

## 2016 Update on the White-clawed Crayfish Population within the Wyre Forest

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### Introduction

This year was the seventh year of a programme of annual monitoring of the native White-clawed Crayfish *Austropotamobius pallipes* population in four tributaries of Dowles Brook. The study started in 2010 following the discovery of White-clawed Crayfish in a small stream in the forest. During 2016 all four watercourses were re-surveyed as part of the monitoring programme and this article gives a summary of the findings of the work.

White-clawed Crayfish are classified as Endangered in the IUCN Red List of Endangered Species and their populations are declining throughout much of their range. It is predicted that the species will face extinction in much of their former range within the next few decades. White-clawed Crayfish populations are under threat from: (i) a fungal-like disease, 'crayfish plague'; (ii) direct competition from introduced alien crayfish species; and, (iii) biochemical degradation of lotic/lentic habitats. White-clawed Crayfish are protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended). As an Annex II species under the Habitats Directive, member states are required to maintain favourable conservation status through the selection of a series of European Sites. The White-clawed Crayfish is listed as a Species of Principal Importance in England under Section 41 of the NERC Act 2006 and is a Priority species in the UK Biodiversity Action Plan (BAP). The UK BAP seeks to maintain the current distribution of the species through a combination of restricting the spread of non-native crayfish and crayfish plague, as well as providing suitable habitat features.

### Method

A detailed description of the survey methods are given in the annual Wyre Forest Study Group Reviews for 2010, 2011 and 2012. The daytime manual search of suitable refugia and night-time torching of the watercourses followed published guidelines and best practice (Peay 2002). The daytime manual search provides information on relative abundance and population structure, including size distribution and sex ratio. The night-time torching is a more accurate reflection of the abundance of active animals.

The 2016 survey replicated (as closely as possible) the previous year's surveys with a similar team of surveyors, the same number and start and end points of each sample patch and the same amount of survey effort. The 2016 survey patches started within 1m of the location of the start of the 2015 survey patches. All survey work was undertaken by two licensed surveyors

and several assistants between the 25 July and 19 August 2016. Mike Averill, Ann Hill, Graham Hill and Jane Scott (from the 2010 core team of surveyors) undertook the monitoring surveys of Bell Brook and Forest Lodge Stream assisted by Alice James, Caroline Savage, Jessica Stuart-Smith, Kari-Anne Heald and Natalie Walsh. Survey work in Kingswood Stream and Longdon Stream was undertaken by Kathryn Hughes and Graham Hill who have undertaken the monitoring since the study began in 2011. Any crayfish found during casual searches (defined as not the standard or torching survey methods) of the watercourse, or on or near the bank, were recorded separately.

Comparison of the observations across the years is interpreted using Catch per Unit Effort (CPUE) data as an index for the long-term monitoring of the crayfish populations. Monitoring observations included all crayfish (dead or alive). For the purpose of the comparison across years, the CPUE was calculated using only the live observations. Standard units were used i.e. one minute time periods, one refuge searched by hand and/or one baited trap. Differences in live observations across the years were investigated using the one-tailed t-Test to compare the CPUE data from both the standard and torching surveys during the six years 2010 to 2016 inclusive.

### Results

The 2016 monitoring survey results are displayed in Figure 1 and the details are described in the following text.

### Habitat

Water levels were extremely low in all watercourses this year with parts of banks and bed exposed and a reduced width of wetted channel in many areas. Water clarity in all watercourses was good with 100% bed visibility.

All four watercourses were found to have a suitable combination of in-channel and bank-side habitat. There was little observed change in crayfish habitat along Bell Brook and Forest Lodge Stream. Bell Brook continued to support excellent and abundant in-stream refugia and frequent inaccessible refugia in tree roots and between rocks in the bank. Forest Lodge Stream continued to have abundant bank-side habitat (undercut banks, large tree roots) and locally abundant in-stream habitat (boulders, cobbles, tree roots, debris dams). Large woody debris remained abundant in the upper reaches. The survey of Kingswood Stream found that flow was low and bed visibility was good for much of the stream and better than in previous years. Longdon Stream conditions were good: water levels were low and visibility to the stream bed was good.

