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White-Clawed Crayfish in Wyre 2023

INTRODUCTION

Members of the Wyre Forest Study Group began a programme of annual surveys for crayfish in the Wyre Forest in 2010 (Hill, 2011). A catchment wide survey was undertaken in 2011 as part of the Grow with Wyre Project (Hill and Hill, 2012). Night-time torching and daytime surveys, by hand, showed that White-clawed Crayfish were present in only four streams; that Signal Crayfish were present in many other streams and crayfish appeared to be absent from other streams.

White-clawed Crayfish (*Austropotamobius pallipes*) have probably been present in the streams of Wyre for many centuries (Kouba *et al.*, 2015), They are Britain's only native species of crayfish. Preferring waterbodies with clean water, the streams of Wyre would have been ideal places for them to proliferate. Signal Crayfish (*Pacifastacus leniusculus*) were introduced to Britain as a food crop in the 1970s and since then have both escaped into the wild and out-competed White-clawed Crayfish. They have become, arguably, Britain's dominant species of crayfish.

Annual surveys of the streams with White-clawed Crayfish were conducted from 2010 to 2023 (Table 1). Initially, high powered torches were used at night to count native crayfish in streams where they were known to persist. The number of streams with White-clawed Crayfish reduced over the years although Bell Brook held a nationally important population until 2016. At this time Crayfish Plague (*Aphanomyces astaci*) arrived in Bell Brook and every White-clawed Crayfish in Bell Brook perished. Crayfish Plague is fatal to White-clawed Crayfish and is often introduced by the invading Signal Crayfish although no Signal Crayfish have ever seen in Bell Brook.

Following the loss of White-clawed crayfish from Bell Brook in 2016 only one stream was known to retain a population of native crayfish. That stream has many positive characteristics for crayfish; it is a small stream with clear water, hosts a wide variety of habitats, has plenty of cover and is rather inaccessible. Whist this makes surveying a real challenge it also means that visitors, dogs, cyclists *et al.* are less likely to disrupt the crayfish.

The annual surveys were not conducted in 2020 or 2021 because of the restrictions imposed by the COVID-19 Pandemic.

In 2022 eDNA surveys were used to investigate whether native crayfish were still present in Forest Lodge Stream.

The aim of the 2023 survey was to determine if Native Crayfish were still present in Forest Lodge Stream and to establish the crayfish status of Bell Brook. Surveys of Bell Brook after 2016 had not found any crayfish although it was assumed that Crayfish Plague persisted. If the plague had burnt itself out and there were no Signal Crayfish in Bell Brook there was a possibility that a re-introduction could

Table 1. Crayfish status of Wyre Forest Streams from 2011 to 2023.

	Bell Brook	Forest Lodge	Kingswood Stream	Longdon Stream	Dowles Brook	Primary method
2010	Native	Native	No survey	No survey	No survey	Torching
2011	Native	Native	Native	Native	Signal	Torching
2012	Native	Native	Native	Native	No survey	Torching
2013	Native	Native	Native	Native	No survey	Torching
2014	Native	Native	None	Native	Signal	Torching
2015	Native	Native	Native	Native	No survey	Torching
2016	Plague	Native	Signal	None	No survey	Torching
2017	Plague	Native	Signal	None	No survey	Torching
2018	Plague	Native	Signal	Plague	No survey	Torching
2019	None	Native	No survey	No survey	No survey	Torching
2020	No survey	No survey	No survey	No survey	No survey	No survey
2021	No survey	No survey	No survey	No survey	No survey	No survey
2022	No survey	Native	No survey	No survey	No survey	eDNA
2023	Signal & Plague	Native & Plague	No survey	No survey	No survey	eDNA

be considered, therefore a check for Native, Signal and Plague DNA was planned.

LOCATION

Appropriately accessible locations at the lower ends of both Forest Lodge Stream and Bell Brook were identified and permission obtained from the land owners for water samples to be collected.

METHOD

On 1st September 2023 the sites on Forest Lodge Stream and Bell Brook were visited by the author and Mike Averill. Water samples were collected from each site (one by each person to avoid cross-contamination) following the methods developed by SureScreen Scientifics.

SureScreen Scientifics have developed a sampling kit, protocol and analysis for Crayfish eDNA surveys (SureScreen Scientifics 2023) which was appropriate to our needs.

A site, suitable for collection of water samples, was identified on each stream. The site needed to be easily accessible, so that sample collections could be made from the bank; the stream to be sufficiently deep to collect 20 water samples from the centre of the water column without disturbing the bed (10cm suggested as the minimum depth) across a representative area of the streams.

