Freshwater pearl mussel

(comprehensive revision of SAP in 2004)

1. A Definition

The freshwater pearl mussel (*Margaritifera margaritifera* L.) is a bivalve mollusc that lives in fast flowing, nutrient poor rivers with clean sandy and stony bottoms.

The pearl-mussel can indeed produce pearls, and has been exploited for them since Roman times. Indeed, one factor responsible for the species decline is likely to have been this exploitation.

The mussels may grow up to about 15 cm in length and live up to 80 to 100 years. Unlike the more familiar saltwater mussels, the shell is oval and elongated, somewhat like that of a clam, and is dark brown or blackish.

It is a rare, globally threatened species that has been lost from all but seven English rivers. In Devon it was historically found in several catchments including the Tamar (Devon/Cornwall border), the Exe, Dart, Teign, Taw and Torridge. It is now only known from the Taw and Torridge and here only in low numbers.

2. Why an Action Plan?

The fresh water pearl mussel colonies on the rivers Taw and Torridge are only a remnant of a wider historical distribution in the county. Nationally five areas have been identified as having priority river systems for pearl mussel conservation, of which the Torridge in Devon is one. Implementation of the national Species Action Plan is a high priority here as the river supports a nationally important population.

The main causes of the decline of the freshwater pearl mussel are eutrophication, historical pearl fishing and, more locally, environmental conditions within water courses, including quality of the water and substrate.

The Devon populations of fresh water pearl mussels are not thought to have produced young for over 40 years. As a long lived species, the adults may survive a degree of environmental change, tolerating some level of eutrophication or siltation. However where juveniles cannot establish themselves, a population will eventually die out unless remedial action is taken.

Recent research has shown genetic distinctiveness in each of the populations of pearl mussel in Britain and, with this, subtle differences in habitat preference. This makes the Devon population all the more important to conserve, contributing to maintain genetic diversity of the species in Britain.

3. Relevant ecology

The Life in UK Rivers project was established to develop methods for conserving the wildlife and habitats of rivers within the Natura 2000 network of protected European rivers. A series of published reports collate the best available information on the ecological requirements, monitoring and re-introduction of the species. These can be read on the website at: www.riverlife.org.uk

Sexual maturity is reached at around 12 years old. Females inhale male sperm that is shed directly into the water. The fertilised eggs develop into tiny bivalve larvae called glochidia, each female being able to shed around 3 million of these into the water in late summer. An estimated 0.01% survives, to be inhaled by a host salmonid fish where they lodge on the gills. The following spring the juvenile mussels fall off and have to find a suitable location in clean sand. This is the most critical and sensitive phase in the pearl mussel life cycle with further massive mortality. The successful ones grow quite rapidly, reaching 2cm in 4-5 years. As they mature the outer shell becomes dark and wrinkled and often badly eroded.

Juvenile mussels may be eaten by fish when small, whilst adult mussels have a few natural predators. Otters are known to eat them, and if stranded by low water they may be taken by avian predators.

Freshwater pearl mussels are one of the longest-lived invertebrates known. They have a natural life span of 80-100 years. They live almost buried in clean coarse sand or gravels, preferring sites with a good mix of larger stones. Despite low calcium levels in their rivers they can grow massive shells, reaching 12-15 cm in length. They are filter feeders, extracting fine organic particles and it is suggested that at their natural abundance they have a significant role in improving water quality.

Pearl mussels need good water quality in the first place to survive - low nutrient levels, pH 7.5 or less, nitrate levels not exceeding 1.0mg l^{-1} and phosphates <0.03mg l^{-1}. Critical parameters affecting recruitment are biological oxygen demand (BOD), calcium and phosphate levels. Adult mortality is linked to nitrate concentrations and increased levels of phosphate. Calcium and BOD can cause reduced survival and establishment of juveniles.

4. Distribution and population of freshwater pearl

mussel in Devon

There are only two known populations of the species in the county, on the Torridge and Taw. Recent studies have revealed some previously unknown populations in other parts of Britain, so there is a slight possibility that this is also the case in Devon.

Current Population in Devon:

The status of this globally threatened species is highly threatened in Devon. Current records exist from surveys of the Torridge (1995, 1999 and 2002) and Taw (1995 and 1999), with former records from the Tamar (1966), Exe (1968), Dart (1972), Teign (unknown). Our largest population is on the Torridge and in 2002 only about 1350 mussels were found in approximately 11km of river, none of them in dense mussel beds. The Taw population in 1999 was close to extinction at less than 100 mussels.