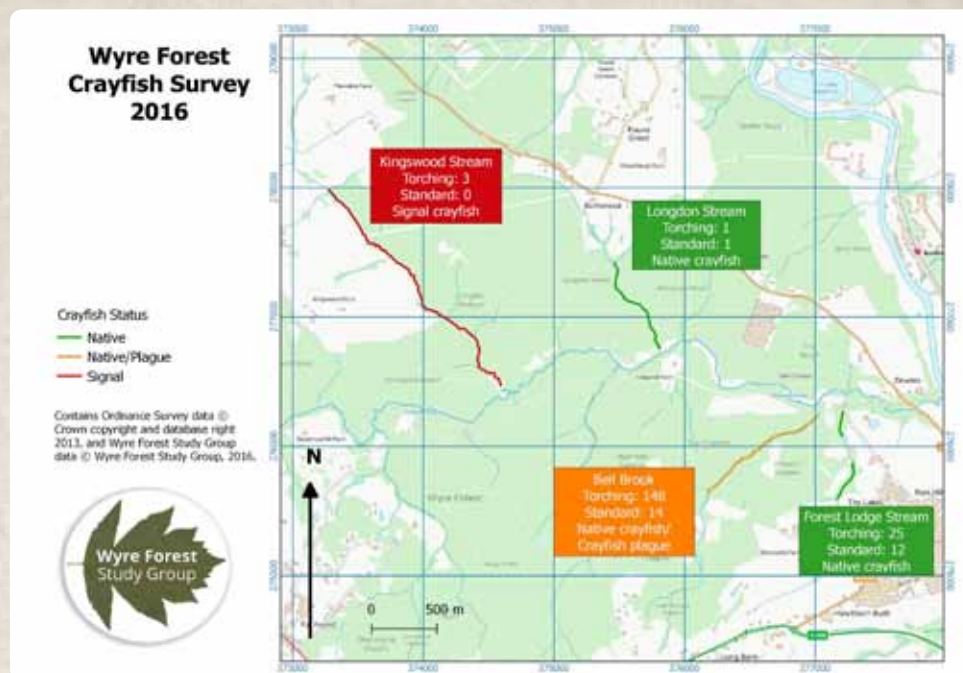


Figure 1. The location of the individual watercourses in the Wyre Forest showing the results of the 2016 survey

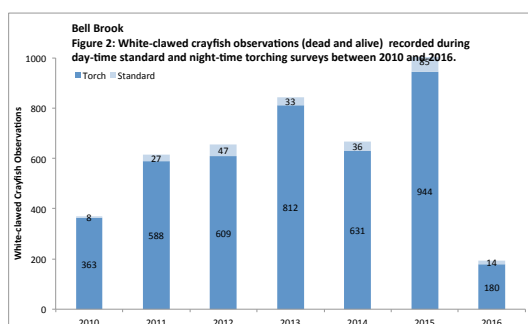
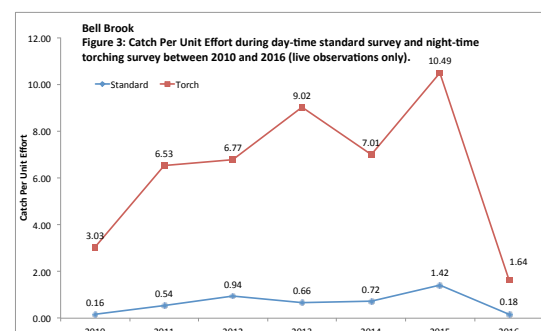
## Bell Brook

Male and female, adult and juvenile White-clawed Crayfish were found to be present in Bell Brook. However, in 2016 there was a decrease in White-clawed Crayfish observations made during both standard and torching surveys, Figure 2. Both daytime survey and torching survey observations were less than 20% of the previous year's observations. The maximum count was of 180 White-clawed Crayfish (148 live crayfish plus 20 dead adults and 12 dead juveniles) recorded during one torching survey of Bell Brook: this being the lowest count of all monitoring years to date and the first year that any White-clawed Crayfish had been found dead in the watercourse. The daytime survey of fourteen observations included three dead White-clawed Crayfish.

