

CONSERVING WHITE-CLAWED CRAYFISH IN ENGLAND AND WALES

Some briefing Notes for Wildlife Trusts

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The white-clawed crayfish is a species in decline in England and Wales and it will decrease markedly over the next few decades. Nonetheless, there are conservation measures that can be taken now to keep at least some populations of this indigenous species for the future. These notes suggest priorities for action at local level. The Wildlife Trusts can participate in these actions and some are already involved.

THREATS

White-clawed crayfish *Austropotamobius pallipes* populations are still widespread in England and Wales, but are decreasing in almost all areas. In many counties in southern England, where they were formerly abundant, there are only a few small populations remaining. The emphasis here is on the situation in England and Wales.

Scotland has no indigenous crayfish, but there are two sites where white-clawed crayfish were introduced.

Northern Ireland is, together with the Republic of Ireland, one of the most important areas for white-clawed crayfish in Europe, because there are no known populations of non-indigenous crayfish and introduction of crayfish is banned. Illegal importation is still a risk, but does not appear to have happened so far.

The threats to white-clawed crayfish in England and Wales are:

- Crayfish plague
- Competition from non-indigenous crayfish
- Deterioration of habitat

Crayfish plague

Crayfish plague *Aphanomyces astaci* is a disease that can be carried by signal crayfish *Pacifastacus leniusculus* and other American species of crayfish (e.g. red swamp crayfish *Procambarus clarkii*, spiny-cheeked crayfish *Orconectes limosus*). The disease usually has little effect on American species (although there are a few cases of very badly stressed signal crayfish populations being affected by the disease). All European species are highly susceptible to crayfish plague. If an outbreak of the disease occurs, an entire population of white-clawed crayfish can be lost within weeks. The spores are viable for up to two weeks, so occasionally small sub-population can survive in semi-isolated parts of catchments where crayfish plague has wiped out the population in most of the river system. Once one white-clawed crayfish in a population catches the disease, millions of spores are released into the

water from the dying animal, making an epidemic almost certain. There is no sign of any resistant strains of white-clawed crayfish or other European crayfish.

Spores can be carried on wet angling gear and farmed fish. The spores can be killed by washing with an iodophore or hypochlorite bleach. They also become unviable if gear is cleaned of mud and dried out completely for a day or more.

Not much is known about naturally occurring diseases in white-clawed crayfish populations. There have been cases of mass mortality of white-clawed crayfish where crayfish plague was not present and there was no pollution. There is more chance of recovery over time from endemic diseases.

The presence of a population of American crayfish does not automatically mean there will be an outbreak of crayfish plague. There is a growing number of examples in England where signal crayfish have been established for years (over 20 years in some cases) and there are abundant populations of white-clawed crayfish upstream and downstream that have not died of crayfish plague.

Competition from non-indigenous crayfish

This does not mean that white-clawed crayfish are safe, as signal crayfish populations expand and outcompete white-clawed crayfish. This process takes around 4-6 years from first detected arrival of signal crayfish to local extinction of the white-clawed crayfish. The signal crayfish produce more young than white-clawed crayfish, do it earlier in the summer to benefit from a longer growing season, they grow faster and are much more aggressive. This means that if refuges are limited, white-clawed crayfish are ousted and are more vulnerable to predation by fish or birds. As signal crayfish mature they reach much larger body size and there is some evidence to suggest they can reach much higher biomass per unit area than white-clawed crayfish. This means they have greater impacts on aquatic ecology. A higher proportion of the total productivity of a waterbody ends up in signal crayfish, instead of aquatic plant, other aquatic invertebrate or fish.

In river systems, if signal crayfish colonise a stream they go through a phase of initial establishment. They do not spread far at first, but just increase in abundance locally. Once the population builds up, competition for resources between signal crayfish leads to the surplus population moving into new areas. The population then expands progressively. Expansion occurs both upstream and downstream, although it occurs more readily downstream. The rate varies according to suitability of habitat and where conditions are more difficult, the rate of spread is slower, for example in high energy upland streams the rate of upstream spread is much lower than in lower gradient productive rivers with abundant food and shelter available. Typical rates recorded are around 1-2 km/year.

