



PATHWAYS FOR TRANSMISSION OF CRAYFISH PLAGUE, *Aphanomyces astaci*, IN ENGLAND AND WALES



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Introduction

Aphanomyces astaci belongs to the Oomycetes, which according to recent phylogenetic analyses are no longer classified as fungi, but are instead related to heterokont algae.

The natural hosts of *A. astaci* are crayfish species indigenous to North America (NA), which carry the Oomycete in their cuticle without developing clinical disease. However, *A. astaci* is the most serious pathogen of European and Australian freshwater crayfish and infection usually leads to 100% mortality in affected populations.

Aphanomyces astaci was introduced into central Europe in the middle of the 19th century and reached England and Wales in 1980. The escape of NA crayfish, introduced to the UK for farming, led to the first crayfish plague outbreak in England.

In the 25 years since its first arrival in the UK, *A. astaci* has spread to various parts of England and Wales, wiping out numerous populations of the only British native crayfish species, the white clawed crayfish *Austropotamobius pallipes*.

With increasing numbers of NA crayfish populations establishing in natural waters in England and Wales, and the restrictions on imports of non-native crayfish, the main disease threat to uninfected populations is from populations of NA crayfish already established in this country.

Crayfish plague is the most important disease threat to the only native freshwater crayfish species in the UK.

Properties of *Aphanomyces astaci*

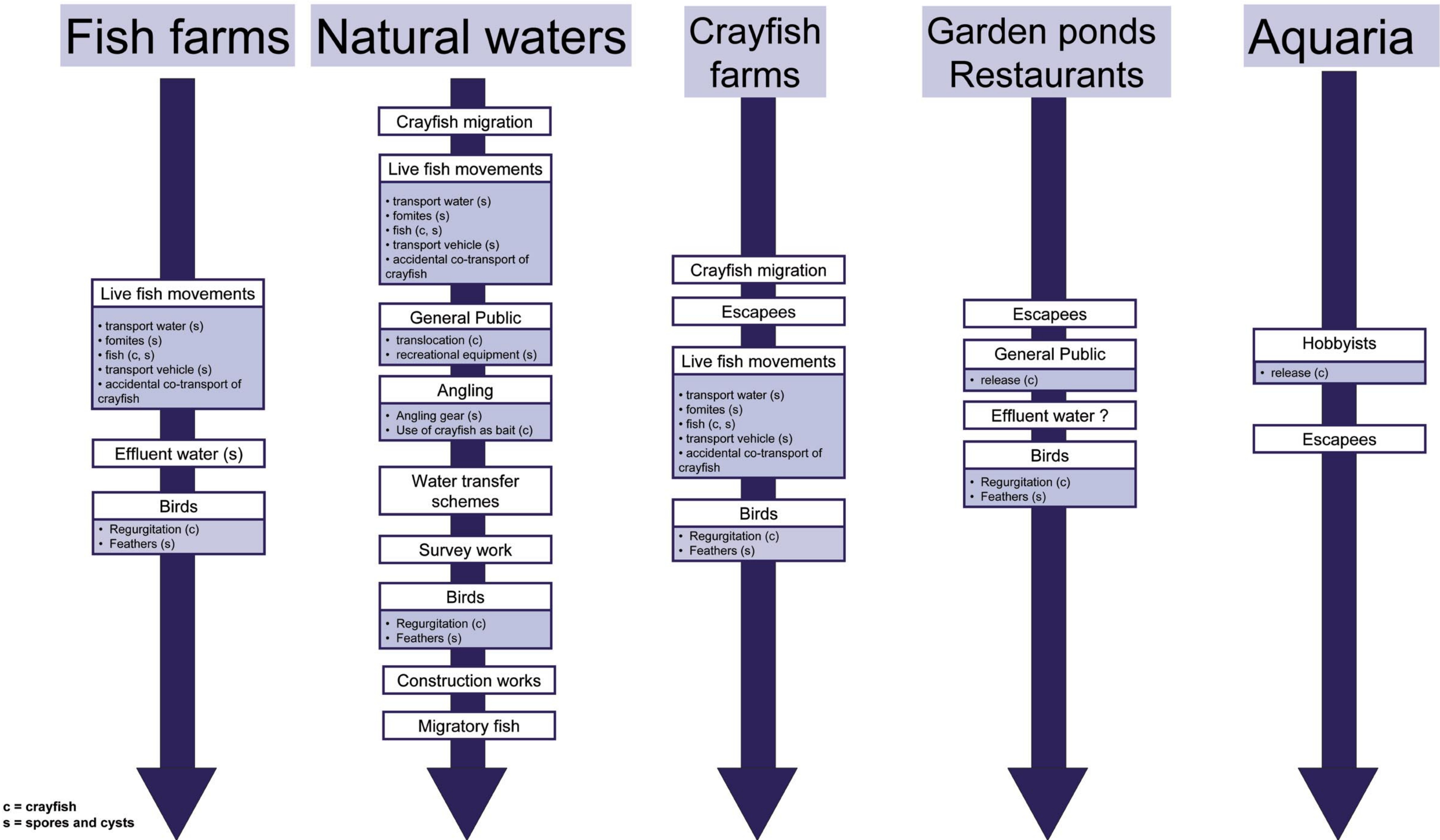
- 3 life stages: mycelium, zoospore, and cyst
- North American crayfish can serve as life long carriers
- Cysts and zoospores survive off the host in water for >14 days
- Mycelium survives on dead crayfish for at least 5 days

