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The Decline of the Native White-Clawed Crayfish in Wyre

In the 1950s and 1960s:

> '*it used to take half an hour to collect half a bucket of Crayfish for lunch*' and '*Every likely stone had one or more crayfish under it and they were easy to catch*'.

So said two residents of the Wyre Forest about the abundance of White-clawed Crayfish in the 1950s and 1960s.

How things have changed.

White-clawed Crayfish (Figure 1) are in serious trouble in Wyre. In 2023 they were probably only to be found in one small stream. Members of the Wyre Forest Study Group have been monitoring the watercourses of Wyre since 2010, charting the last throes of this, the only native British Crayfish.

How have we got to this state?

White-clawed Crayfish (*Austropotamobius pallipes*) is considered to be the only native crayfish in Britain although it is likely that the species was introduced to Britain around 1,000 years ago from Europe (Kouba *et al.*, 2015). Having been introduced into Britain, they are now naturalised across large parts of England and Wales.

White-clawed Crayfish thrive in good quality clean (silt-free) water. They are found in many aquatic habitats ranging from fast flowing streams to lakes and canals and they are omnivores. Crayfish mate in autumn, as water temperature declines, the female carries the fertilised eggs under her powerful tail. After hatching, the juveniles remain attached to the female until the following June/July when they detach, seeking an independent existence. Of the order Decapoda, crayfish have five pairs of legs, the front pair have developed into large claws which are used to manipulate food and for defence.

The streams of Wyre provide excellent habitat for our native crayfish as the streams are clear with abundant macroinvertebrates to keep them nourished. Population density will vary, partly because of the availability of calcium. Although much of Wyre is set on sandstones and coal measures (Westwood *et al.*, 2015, p18) many streams are calcareous, in some streams Tufa is deposited. Crayfish require calcium to strengthen their outer skeleton which is moulted annually as an adult. The streams of the Wyre Forest have provided good quality habitat for a large population of White-clawed Crayfish for around a millennium. On



Figure 1. Adult male White-clawed Crayfish Rosemary Winnall

1st July 1886 members of the Worcestershire Naturalist Club went to Blakemoor [near Clows Top] in search of 'Cray-fish', where they intended to catch some, although they failed to do so (Worcestershire Naturalists Club, 1897). When the Wyre Forest Sites of Special Scientific Interest were notified in 1955 the quality of habitat for White-clawed Crayfish was included in the citation (Natural England, 1998). The Forestry Commission was, and is, heavily involved in the management of the forest, and in 1978 Wyre was notified as a National Nature Reserve which was followed by the Forestry Commission and Natural England purchasing or leasing land within the forest.

So, in the 1950s and 1960s White-clawed Crayfish were abundant in Wyre, Natural England and Forestry England were responsible for management and the future looked good.

American Signal Crayfish (*Pacifastacus leniuculus*) are, as the name suggests, native to North America. These crayfish are larger, more aggressive and with greater fecundity than our natives, they also carry a fungus-like organism – Crayfish Plague (*Aphanomyces astaci*). Because Signal Crayfish and Crayfish Plague evolved together, Signal Crayfish are not affected by the plague. However, for the White-clawed Crayfish, this plague is lethal and causes mass mortality (Holditch, 2003). Crayfish make good eating, so in 1972 someone had the bright idea of importing Signal Crayfish into Britain (Aldridge, 2012) – they are tasty, grow quickly so what was there to lose? Well plenty, as it turned out.

White-clawed Crayfish are listed under Schedule 5 of the Wildlife & Countryside Act 1981, but only receive protection under

Sections 9(1) and 9(5) of the Act. Section 9(1) makes it an offence to take white-clawed crayfish, under Section 9(5) it is an offence to offer for sale, transport for sale, advertise for the purpose of trading any live, dead, part, or derivative of, White-clawed Crayfish. Section 9 applies to all stages in their life cycle. Under the Habitats Directive, Special Areas of Conservation (SACs) can be created due to the presence of White-clawed Crayfish.

The stream network in Wyre contains 123km of stream channel (excluding the River Severn). Up until the 1970s it is likely that most, if not all, of these streams would have populations of native crayfish. In 1987 John Bingham, who was working for English Nature at the time, recorded the native crayfish abundance and habitat quality in streams in the Dowles Brook and Earnswood Brook catchments (Figure 2).

The results of the 1987 survey show that native crayfish were abundant in Dowles Brook, Baveney Brook and Kingswood Stream, with occasional sightings in Mad Brook and Lem Brook and in smaller streams Bell Brook, Forest Lodge Stream, and Longdon stream.