Deterioration of habitat

White-clawed crayfish are susceptible to pollution incidents. Synthetic pyrethroid insecticides are a major problem in some farming areas, because extremely low concentrations can kill aquatic insects and crustaceans, including crayfish. They are rather more tolerant of brief spells of low dissolved oxygen than fish and can climb

into air if they have to. They are readily killed by ammonia, however, so occasional spills of farm slurry or sewer overflows can be enough to make stretches of watercourse uninhabitable for crayfish. If pollution occurs only sporadically crayfish may still be absent because it may take too long for crayfish to colonise from unaffected areas.

Dredging and re-profiling of stream banks can remove refuges. So too can excessive maintenance of channels for flood defence. Crayfish like dead wood and accumulations of leaf litter, for shelter and food.

Drought is also a problem in parts of lowland England. White-clawed crayfish can only stay out of water for a few hours and only if conditions are damp. If natural low flows or abstraction dry out streams, white-clawed crayfish will be lost. In streams with a bed of fine substrate such as sand, chalk or gravel, the only available refuges may be in the steep, submerged banks of a stream or among fine tree roots. If low flows expose the banks, there may be no refuges in the channel. If that happens most of the crayfish may be lost due to predation.

CONSERVATION ACTION

Control of signal crayfish

Is it possible to get rid of non-indigenous crayfish or stop them spreading?

Essentially no!

Once signal crayfish are established in a watercourse, there is generally nothing that can be done to eradicate them, control them or reduce the rate of spread. A number of projects have been tried and none of them have had any success. The problems are as follows:

- All survey methods for crayfish have significant limitations. Even with manual survey in habitat that can be readily surveyed cannot detect crayfish at low abundance. This means there is uncertainty as to the extent of the population.
- Physical methods of removing crayfish, such as trapping, just sustainably harvest the population. Even extremely intensive manual removal has failed, in all the watercourses where it has been attempted.
- It only takes one berried female or a pair of crayfish for the population to start recovering. As soon as “control” measures cease or reduce, any gain made (if any at all) is lost very quickly. Control is not a sustainable option.
- Predators are not effective – signal crayfish can reach huge population densities in lakes stocked with high densities of predatory coarse fish. Rates of spread may be slower in areas with naturally high abundance of eels, but evidence for this is mixed and unconfirmed. Artificial stocking is unlikely to be effective, as eels tend to disperse by water and even over land.
- There are no known diseases that are selective to American crayfish.

- There have been some preliminary trials using an organic insecticide, natural pyrethrum on signal crayfish, in carefully controlled conditions. Early results are encouraging, but the treatment kills other invertebrates and fish. It is expensive. It can only be used in limited areas, where the whole extent of the signal crayfish population is known and can be treated, without causing impacts outside the target area.

In conclusion, eradication is rarely possible and control is ineffective, expensive and unsustainable.

Angling clubs increasingly want to trap crayfish to reduce the nuisance of crayfish taking angling bait. Any benefit in reducing nuisance is unproven (although there may be a placebo effect, making people feel better to be doing something rather than nothing). As most of any crayfish population is below the size limit that can be caught in traps, it will definitely have no effect on reducing the population overall.

It is strongly recommended that Wildlife Trusts avoid any involvement in efforts to “control” non-indigenous crayfish. Resources are much better spent on other conservation effort for white-clawed crayfish.

The need for isolated refuge areas

As indicated above, white-clawed crayfish cannot co-exist with American species of crayfish. It is not possible to stop the American species progressively increasing their range. This means the only way white-clawed crayfish can survive is in completely isolated places, away from non-indigenous crayfish.

In most catchments, if a signal crayfish population starts spreading in one area of a catchment, it will expand to all the watercourses eventually, unless there are significant barrier to movement. Any habitat that can be used by a white-clawed crayfish can be taken over by signal crayfish – and signal crayfish are much better at surviving pollution, crossing physical barriers and withstanding drying out.

This means that most of the populations of white-clawed crayfish currently in rivers will eventually be lost to invading populations of American crayfish. There will be no prospect of being able to re-introduce white-clawed crayfish in future. Once the signal crayfish or other species are widely established in a river system, it is likely to be permanent.