The abundance of active White-clawed Crayfish in Bell Brook, calculated as the Catch Per Unit Effort (CPUE) statistically significant decreased in 2016. The torching

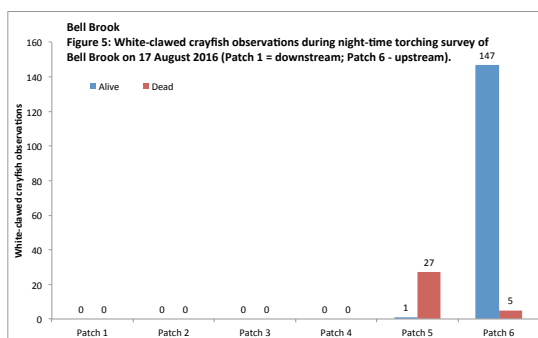
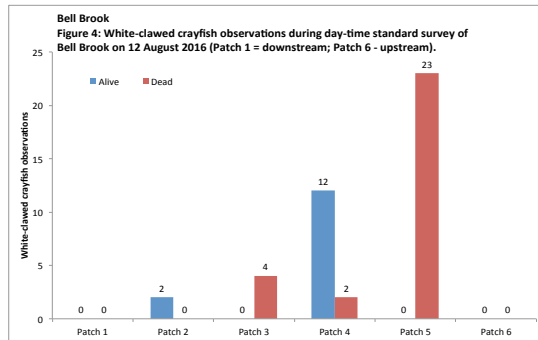
results indicated the significantly lowest crayfish abundance of the seven years 2010 to 2016 inclusive ( $t = 5.60735$  One-tail,  $n = 6$ ,  $P = <0.05$ ). The standard survey showed the significant second lowest abundance of crayfish across the seven years 2010 to 2016 inclusive ( $t = 5.40295$  One-tail,  $n = 6$ ,  $P = <0.05$ ). Figure 3.

The standard daytime survey undertaken on 12th August was the first year since the study had begun when dead and moribund individuals (male and female,



adult and juvenile) had been recorded in Bell Brook, Figure 4. Many of the alive and moribund White-clawed Crayfish appeared to be acting strangely with disorientated movements and abnormal behaviour. White-clawed Crayfish were also recorded on the banks.

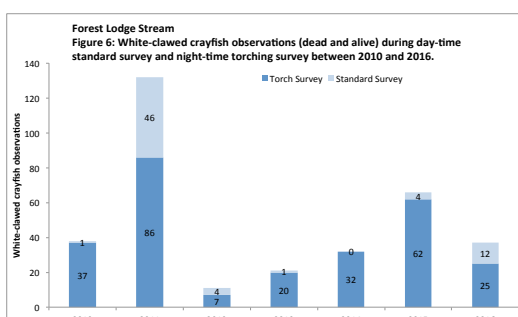
By the time the night-time torching survey was undertaken five days later on 17th August there was no evidence of White-clawed Crayfish in the four downstream survey patches and an increased number



of dead White-clawed Crayfish in Survey Patches 5 and 6, Figure 5. In Survey Patch 5 there was 20 adults (19 dead and one alive) plus eight dead juveniles. In Survey Patch 6 there was 77 adults (2 dead and 75 alive) plus 75 juveniles (3 dead and 72 alive).

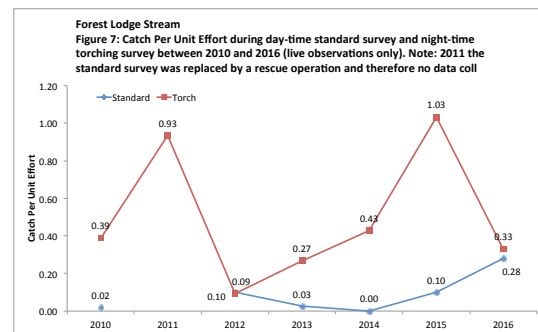
## Forest Lodge Stream

Male and female, adult and juvenile White-clawed Crayfish were found to be present in Forest Lodge Stream: this included two dead White-clawed Crayfish that were recorded in Forest Lodge Stream; one on each survey visit. White-clawed Crayfish records had a maximum count of 25 White-clawed Crayfish (5 live adults, 1 dead adult and 19 alive juveniles) recorded during one torching survey of Forest Lodge Stream, Figure 6. Excepting the rescue operation in 2011, the standard daytime survey recorded the highest number of White-clawed Crayfish of all the monitoring years.



