1. The oomycete Aphanomyces astaci is generally considered a parasite specific to freshwater crayfish, and it has become known as the crayfish plague pathogen. Old experimental work that reported transmission of crayfish plague to the Chinese mitten crab Eriocheir sinensis, and the ability of A. astaci to grow in non-decapod crustaceans, has never been tested properly. 2. We re-evaluated the host range of A. astaci by screening for the presence of A. astaci in two crab species cohabiting with infected crayfish in fresh waters, as well as in other higher crustaceans from such localities. The animals were tested with species-specific quantitative PCR, and the pathogen determination was confirmed by sequencing of an amplified fragment of the nuclear internal transcribed spacer. Furthermore, we examined microscopically cuticle samples from presumably infected crab individuals for the presence of A. astaci-like hyphae and checked for the presence of pathogen DNA in such samples. 3. Screenings of benthopelagic mysids, amphipods and benthic isopods did not suggest infection by A. astaci in non-decapod crustaceans. In contrast, both studied lake populations of crabs (a native semiterrestrial species Potamon potamios in Turkey, and an invasive catadromous E. sinensis in Sweden) were infected with this parasite according to both molecular and microscopic evidence. 4. Analyses of polymorphic microsatellite loci demonstrated that A. astaci strains in the crabs and in cohabiting crayfish belonged to the same genotype group, suggesting crayfish as the source for crab infection. 5. The potential for A. astaci transmission in the opposite direction, from crabs to crayfish, and potential impact of this pathogen on populations of freshwater crabs require further investigations, because of possible consequences for crayfish and freshwater crab conservation and aquaculture.