At some point between 1987 and 2000, Signal Crayfish were introduced into Wyre. The exact details are not known but by 2000 there were no longer native crayfish in Dowles Brook (Linck, 2000). The assumption is that Crayfish Plague arrived with the Signal Crayfish and wiped out the White-clawed Crayfish population. Despite this, native crayfish persisted in Wyre. In 2010 members of the Wyre Forest Study Group were exploring the culvert carrying Bell Brook underneath the old railway line when they became aware of White-clawed Crayfish in the water. Members of the group returned some days later to properly survey for native crayfish. By good fortune the group first searched the adjacent stream (an accident of navigation) and found White-clawed Crayfish there (Forest Lodge Stream) and then moved on to Bell Brook and found a good population (Hill, 2011). This was good news!

Under the auspices of Grow with Wyre (GwW), who provided funding, in 2011 a plan

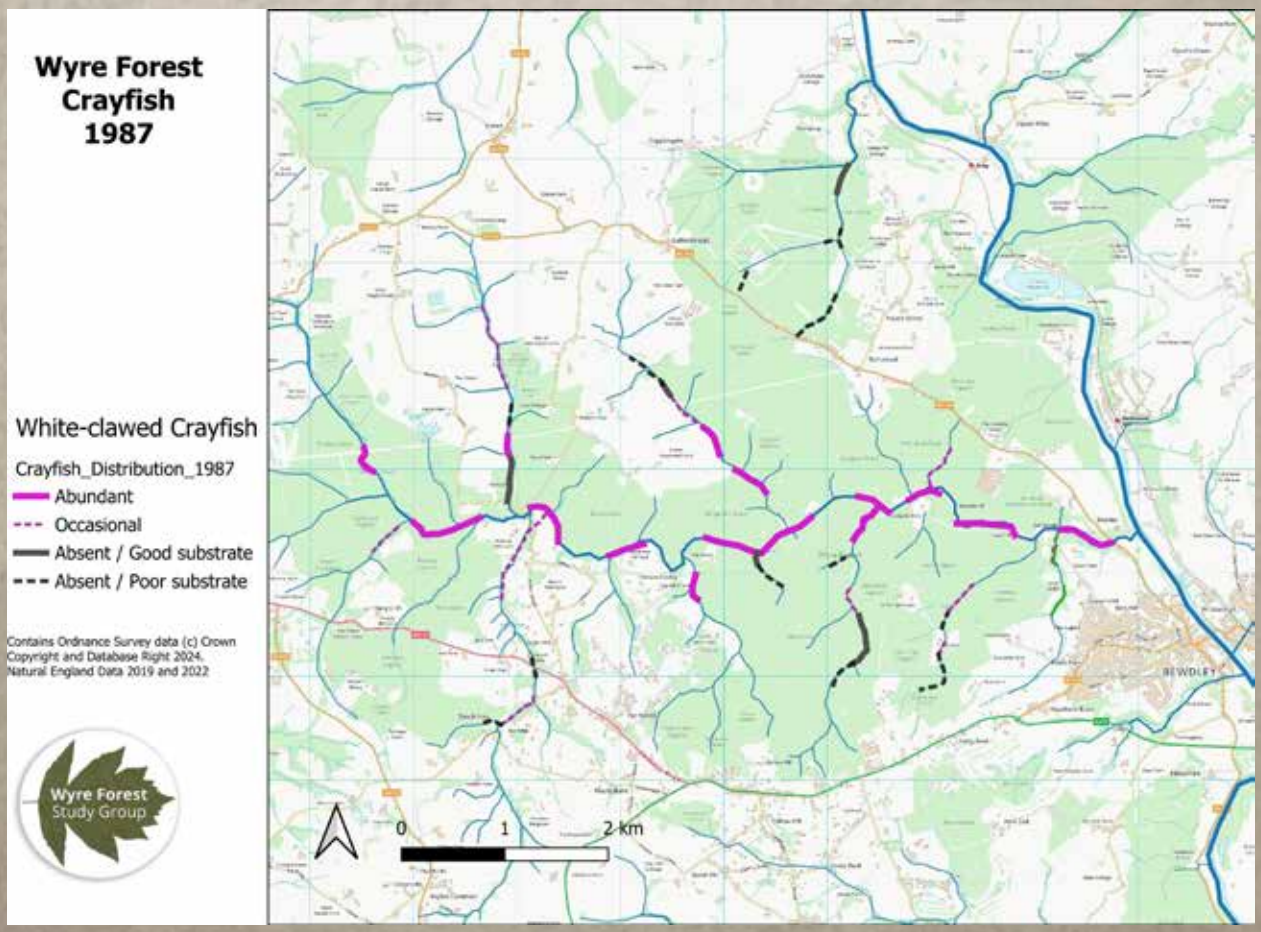


Figure 2. Distribution of White-clawed Crayfish and suitable habitat in Wyre Forest Streams 1987.

