

Are contaminants in freshwater and estuaries regulating the European eel population?

SF0255 The impact of diffuse pollution on European eel population.

What's the problem?

In the past 40 years, the number of European eel has significantly declined and as a result the population is judged to be outside safe biological limits. There is evidence that this decline is the result of a range of factors both anthropogenic, (e.g. exploitation, habitat deterioration, obstructions to migration, pollution, parasites and disease) as well as changing environmental processes (e.g. global warming, changes to oceanic conditions,). In response to this decline, the EU “Eel Recovery” regulation, was implemented which requires each Member State to develop an Eel Management Plan in order to protect and restore the population. However, until there is a full understanding of the factors causing the low recruitment of eels, the success of any management plans and conservation measures may be limited. It has been suggested that contaminants may be a factor in regulating the eel population and research is required to understand the extent of the problem in order to successfully implement the Management Plans.

What are the aims of the project?

The overall objective of the research was to investigate the role of specific diffuse aquatic contaminants in regulating the population of European eels. In particular the specific objectives of the research are to:

1. Investigate the impact of relevant environmental contaminants on the transition from freshwater to the marine environment and the subsequent adaptation of migrating adult silver eels to saline conditions.
2. Investigate the impact of contaminants within coastal and estuarine environments on the transition of juvenile eels from the marine to the freshwater environment.
3. Investigate the impact of sediment-derived contaminants on growth and survival in juvenile eels.
4. Investigate the impact of freshwater contaminants on the migratory behaviour of silver eels during their initial estuarine/coastal spawning migration.
5. Provide advice and recommendations on the management of aquatic contaminants to support the implementation of the Eel Recovery Plans.



Figure 1: Photograph of silver eel captured by netting

Which policy areas will the research inform?

The research will support Defra and the Government in fulfilling its obligations to the European Parliament, as set out in the EC's Eel Recovery Plan; support Defra, Environment Agency and English Nature in the management of biodiversity in aquatic ecosystems and the conservation of endangered and rare fish species; and address the recommendations of the Salmon and Freshwater Fisheries Review and the ICES/EIFAC Working Group on Eel (WGEEL).



Department
for Environment
Food & Rural Affairs

What are the results from the project and how will they be used?

The research investigated the impact of a range of contaminants on the freshwater spawning migration of the silver eel, the return of the juveniles from the sea and into freshwater and their subsequent period of growth, all considered to be key sensitive stages in the life history of the eel. The contaminants, which included herbicides, organophosphate insecticides, fungicides, molluscicides, flame retardants and metals such as copper, lead, zinc and chromium) were chosen because they are regularly monitored in estuaries and freshwater during periods when eels were migrating between the two environments and because the contaminants were considered to affect the key physiological and behavioural processes that are essential to the successful transition of the eels between the marine and freshwater environments.

Overall, the results of the research indicate that exposure to the contaminants within freshwater had little effect on the run-timing of silver eels as they migrated out to sea, although the herbicide atrazine did modify a physiological parameter important in the salt water adaptation of the eel. In a similar way, there was no evidence from the present study that contaminants present within the coastal zone and estuaries have an effect on the ability of glass eels and elvers to successfully move into the freshwater environment.

Although, the short term exposure of silver eels to contaminant did not affect the silvering process or successful short term migration, the present study did indicate that exposure to certain metals within sea water produced significant genetic damage in the glass eels. Damage at the molecular level in many fish can cause serious problems but in the present study it is not clear to what extent the genetic damage is carried through to the whole animal or what the effects might be at the population level.

Although, eels are known to bio-accumulate a number of toxins as a result of their high fat content, the present research also indicated no physiological or behavioural effects on juvenile eels as a result of

exposure to contaminated sediment or ingested contaminated prey. Therefore, the results indicated that the short-term exposure of eels to contaminants may not be the principal factor regulating populations. However, eels are resident in freshwater for many years and the long term exposure of eels to contaminants is of concern together with the effects of mixtures of contaminants. In addition, the role of water quality on the oceanic spawning migration and reproductive capabilities of the fish still need investigation.

The results of the project will be used to identify other factors operating both in the marine and freshwater environments that may cause the decline of the eel and support the implementation of the EC Eel Recovery Plans.



Figure 2: Glass eel hidden in substrate.

Where can I find further information about this and related research?

For further information please contact
Dr Andy Moore at Cefas
andy.moore@cefas.co.uk

Alternatively please contact
Dr Julius Piercy at Defra
julius.piercy@defra.gsi.gov.uk

Defra Science – did you know?

At any one time Defra manages over 2000 research projects covering a wide range of topics. For more information on current research see <http://randd.defra.gov.uk> and to find out about future research proposals see the Defra Research and Analysis page at: www.defra.gov.uk/evidence/index/htm