A White-clawed Crayfish eDNA sampling kit was obtained from SureScreen Scientifics for each stream. The kit contained all of the required equipment, which was sealed and sterile:

1. Plastic ladle to collect water samples.
2. Pair of vinyl gloves.
3. One plastic bag.
4. One 50 ml syringe.
5. One small syringe of DNA preservative.
6. A sealed tube containing DNA filter and caps.

At each site, using the ladle provided in the sampling kit, twenty water samples were collected from the centre of the water column, in a zig-zag pattern working upstream. Each water sample was placed into the plastic bag, which was sealed and the contents shaken to thoroughly mix the water samples.

The 50 ml syringe and DNA filter were removed from their respective containers.

The 50 ml syringe was filled with water from the plastic bag; the DNA filter attached to the end of the syringe and the water gently, but firmly, ejected from the syringe through the DNA filter. The DNA filter was removed from the syringe so that the 50 ml syringe could be re-filled and the process repeated until 500 ml (ten syringes full) of water had been filtered through the DNA filter.

The 50 ml syringe was then filled with air which was forced through the DNA filter to remove any remaining water.

The contents of the DNA Preservative syringe were injected into the DNA filter which was then sealed at both ends with the seals provided. The DNA filter was placed into the transport container and the top secured.

The samples were stored overnight in a domestic fridge and sent, by courier, to SureScreen Scientifics for analysis on 4th September 2023.

RESULTS

The results of the analysis were received from SureScreen Scientifics on 13th September 2023.

Forest Lodge Stream

Analysis showed that both White-clawed Crayfish DNA and Crayfish Plague DNA was present in all of the 12 replicates analysed (Table 2).

Bell Brook

Analysis showed that there was no White-clawed Crayfish DNA in any of the 12 replicate samples. There was Signal Crayfish DNA in all 12 replicates and Crayfish Plague in 11 replicates (Table 3).

DISCUSSION

Table 2. Results of DNA analysis of water samples taken from Forest Lodge Stream on 1st September 2023.

RESULTS

Date sample received at Laboratory: 05/09/2023
Date Reported: 13/09/2023
Matters Affecting Results: None

Lab Sample ID.	Site Name	O/S Reference	Species	Result	SIC	DC	IC	Positive Replicates
FK1509	Forest Lodge Stream	SO 77227 76366	*White-Clawed Crayfish*	Positive	Pass	Pass	Pass	12
			Crayfish Plague	Positive	Pass	Pass	Pass	12

Table 3. Results of DNA analysis of water samples taken from Bell Brook on 1st September 2023.

RESULTS

Date sample received at Laboratory: 05/09/2023
Date Reported: 13/09/2023
Matters Affecting Results: None

Lab Sample ID.	Site Name	O/S Reference	Species	Result	SIC	DC	IC	Positive Replicates
FK1508	Bell Brook	SO 76933 76166	*White-Clawed Crayfish*	Negative	Pass	Pass	Pass	0
			Signal Crayfish	Positive	Pass	Pass	Pass	12
			Crayfish Plague	Positive	Pass	Pass	Pass	11

Forest Lodge Stream

Analysis showed that water samples from the lower end of Forest Lodge Stream contained DNA from both Native Crayfish and from Crayfish Plague. In the previous year (2022), samples obtained under similar conditions, had showed that only DNA from Native Crayfish was present (Hill, 2023). The 2023 result suggests that, during the intervening 12 months, Crayfish Plague had arrived in Forest Lodge Stream.

Crayfish Plague is always fatal to White-clawed Crayfish (Kouba *et al.,* 2015), making this finding potentially disastrous for the native crayfish. The samples submitted for analysis comprised of water that had mixed as it flowed downstream over a distance of at least 1km therefore, White-clawed Crayfish and Crayfish Plague may exist in separate locations. There are several scenarios in which DNA from both White-clawed Crayfish and Crayfish Plague might be found together:

a. White-clawed Crayfish persist upstream of an area where Crayfish Plague is found.

b. Crayfish Plague exists in the whole water course and the White-clawed Crayfish DNA is from deceased native crayfish.

c. Crayfish Plague and White-clawed Crayfish exist in the same reach (which is unlikely).

Bell Brook

Analysis of the water sample from Bell Brook showed that there was no White-clawed Crayfish DNA present in the samples. This is consistent with the assumption that all White-clawed Crayfish were wiped-out in 2016. Crayfish Plague DNA and Signal Crayfish DNA were both present in Bell Brook. Although Signal Crayfish have not been seen in Bell Brook before, they carry Crayfish Plague and their presence was not unexpected.

The presence of Signal Crayfish and Crayfish Plague rules out any possibility of re-introducing Native Crayfish to Bell Brook.