Comparison of the CPUE results across the years indicated statistically significant differences in White-clawed Crayfish abundance in Forest Lodge Stream (standard surveys:  $t = 2.10399$  One-tail,  $n = 5$ ,  $P = <0.05$ ); and torching surveys: ( $t = 3.75357$  One-tail,  $n = 6$ ,  $P = <0.05$ ) between 2010 and 2016, Figure 7.

Male and female White-clawed Crayfish with a wide range of carapace sizes (between 14.5mm to 40.5mm carapace length) were present in Forest Lodge Stream

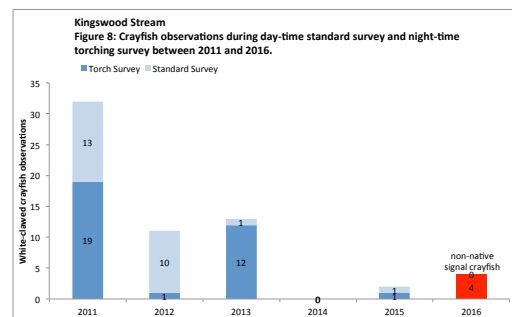


in 2016. Eight female White-clawed Crayfish (five juvenile, two live adults and one dead female adult) and two male adults were caught during the standard survey of 2016; two White-clawed Crayfish escaped capture. 22 juvenile and 40 adult (including one dead adult) White-clawed Crayfish were recorded during the night-time torching survey.

## Kingswood Stream

The survey of Kingswood stream on 26th July 2016 found that flow was low and bed visibility was good for much of the stream and better than in previous years.

No evidence of native or non-native crayfish was found during the standard daytime survey. During the torching survey on the same night American Signal Crayfish *Pacifastacus leniusculus* were found below the bridgeway crossing, Figure 8. Three adult female American Signal Crayfish were found with the fifteen minutes of torching downstream of the bridgeway crossing and a further adult female American Signal



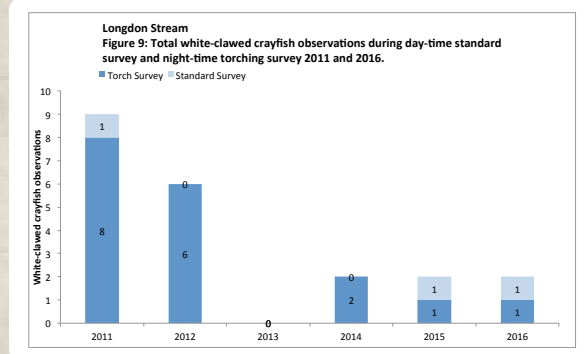
Crayfish was seen in the watercourse downstream to the Experimental Pool. Carapace sizes ranged between 36.5mm to 42.5mm carapace length.

No evidence of White-clawed Crayfish was found in Kingswood Stream in 2016. Monitoring has shown a steady decline in native crayfish numbers in Kingswood Stream from the maximum count of 19 White-clawed Crayfish recorded during a night-time torching survey in 2011. Last year one White-clawed Crayfish was recorded.

## Longdon Stream

On 25th July 2016 one female adult White-clawed Crayfish (33.8mm carapace length) was found during the torch survey, Figure 9. No crayfish were caught during the hand searching although one White-clawed Crayfish escaped capture.

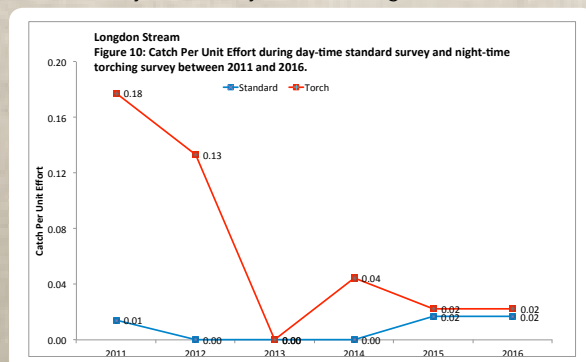
The CPUE across the years is shown in Figure 10. There was a statistically significant difference between the standard CPUE during the seven years 2010 to 2016



inclusive ( $t = 2.07457$  One-tail,  $n = 5$ ,  $P = <0.05$ ) and between the torching CPUE during the same seven years ( $t = 2.19307$  One-tail,  $n = 5$ ,  $P = <0.05$ ).

