfish
White-clawed Crayfish
Data supplied by: Devon Biodiversity Records Centre, Environment Agency, Nicky Green Associates and Blackdown Hills AONB Partnership
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