science summary

Environment Agency

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Evaluating climatic effects on aquatic invertebrates in southern English rivers

Science Summary SC070046

Despite indications that streams and rivers will be among the most sensitive of all ecosystems to climate change, real evidence is scarce. This report of an analysis of Environment Agency data by Cardiff University shows how southern chalk-streams have warmed by 1.8 to 2.7 °C in winters over the past 26 years. However, no region-wide effects on river invertebrates were detectable, either because summer temperatures increased less (0.9 to 1.3 °C), or because improved water quality in recent years has countered adverse temperature effects. This report suggests that positive management of other pressures on water could offset at least some anticipated climate change problems. However, concerns remain that climate change could still affect unpolluted sites, and this possibility is being investigated in the second phase of this project.

In general, rivers follow air temperature closely, affecting the many cold-blooded animals that dwell there, as well as oxygen concentrations and key ecological processes such as decomposition. Climatic effects on rainfall pattern will have profound ecological effects in rivers through changing flow and the dilution or flushing of pollutants. Although effects on river organisms elsewhere from natural and man-made climate change are already clear, few studies have been carried out. This examination in southern England is thus important for informing possible abstraction strategies, assessing how climate might interact with other pressures, understanding climatic effects on monitoring data, identifying resources at risk, and developing adaptive management.

The analysis of biological data involved 52 sites on 50 surface- and chalk-fed rivers in the Dorset and Wiltshire Avon; the Bristol Avon; and in Hampshire and Devon. Trends in invertebrate composition and abundance were assessed for 10-18 years over the period 1989-2007 in relation to temperature (available from three sites), discharge and water quality. Emphasis was placed on average, region-wide patterns, since these were most likely to reflect climatic trends.

Over the study period, small but significant shifts in invertebrate composition occurred in two groups of chalk-fed sites. While increasing river temperature could explain some of this change, effects were spurious because:

i) assemblages gained taxa typical of faster flow or well-oxygenated conditions, contrary to expectations from warming;

ii) individual invertebrate families tended to increased in abundance rather than decline;

iii) declining ammonia, orthophosphate and biochemical oxygen demand (BOD) explained more variation in invertebrate composition than did temperature;

iv) pollution indices such as BMWP, ASPT, and taxon richness all increased.

Discharge explained considerable inter-annual variation among invertebrates at some chalk-stream sites, although there was no overall long-term trend in mean discharge during winter or summer.

The report suggests that further assessment of climatic effects should be done at sites unaffected by water quality, along with a review of the organisms, ecological functions and river types at risk. The Environment Agency should bolster its current programme for monitoring river temperature, and with water companies, should consider how best to manage interactions between water quality, abstraction, land use and climate change as part of an adaptive strategy. Given the clear value of these past Environment Agency data in revealing the trends reported here, the report recommends that the Environment Agency consider whether its future biological monitoring strategy will be adequate for detecting climate change effects.

This summary relates to information from Science Project SC070046 reported in detail in the following output(s):

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