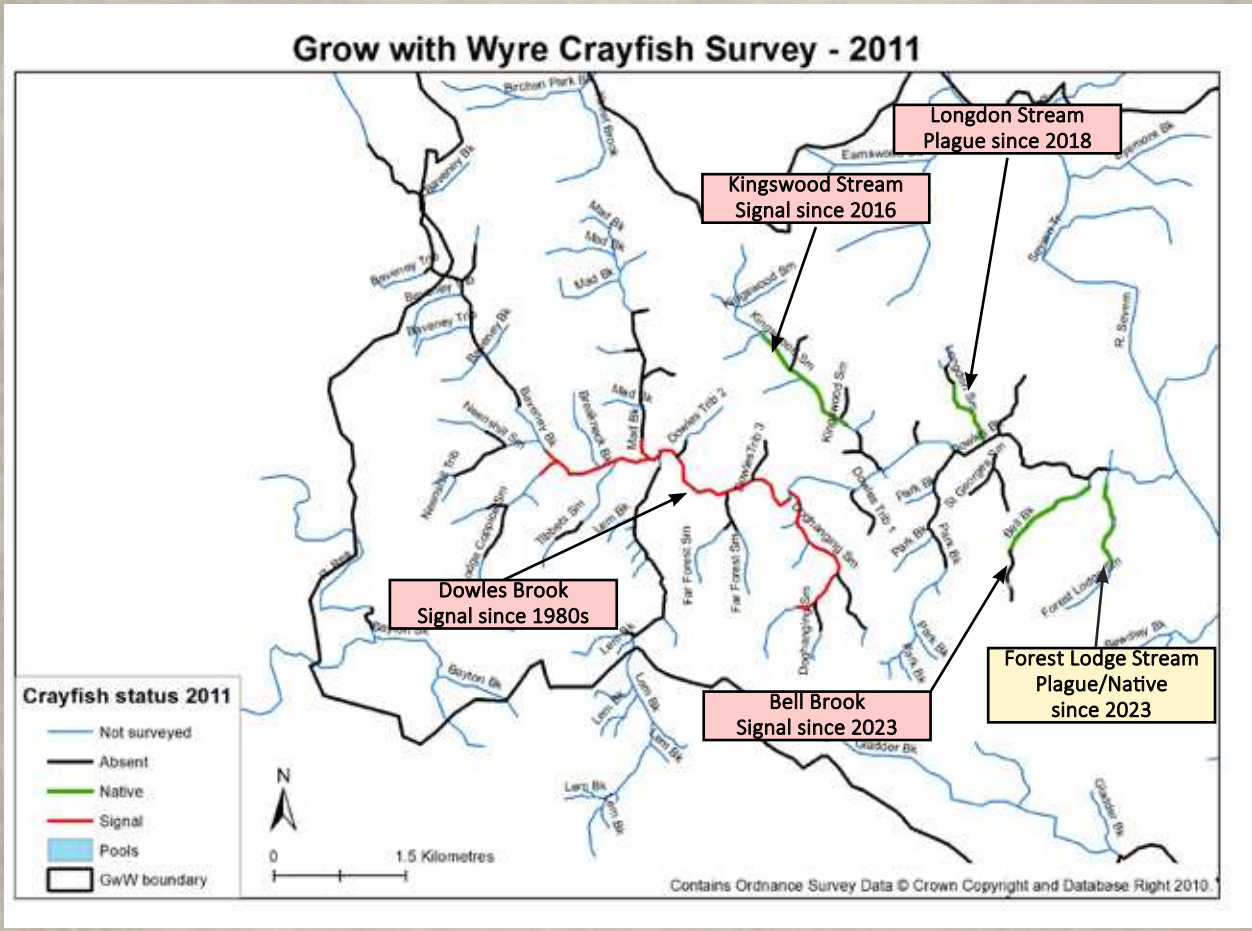


Figure 3. Status of crayfish in Wyre Forest Streams to 2023.

was drawn up to survey the watercourses of the GwW area for crayfish, particularly aiming to see if there were native crayfish in any other streams. Every mapped stream in the Dowles Brook catchment was visited and assessed for crayfish habitat suitability. Most streams contained suitable habitat and those were assessed by night-time surveys (crayfish are nocturnal) and by the standard survey – searching suitable habitat and turning stones over during the day. The project concluded that both White-clawed and Signal Crayfish were present in the catchment, but that only four streams held populations of natives – Bell Brook, Forest Lodge Stream, Longdon Stream and Kingswood Stream. No Crayfish were found in Lem Brook, whilst Signals were doing well in Dowles Brook and Doghanging Stream. It was decided that members of the Wyre Forest Study Group would monitor the four streams with native crayfish as an on-going project.