## Discussion

Following on from six years of positive reporting, the seventh annual monitoring survey revealed a depressing picture for the future of the native White-clawed Crayfish in Wyre. It is of great concern and



incredibly disappointing that the report describes the arrival of crayfish plague *Aphanomyces astaci* in one (possibly two watercourses) and American Signal Crayfish *Pacifastacus leniusculus* in another watercourse.

Soon after starting the surveys in Bell Brook it was apparent that there was a negative change to the White-clawed Crayfish population in the stream. Dissolved oxygen levels were measured and found to be on the low side (~80%) but there was no immediate evidence of a cause of mortality. Several White-clawed Crayfish carcasses were collected and the incident was reported to the Environment Agency (EA) Incident Line. The EA visited the site on and took some invertebrate samples to analyse in the laboratory. *Gammarus*, mayfly and stoneflies were found alive in expected numbers so Bell Brook had not been impacted by pesticide pollution. The EA sent some dead White-clawed Crayfish to The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) for analysis and it was confirmed by CEFAS that crayfish plague was present in the Bell Brook. Crayfish plague spores can be transmitted in water, on damp equipment or on any wet item that comes into contact with contaminated water and on wild animals. The spores can live for 22 days on damp clothes or equipment or in water. As the spores multiply within the crayfish and are then released into the water, the plague can last for several weeks or months. The plague will cease when there are no more remaining crayfish hosts in close proximity to each other. The spores are likely to become less infectious as water temperatures decline during the autumn. It is unknown where the current outbreak of crayfish plague has been transferred from. Infected crayfish reach new localities by natural migration, intentional transport by people, unintentional transfer by people and crayfish predators. Dead crayfish are soon predated upon by other aquatic animals and in particular by birds: this forms a possible route of transmission via contaminated feathers and feet.

Stress from low water levels, increased water temperature and increasingly high White-clawed Crayfish population density in Bell Brook may have made the population vulnerable to crayfish plague. It has to be hoped that a few White-clawed Crayfish individuals will survive in Bell Brook although realistically crayfish plague is known to be highly infectious and has the potential to devastate a whole crayfish population.

Forest Lodge Stream had both male and female White-clawed Crayfish of a range of sizes from juvenile to adult. It is uncertain whether the few dead White-

clawed Crayfish found in Forest Lodge Stream were the result of flow conditions or are a consequence of crayfish plague. Forest Lodge Stream has been found throughout the monitoring study to have a variable population abundance related to high and low flow conditions.

American Signal Crayfish were found in **Kingswood Stream**. The confluence of Kingswood Stream and Dowles Brook is approximately 360m downstream of the known location of American Signal Crayfish. In 2014 ten baited traps were set at Mercian Way bridge junction with Dowles Brook and nineteen adult female and eleven adult male American Signal Crayfish were caught (Hill 2014). Survey work for non-native crayfish in Wyre has always been limited because of the implications of catching any non-native species i.e. not being able to return the animal to the wild. It is thought highly likely by the author that American Signal Crayfish are present further downstream of Mercian Way but have just not been recorded. It is probable that the artificial boulder strewn channel/culvert near the confluence of Kingswood Stream and Dowles Brook has been ineffective as a barrier against upstream migration of the American Signal Crayfish from Dowles Brook. Once established any efforts to eradicate American Signal Crayfish by trapping or intensive manual removal is likely to be unsuccessful. American Signal Crayfish grow faster, are more fecund, more aggressive and are tolerant of a wider range of conditions than the White-clawed Crayfish, and

therefore out-compete the native species (<http://www.nonnativespecies.org/factsheet/factsheet>). They feed on fish and amphibian eggs, tadpoles, juvenile fish, aquatic invertebrates, detritus and aquatic vegetation and so may reduce populations of native species and affect food webs. Community diversity and richness are lower, and food webs are altered at sites containing American signal crayfish.