Exposure factors

The establishment of *A. astaci*, following its introduction to an uninfected population, will depend on a number of factors, e.g.:

- Host population density
- Prevalence of carrier status within NA crayfish population
- Intensity of infection per individual animal
- Degree of spore release from infected animal
- Water temperature

Sources of Carrier Crayfish



Uninfected crayfish population

Conclusion and recommendations

The aim of our work was to identify pathways for the spread of *A. astaci* in England and Wales. The eventual goal is to support policies to minimise the risk of further spread of the pathogen. We conclude that anthropogenic live fish movements pose a serious threat for the transmission of crayfish plague at present (Table 1). However, this conclusion is based on a preliminary analysis and further research is required to quantify the risk of live fish movements compared with other routes of transmission.

The movement of live fish is the most important route of spread for crayfish plague.

Table 1: Risks of various routes for transmission of *Aphanomyces astaci*

Rank	Route of transmission	Estimated level of risk for transmission between catchments	Estimated level of risk for transmission within catchments	Transmission from other sources (garden ponds, restaurants, aquaria)
1	Live fish movements (anthropogenic)	High	High	n/a
2	Release of NA crayfish by General Public	High	High	High
3	Crayfish migration	Extremely low	Very high	n/a
4	Effluent water from rearing facilities	n/a	high	Negligible?
5	Angling with crayfish bait	Moderate	Moderate	n/a
6	Escapees	n/a	Moderate	Moderate
7	Bulk water transfer	Low	Low	n/a
8	Survey work	Extremely low	Low	n/a
9	Use of leisure equipment	Extremely low	Low	n/a
10	Angling equipment	Extremely low	Extremely low	n/a
11	Birds	Extremely low	Extremely low	Extremely low
12	Migratory fish	Negligible	Extremely low	n/a
13	Construction works	Negligible	Negligible	n/a

n/a = not applicable

The following data need to be collated for a further in depth analysis:

1. Numbers, topographic location of
 - Crayfish farms keeping NA crayfish
 - Fish farms also having NA crayfish on site
 - NA crayfish populations in the wild
 - Garden ponds harbouring NA crayfish
 - Places (households, aquarists shops, ...) keeping NA crayfish in aquaria
2. More detailed data on exposure factors

The risk of transmission of *A. astaci* might be reduced through

- change to the regulatory management of live fish movements (e.g. Salmon and Freshwater Fisheries Act, Section 30 consent)
- application of measures to mitigate the risk of pathogen transmission.

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