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Research information note

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Evaluation of potential use of biomarkers as long-term monitoring tools in asessing ecological quality in terrestrial and aquatic environments of the UK

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Introduction

Biomarkers can be defined as biochemical, cellular, physiological or behavioural variations in the tissue or body fluids or at the level of whole organism that provide evidence of exposure to chemical pollutants, and may also indicate a toxic effect. These tools therefore have potential application in assessing impacts on, or monitoring the condition of, living organisms, and act as early warning indicators of ecological harm.

There are a wide number of biomarkers available at various states of readiness, ranging from the established, routinely deployed, to the more "blue sky" methods under developement. In addition to the wide range of potential tools available, there are also a number of practical and technical limitations in using and interpreting the subsequent results.

What was done

English Nature commissioned a broad review of biomarkers which could be used as long-term indicators of chemically induced stress on terrestrial and aquatic wildlife resulting from anthropogenic activities. In particular:

- What tools have been / are being developed?
- What is the range of circumstances these tools could be applied to?
- Which of the above tools are currently in use?
- What applications have been found for these tools?
- What potential applications are there for the tools identified above and how will they add to information derived from existing monitoring procedures?
- How could biomarkers be integrated into current or new monitoring programmes?

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The main body of the review was presented as two tables (on an accompanying CD). The first is a summary table that provides a quick overview of the biomarkers, their advantages and limitations. The second table is more detailed and enables searching upon items such as environment type. Information provided in the second table will assist in the decision-making process regarding the potential for incorporation into new or existing biomonitoring schemes.

Following this review, a workshop was held between biomarker practitioners and potential end-users to discus further the application of biomarkers and to agree a way forward in their development. The proceedings of this workshop were appended in the ENRR.

Results and conclusions

It was concluded that an integrated approach should be adopted for the use of biomarkers in biomonitoring schemes, which would includes measurement of biological effects and chemical residue data to provide information about the extent of contamination to habitats of interest. Biomarkers should be used as a complementary tool and not as a stand-alone measure. Some programmes would benefit from the use of non-specific biomarkers (indicative of a general health) while others would be more focussed and use specific biomarkers (responses to certain chemicals, or groups of chemicals).

The view from those who attended the workshop supported theses conclusions. In addition, the workshop delegates made suggestions for the way forward. These include:

- A need to develop methods for biomarker measurements into standardised tests that have been ratified by international organisations.
- A need for research to concentrate on bringing a smaller number of more robust biomarkers to the stage where they could fit into a framework of assessment.
- The relevance of experiences obtained from the medical research community to ecological applications should be considered ie what the effects are in human health monitoring which act as compelling arguments/triggers (red lights) for further action?

English Nature's viewpoint

The review and workshop represented the first stages of English Nature's work in considering the potential of biomarkers in future monitoring. There is a clear role for these tools as distinct strands of information within ecological assessment frameworks. The challenge now is facilitate engagement between academic, and other research institutes involved in developing tools, and potential end-users, to develop future studies aimed at making biomarkers more operational.

Further information

For the full report or other publications on this subject, please contact the Enquiry Service on 01733 455100/101/102 or email enquiries@english-nature.org.uk

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