Supplementary Information files for Invasive crayfish alter the long-term functional biodiversity of lotic macroinvertebrate communities

Functional Ecology

BRITISH ECOLOGICAL SOCIETY

Invasive crayfish modify the functional diversity of rivers

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One of the most pressing threats to the natural environment is the spread of flora and fauna outside their native regions. The establishment of a non-native invasive species within a new habitat range is often associated with adverse effects for the native animals and plants present as they are often outcompeted or preyed on. Signal crayfish, which are native to North America, are one of the most prevalent invasive species in Europe.

We studied how signal crayfish invasion in a number of UK rivers altered the functional diversity of freshwater macroinvertebrates (e.g. insects and amphipods). This was examined by exploring the functional traits that macroinvertebrate communities possess. Functional traits describe the biological properties (e.g. body size, feeding strategies) and preferences towards certain environmental conditions (e.g. substrate conditions of the riverbed and flow velocity of the water) of individual macroinvertebrate species. The biological traits that each riverine community possesses is particularly important as different species contribute different biological traits that maintain a healthy ecosystem. For example, the loss of a species consuming a certain food group may disrupt the transfer of energy to other taxonomic groups such as fish or algae. As signal crayfish typically feed on species possessing certain traits, such as slow-moving species like snails and leeches, we were interested to see if signal crayfish altered the composition and diversity of biological traits present in macroinvertebrate communities. To do this, we compared macroinvertebrate communities living in rivers which were invaded by signal crayfish with those that did not support signal crayfish in three UK regions.

We found that signal crayfish altered the composition of functional traits expressed by macroinvertebrate communities, with an increase in more extreme trait combinations. There was a reduction in the overall range of functional traits expressed in invaded rivers with the biological traits present representing a subset of those in rivers without crayfish. These results suggest signal crayfish are selectively preying on certain prey macroinvertebrates and we found that species that crawled, consumed other invertebrates and that lived in cobble and pebble habitats were negatively affected by crayfish invasion. In contrast, species that burrow and that live in mud and sand were positively associated with crayfish invasion. These findings can help guide river managers to implement effective measures to mitigate the ecological effects of signal crayfish.