During the 2011 surveys it was noted that, in places, there were structures that might be considered barriers to upstream movement of crayfish- waterfalls, culverts and similar. All four streams with native crayfish drain into Dowles Brook (which has Signal Crayfish) and each was protected by a barrier at the lower end of the stream. Bell Brook was protected by culvert pipes under the railway line, there being 0.5 m of vertical concrete above the stream bed below the culvert (Figure 4). Forest Lodge Stream was protected by another piped culvert discharging 1.30 m to the streambed below (Figure 5). Both of these features provided a considerable barrier to the upstream movement of Signal Crayfish from Dowles Brook. Kingswood Stream and Longdon stream were protected by cascades below a forest track which, although a barrier to upstream movement of crayfish, were less effective than the other two streams.

We were fortunate that Dr Ann Hill and myself held Licences from Natural England to handle White-clawed Crayfish and that several members of the WFSG were keen to be involved with surveys. It was decided that each stream with native crayfish would be surveyed annually, using night-time surveys


Figure 4. Bell Brook culvert Graham Hill


Figure 5. Forest Lodge Stream culvert Graham Hill

and daytime searches where appropriate.

Surveys in 2012 and 2013 (Table 1) showed that the four streams had populations of native crayfish. Kingswood and Longdon Streams had small populations; Forest Lodge Stream had a moderate population but Bell Brook held a large population. In Bell Brook, surveying c. 25% of the channel length between the old railway line and the track to St George's farm using powerful torches, nearly 1000 native crayfish were counted. This was a nationally significant population.

In 2014 native crayfish were found in Bell Brook, Forest Lodge Stream and Longdon Stream, but no crayfish were found in Kingswood Stream. In 2015 native crayfish were found in all four target streams. During this year Chris Troth, a BSc student at the University of Worcester, used Bell Brook as a research site to show that crayfish DNA could be extracted from water samples (Troth, 2016).

2016 was a disastrous year for native crayfish in Wyre. Crayfish Plague killed all of the native crayfish in Bell Brook, Signal Crayfish were found in Kingswood Stream and no crayfish were found in Longdon Stream. Therefore only Forest Lodge Stream still contained White-clawed Crayfish.

In 2017, to prevent potential contamination of native crayfish streams, only bankside torching surveys were conducted, only Forest Lodge Stream still supported native crayfish. An eDNA survey showed that Signal Crayfish and Crayfish Plague were present in Bell Brook and Kingswood Stream. Longdon Stream was negative for both species of crayfish and crayfish plague.

In 2018, following night-time surveys of all four crayfish streams, only Forest Lodge Stream contained native crayfish. No records of any species were found in Bell Brook; Signal crayfish DNA was found in Kingswood Stream and – surprisingly – Crayfish Plague was found (in one replicate out of twelve) in Forest Lodge Stream. In 2019, only Forest Lodge and Bell brook were surveyed by torch. Forest Lodge held native crayfish whilst no crayfish were seen in Bell Brook.

No surveys were completed during 2020 and 2021 due to the COVID-19 pandemic.

In 2022 it was assumed that only Forest Lodge Stream was likely to contain any native crayfish. Funding was generously provided by Worcestershire Wildlife Trust to enable an eDNA survey of that steam to be undertaken. This showed that White-clawed Crayfish were present and that Crayfish Plague was not present.

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

Stream	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Method	Torch	Torch	Torch	Torch	Torch	Torch	Torch	Torch	Torch	Torch	Torch	Torch	eDNA	eDNA
Bell Brook	Native	Native	Native	Native	Native	Native	Plague	None	None	None	NS	NS	NS	Signal/ Plague
Forest Lodge Stream	Native	Native	Native	Native	Native	Native	Native	Native	Native	Native	NS	NS	Native	Native/ Plague
Kingswood Stream	NS	Native	Native	Native	None	Native	Signal	Signal	Signal	NS	NS	NS	NS	NS
Longdon Stream	NS	Native	Native	Native	Native	Native	None	None	Plague	NS	NS	NS	NS	NS
Dowles Brook	NS	Signal	NS	NS	Signal	NS	NS	NS	NS	NS	NS	NS	NS	NS

In 2023 eDNA surveys of Forest Lodge Stream and Bell Brook were undertaken. This showed that both Signal Crayfish and Crayfish Plague were present in Bell Brook and that both White-clawed Crayfish and Crayfish Plague were present in Forest Lodge Stream.

