

Evidence

Investigation of the mechanisms and potential impact of endocrine disruption effects in UK freshwater molluscs

Project summary SC030187 & SC030279

The Environment Agency has a responsibility to manage and improve the quality of our water resources. Two new research projects were commissioned to find out how some of the chemicals regularly washed into rivers and streams can affect the wildlife living there. The research has demonstrated that chemicals which mimic naturally occurring hormones can affect wild freshwater snails and that some effects may have long-term implications for population health and reproduction. This report will inform our decision-making on how best to monitor and manage these chemicals in water courses.

Endocrine Disruptive Chemicals (EDCs) can affect the natural hormone levels in wild animals and are regularly found in treated domestic sewage effluent. The correlation between sewage effluent in British rivers and abnormal reproductive development in fish is widely recognised. It is possible that freshwater invertebrates are also affected by EDCs, but little is known about their effects insects, crustaceans, worms and snails.

These two projects are complementary approaches to understanding the potential for EDCs to affect freshwater snails. The first explored the effect of the chemicals at the molecular and cellular level, and in particular asked what the biological mechanism for the effects seen might be. The second study investigated the effects of EDCs on whole populations, under semi-field and laboratory conditions. Its main purpose was to explore the suitability of different snail species as test organisms when assessing the impact of known and potential EDCs.

Previous research has shown that steroid hormones and other EDCs affect reproduction in some freshwater snails. Recently, receptors were discovered in snail cells that are very similar to oestrogen receptors found in vertebrates.

These receptors are found in both male and female snails and at different levels depending on the time of year and breeding period. The levels in tissues from snails exposed to water-borne oestrogens were altered in comparison to control snails.

The aim of the second project was to explore whether several native mollusc species (*Planorbis corneus*, *Viviparus viviparus* and *Bithynia tentaculata*) could be used to test the effects of EDCs on freshwater snails. The researchers investigated which species could be cultured in the laboratory and how much their reproduction was altered when they were exposed to a range of EDCs.

The researchers first tested the effects of vertebrate sex hormones and a mixture of natural and synthetic EDCs on the three snail species in outdoor tanks designed to mimic field conditions. Growth, survival and reproduction rates, levels of parasite infection and effects on gonads were assessed in adult snails and their offspring. This indicated the sensitivity and usefulness of the species for subsequent testing under laboratory conditions. Interpretation of the impact of EDCs was complicated due to a high level of variation in the responses of individual snails to the chemicals. This variability could be due to a combination of factors, including age, maturity, health and genetics. Varying levels of parasite infection among test snails was a particular concern.

Despite these difficulties, there were differences in the reproductive output of snails exposed to EDCs. The strength and direction of this response was influenced by the amount of chemical and the time of year. Awareness of this interaction between the chemical effect and the season is especially important when designing future tests.

Exposure to high levels of natural hormone and mixtures of EDCs caused poorly differentiated gonads, intersexuality and changes in the sex ratio of surviving offspring.

In snails that underwent their early development while exposed to the EDC, some of these effects persisted a year after the EDC was withdrawn. These effects have the potential to affect population levels.

The researchers recommend that establishing laboratory strains of a range of snail species, for use in tests, should be a priority. They consider that this would eliminate much of the variability in responses found in wild caught snails and is an essential next step towards the development of reliable and useful tests that use native molluscs.

This summary relates to information from project's SC030187 & SC030279, reported in detail in the following output(s):

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