There are some populations of white-clawed crayfish that are already in isolated sites. In some cases they were always present, but for example a large reservoir or culvert system was built in the past, cutting off the population from the rest of the catchment. In other cases, such as some wholly enclosed old brick pits, white-clawed crayfish must have been introduced by someone at some time in the past.

In Britain it is these well-isolated sites with white-clawed crayfish populations that are the priority for conservation. The term “Ark” sites has sometimes been used for these isolated and potentially “safe” sites for white-clawed crayfish.

Finding and safeguarding (as far as possible) Ark sites is the top priority for conservation of white-clawed crayfish. Wildlife Trusts can help identify new opportunities.

Isolated sites

What sort of sites might be suitable?

Features of Ark sites may include one or more of the following:

- a small catchment going directly to the sea, which has no crayfish at present;
- a quarry or other former mineral working with no outlet stream (which could be used as an access route from an invaded river);
- an enclosed pond or lake, preferably not used for angling, more than 100 m from a watercourse and not subject to flooding;
- a lake or reservoir whose only outlet or overflow is a vertical spillway or cascade at least 2 m high, preferably higher and preferably dry except in floods.

Sites well away from roads, or with little or no public access are less at risk from accidental or deliberate introduction of non-indigenous crayfish than those with heavy use.

There is a need to rate sites with white-clawed crayfish as to how great a risk they have of being colonised by NICS. Efforts can then be made to try to keep the risks low, or even reduce them.

Some catchments with white-clawed crayfish still present may have no low risk sites at all. In those areas there are only two options: accept the progressive loss of white-clawed crayfish, or find potential Ark sites that are suitable for introduction or reintroduction of white-clawed crayfish. Clearly, any site being considered for introduction of white-clawed crayfish needs to be very carefully assessed. It would not be in the best interests of nature conservation to move crayfish into a lake, only to find this caused the reduction or loss of a population of rare aquatic plants or snails.

Similarly, it would be a waste of resources to carry out an introduction in a site that is quite frequently affected by pollution events.

There are lots of opportunities for new sites, for example in:

- mineral restorations,
- landscaped lakes, which once had crayfish, but became too badly silted to support them and have now been restored,
- small streams that probably had white-clawed crayfish historically, subsequently lost them due to urban pollution, but are now clean enough to allow crayfish to live there again
- large ponds created under agri-environment schemes (these may be used for angling and so more at risk, but still have potential);
- selected new/existing ponds on Trust reserves.

(Re)Introductions

A protocol has been developed for (re)-introductions, which addresses the issues of finding suitable receptor sites for white-clawed crayfish. Some of the issues are discussed below.

How big does a pond have to be to support a viable population of white-clawed crayfish? We don't know. If habitat is suitable, however, a pond of a few 10s metres could support 100s of white-clawed crayfish. Bigger is better – but only if it is reasonably “safe” from colonisation by non-indigenous crayfish.

How much genetic diversity is required? There is a lot of discussion in Europe about genetic diversity in white-clawed crayfish and in some areas, e.g. Italy, there are identifiable strains even between subcatchments. That is not the case in England and Wales, where genetic studies to date all show limited genetic diversity and a close relationship between crayfish in England and those in northwest France.

Care should be taken if aiding recovery of a population that has been depleted e.g. in a watercourse recovering from pollution. In that case use white-clawed crayfish from the same watercourse if possible, or in the wider catchment, assuming they are present elsewhere. With wholly isolated sites the genetic composition is not critical.

In descending order of preference use crayfish from:

- the nearest watercourse in the catchment that has white-clawed crayfish;
- any population in the catchment;
- any population in an adjacent catchment, or the county;
- any population you can get, especially if under long term threat.

All introductions have to be licensed by English Nature. Depending on the location, approval may also be needed from the Environment Agency and, of course, the land owner.

How much of a barrier is needed to stop signal crayfish colonising? Signal crayfish can easily walk up almost any sloping surface. They can climb a vertical face if it is rough, such as stone, or covered in algae and mosses. It is not known the maximum height they will climb a vertical, but rough surfaced barrier. They cannot climb an overhang. They could, however, walk round such a barrier if the bank was easily accessible next to the obstruction. They would be more likely to do so if the bank was wet and had good cover, e.g. springline seepages. They can walk along a concrete culvert just out of the water if the speed of flow is too fast for them to walk against the flow.