The future for native crayfish in Wyre (and nationally) is bleak. They are on the IUCN Red List (IUCN, 2024) as an ENDAGERED species and, short of a miracle, they will be gone from Wyre soon. The identification of DNA from both White-clawed Crayfish and Crayfish Plague in Forest Lodge Stream in 2024 means only that:

a. White-clawed Crayfish persist upstream of an area where Crayfish Plague is to be found, or

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

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

Discussion

So, what caused the demise of native crayfish in Wyre? Changes undoubtedly started with the introduction of infected Signal Crayfish into the forest streams – quite where or by whom is not known but probably somewhere above the waterfall at Furnace Mill after 1987. From there they spread themselves, and Crayfish Plague, down Dowles Brook and up adjacent Brooks. Only those streams with sufficient barriers were spared invasion. Crayfish can walk over land and climb waterfalls, but it took a long time for the invaders to get past the barriers in Kingswood and Longdon Streams.

The barriers in Bell Brook and Forest Lodge Stream were much more impregnable, so was there another mechanism involved? We will never really know, but if humans can introduce crayfish into Wyre as a food crop, then they could also introduce them into Bell Brook or Forest Lodge Stream. This may be deliberate or fishing for crayfish perhaps, or accidental – eggs or young crayfish could attach themselves to footwear, clothing, fishing gear or mountain bikes and move from an infected to an uninfected waterbody. Animals, moving between such bodies, could also carry eggs or young – dogs swimming in Dowles Brook could inoculate Bell Brook or Forest Lodge Stream with plague spores, but so too could Otters, Mink or Deer!

Kozubíková – Balcarová and Horká (2015) consider that barriers prevent natural migration of crayfish, although intentional or unintentional human or crayfish predator transport can bypass them. Crayfish plague can be transported in the water, on contaminated wet equipment and on wild animals.

The crayfish 'landscape' in Britain has changed utterly over the past three decades. For the thousand years prior to 1980 any crayfish in British waterbodies was a White-clawed Crayfish. Today it is most likely to be an alien invader – mostly the Signal Crayfish. In this regard, Wyre is a microcosm of the national picture.

What lessons can we learn then?

Signal Crayfish were introduced to Britain as a food crop, but it is unlikely that anyone foresaw that the introduction would wipe out the native British crayfish. This situation replicates, in Britain, the decline of Red Squirrel *Sciurus vulgaris* against the rise of the Grey *Sciurus carolinensis*, although squirrels are not usually considered a food crop! Importation of Ash *Fraxinus excelsior*, it appears, has brought Ash Dieback *Hymenoscyphus pseudoalbidus* putting this widespread species under threat. **We need effective measures to prevent importation of other threats.**

Land owners and managers (including National and Governmental organisations) must make every effort to stem the tide of harmful imports and lead from the front. The public at large also have a responsibility, although many don't appreciate that. Recreation in Wyre has exploded over the past 30 years. 30 years ago it was possible to walk all day through the forest without meeting anyone. Now it is the other way around – it is almost impossible to walk anywhere in Wyre and not see someone else. There has been an explosion of walkers, runners, dog walkers and cyclists and whilst getting outside and exercising may be good for us all, it is not necessarily good for nature.

Surveyors, ecologists and naturalists must play their part too. Crayfish surveyors have known of the dangers of spreading plague from one waterbody to another for years and they disinfect their in-water equipment between sites. But what about *within* a site? When I was training as a crayfish surveyor working in an upstream direction was considered

good practice, but plague infections can be carried upstream in this fashion – **much better to keep out of the water altogether.** Environmental DNA surveys don't require the surveyor to enter the water and provide useful information – a much better solution albeit with some limitations.

The future?

The native British Crayfish has been all but wiped out by human activities. Sadly it is likely that this situation cannot be reversed in the short-term. **Providing safe sites (Ark Sites) for White-clawed Crayfish** provides a potential reservoir for the time that the non-natives can be controlled. These schemes need proper financial support. There must be proper Government support too. A National Nature Reserve should be a place of safety for nature – yet it is over-run by human activities. Surely, **we can keep people out of sensitive areas.** Education and control will work -but only if there is a will to do it.

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