The small population of native White-clawed Crayfish in **Longdon Stream** appears unchanged in 2016 but continues to give cause for concern.

The programme of annual monitoring is planned to continue in 2017. There is a need to establish the status of the native population in Bell Brook and in Forest Lodge and to confirm the continuing small population in Longdon Stream. There are no plans at this stage to re-survey Kingswood Stream in 2017.

To summarise:

- Mass mortality of the White-clawed Crayfish population in Bell Brook confirmed to be due to crayfish plague *Aphanomyces astaci*.
- American Signal Crayfish *Pacifastacus leniusculus* were found in Kingswood Stream.
- The health of the White-clawed Crayfish population in Forest Lodge Stream is uncertain: dead and alive crayfish found.



Healthy male White-clawed Crayfish

Ann Hill



Dead and moribund native crayfish

Ann Hill



Dead male and female native crayfish

Ann Hill

- The small population of White-clawed Crayfish in Longdon stream appeared unchanged.

It is very important to note that the White-clawed Crayfish populations in Wyre remain vulnerable to extinction. The presence of crayfish plague and American Signal Crayfish indicates that the native White-clawed Crayfish population of Wyre is in an unfavourable condition. It is to be hoped that the programme of monitoring surveys is not recording the demise of the White-clawed Crayfish in the Wyre Forest.

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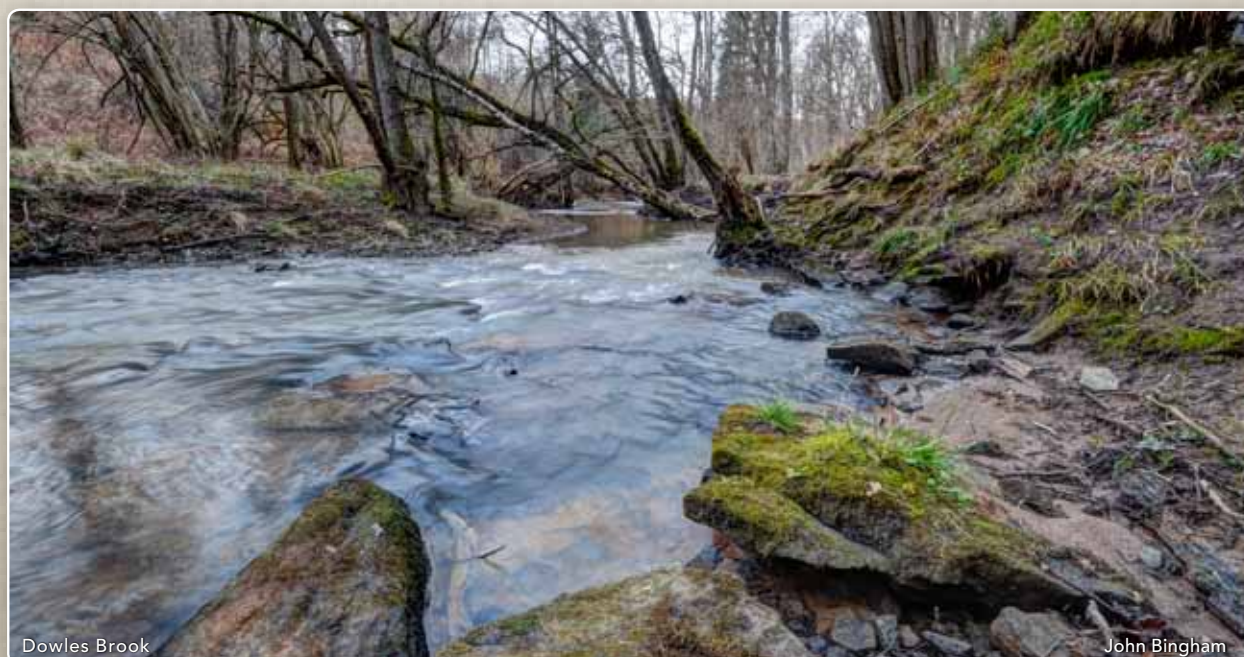
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Dowles Brook

John Bingham