An example of a good barrier to upstream colonisation of a lake by signal crayfish would be an outfall that only overflowed during flood conditions – when crayfish downstream would be deep in refuges avoiding high flows. The outfall would have a vertical concrete fall, preferably more than 2 m in height. Alternatively it might have a pipe projecting from a headwall by at least 15 cm with a free-fall of water at all flows. The outfall would have hard surfaced banks for more than 1 m on either side, preferably much more. If the flow ran down a culvert at steep gradient this would be

favourable, especially one with little or no habitat for crayfish. These conditions sometimes occur in urban areas. A stream may have been dammed to create an ornamental lake. It outfalls over a barrier and then disappears into a long culvert through an urban area.

There are conflicts – anything substantial enough to be a good barrier to colonisation by signal crayfish will be a barrier to the movement of fish too.

If signal crayfish are moving downstream, there is little that can be done in most cases. At one site in Yorkshire a large settling tank was installed on a small culverted outflow from a lake. Crayfish entering the tank crawl to the bottom. The outfall is a long vertical pipe with a broad funnel in the mouth to prevent crayfish moving up. Crayfish have to be removed periodically from baskets in the bottom of the tank.

THE WAY FORWARD

Some people might feel that it is not appropriate to create or adopt new sites for crayfish and that we should not interfere to prevent the extinction of the species; even though it is a loss brought about by human interference, i.e. the moving of species between countries and continents. Others will argue that conservation efforts are worthwhile and that it is just as acceptable to introduce white-clawed crayfish to new sites as it is to create ponds and introduce great crested newts and other amphibians.

We need to recognise and accept that white-clawed crayfish will be lost from the majority of rivers, canals and lakes in Britain. White-clawed crayfish will shift from being a widespread and abundant species to one that is rare, confined to a relatively limited number of isolated sites and watercourses. It is already in that state in a number of counties in southern England. We can act now, while there are still potential donor populations available. We can set up “Ark” populations of white-clawed crayfish in both existing and new refuge sites throughout the geographic range of white-clawed crayfish – as it existed before the introduction of signal crayfish in the mid 1970s.

Wildlife Trusts can help by:

- Providing records of white-clawed crayfish and new locations of non-indigenous crayfish to the Environment Agency and the NBN Gateway (the crayfish record form for the database can be downloaded from the licensing section of the English Nature website).
- Identifying potential “Ark” sites for new introductions of white-clawed crayfish.
- Carrying out or helping with surveys needed to identify whether sites are actually suitable for introduction – for existing waterbodies that means making sure there are no crayfish present already and there are no important species present that would be significantly adversely affected by an introduction.
- Contributing to local publicity to discourage any further introductions of non-indigenous crayfish. Anglers illegally using crayfish as bait and people who hope to make money from wild harvesting of crayfish are the main sources of introduction, but even children catching and keeping non-indigenous crayfish could start new invading populations.
- Keeping a careful eye on fish markets and aquarists suppliers for any live freshwater crayfish. Let the Environment Agency know about it – they may be illegal imports.

FURTHER READING

- *HOLDICH, D. M., 2003. Ecology of the White-clawed Crayfish. Conserving Nature 2000 Rivers Ecology Series No. 1. English Nature, Peterborough. 17 pp.
- HOLDICH, D. M., SIBLEY, P. and PEAY, S., 2004. The white-clawed crayfish – a decade on. *British Wildlife* **15** 153-164.
- *KEMP, E., BIRKINSHAW, N., PEAY, S. and HILEY, P.D., 2003. Reintroducing the white-clawed crayfish *Austropotamobius pallipes*. Conserving Nature 2000 Rivers Conservation Techniques Series No. 1. English Nature, Peterborough. 30 pp.
- *PEAY, S., 2003. Monitoring the White-clawed Crayfish *Austropotamobius pallipes*. Conserving Nature 2000 Rivers Monitoring Series No. 1. English Nature, Peterborough. 58 pp.
- PEAY, S., 2003b. Guidance on habitat for white-clawed crayfish and how to restore it. R&D Technical Report W1-067/TR. Environment Agency, Bristol. 66 pp.
- * available to download from www.english-nature.org.uk/lifeinUKrivers