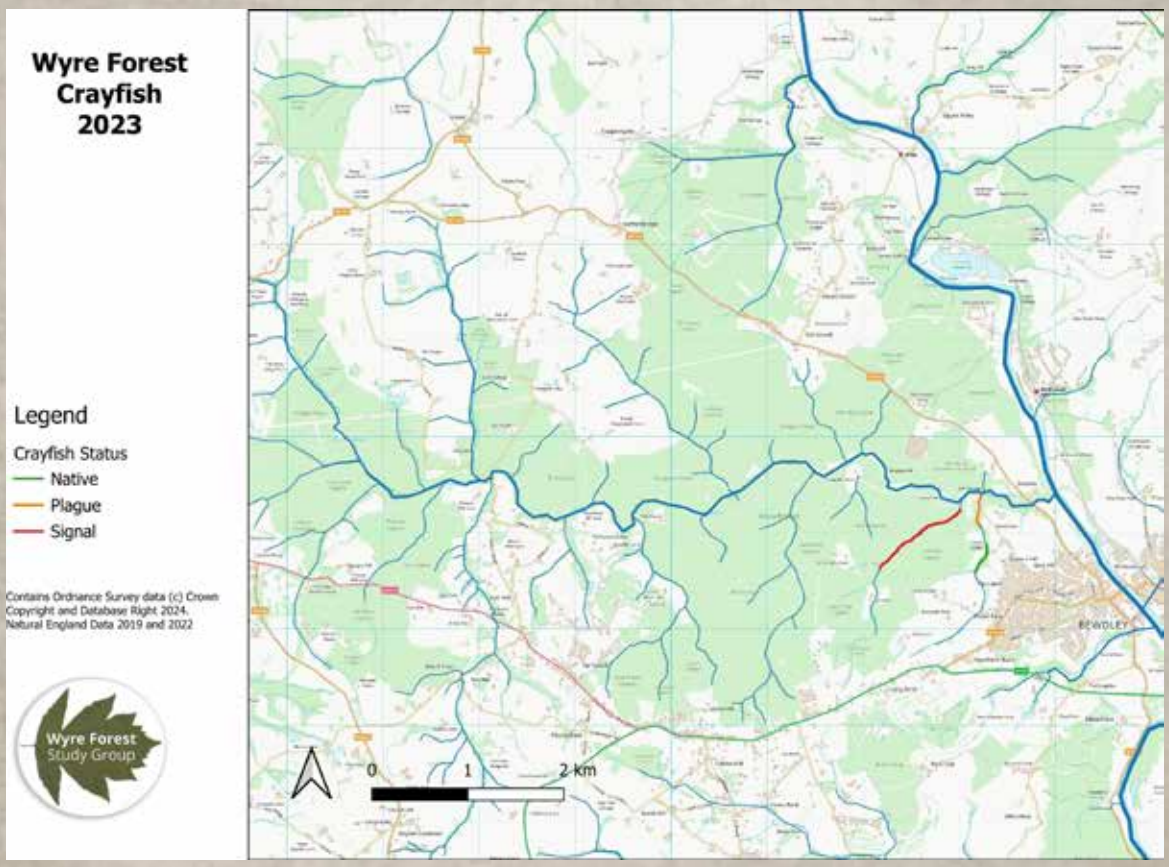


Figure 1. Wyre Forest streams showing results from eDNA sampling on 1st September 2023.

CONCLUSION

The results of the 2023 eDNA survey are very concerning. It would appear that the last remaining population of native White-clawed Crayfish in the Wyre Forest is under threat. Whilst it is possible that crayfish plague could be in the lower reaches of the stream and native crayfish persist in the upper reach, this is by no means certain. In the past, barriers to upstream movement of Signal Crayfish seemed only slow down their colonisation of streams with native crayfish.

Acknowledgements

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References

Hill, A. (2011) Atlantic Stream (White-clawed) Crayfish Austropotamobius pallipes in the Wyre Forest. *REVIEW*, 11, 3-9, Wyre Forest Study Group, Bewdley.

Hill, A. and Hill, G. (2012) Crayfish of Wyre Forest - an update. *REVIEW*, 12, 8-16, Wyre Forest Study Group, Bewdley.

Hill, G. (2023) White-clawed Crayfish in Wyre 2022. *REVIEW*, 23, 22 – 26, Wyre Forest Study Group, Bewdley.

Kouba, A., Buric, A. and Petrusek, A. (2015) Crayfish Species in Europe, In Kozák, P. & Duris, Zdenek & Petrusek, Adam & Buřič, Miloš & Horká, Ivona & Kouba, Antonín & Kozubíková-Balcarová, Eva & Policar, Tomas. (2015). *Crayfish Biology and Culture*. České Budějovice, Czech Republic.

SureScreen Scientifics Ltd. (2023) *Crayfish eDNA*. Available at: https://www.surescreenscientifics.com/forensic-ecology/white-clawed-crayfish/