Elsewhere in Britain:

Recent surveys of England and Wales show that most populations are virtually extinct with very little recruitment. A comprehensive survey in Scotland through the 1990's revealed that the mussel is now extinct in the lowlands and scarce elsewhere except for a few Highland rivers.

Surveys of streams and rivers in England and Wales since 1993 show that there is only one large population remaining of over 500,000 individuals and three other rivers have populations in the low thousands. Many rivers have populations close to extinction with less that 500 individuals and many others have been lost entirely.

5. Current problems for freshwater pearl mussel in Devon

Recruitment: This is judged to be a critical factor with many populations now having ageing populations and low numbers of juveniles surviving. The Devon populations are thought to have no juvenile recruitment. There are several factors affecting this, given below.

Water quality: Eutrophication, an increase in nutrients and productivity in acidic rivers, is a major cause of pearl mussel decline throughout Europe, and particularly noticeable on the Torridge. The resulting organic matter smothers the stream bed with an algal mat covering the substrate and clogging the interstitial spaces between the gravels in which the mussels settle. This can adversely affect successful fertilisation and glochidium release, leading to an ageing population with no juveniles. It is also thought to reduce adult life span. Sewage effluent and fertiliser leachate are known sources of eutrophication.

Chemical water pollution is a factor of high local significance to mussel populations. Heavy metals are highly toxic and pollution from tin mines is thought to have killed the mussels on the River Teign.

Habitat loss: Loss or degradation of habitat through development, land drainage, fisheries management and flood defence works can directly damage the river bed where the mussels live. Sedimentation arising from ingress of silt to the watercourse has a high local impact on populations, blocking interstitial spaces in the substrate and smothering existing mussels.

It is possible that where bank side trees are removed, high river water temperatures can result from hot summer days, which cause problems for the salmonid fish hosts. This in turn may lead to problems for the glochidia which are attached to these hosts, reducing their survival chances.

Salmonid stock size: The threatened status of host salmonid fish in the Torridge is a real cause for concern. Attempts at calculating the density of salmonid fish needed to sustain a healthy mussel population suggest 0.2 salmon m^{-2} to 0.3 trout m^{-2}. First year salmon fry are the most frequent salmonids on the Taw and Torridge main rivers where the mussels occur and therefore the most important host.

Amateur pearl fishing: Rarity and the legal protection in 1998 now deter exploitation but historically this has been a cause of the loss of many mature populations. The direct impact on populations in Devon is thought to have been significant with the total extinction of mussels in the headwaters of the Torridge.

6. Recent changes in population

Throughout the UK since 1950 the species has been recorded from 151 ten km squares in Britain north and west of a line from Scarborough in Yorkshire to Beer Head in Devon. Many populations may not have produced young for over 30 years. Recruitment rates are not known for most populations. Current research is trying, amongst other things, to establish this information. Further details are available in the Life in UK Rivers Report.

7. Current protection

Bern Convention, Appendix III.

EU Habitats Directive, Annexes II and V.

Wildlife and Countryside Act Schedule 5 (1981).

8. Current positive initiatives for freshwater pearl mussel in Devon

Species protection:

- English Nature has prepared a Species Action Plan.
- English Nature and Environment Agency have an R&D project studying the threats to pearl mussels.
- A UK Action Plan has been included in the UK Steering Group Report on Biodiversity.
- The fresh water pearl mussel is listed as vulnerable on the IUCN Red Data Invertebrate List (1990) and the British Red Data Book.

Site management:

- The Torridge has been identified by English Nature as a priority river as one of only seven in the Country known to support existing populations of pearl mussel.
- Actions to reduce sedimentation of salmonid spawning gravels are included in the Environment Agency's Torridge and Taw catchment Salmon Action Plan.
- The EA's Upper Torridge Project is identifying tributaries with particularly poor water quality and advising farmers on ways to reduce diffuse pollution problems. These measures may help in improving the river environment and securing the mussel populations.

Survey:

- English Nature and the Environment Agency (then the NRA) completed a survey of English sites in 1995.

9. Biodiversity planning context

The Devon Biodiversity Plan forms a key link in the chain of biodiversity planning running from the National UK Plan, through regional guidance, to local delivery.

National BAP Context

Species of principal importance in England (NERC Act, S.41):

- Freshwater pearl mussel

Current national BAP targets can be viewed on the Biodiversity Action Reporting System (BARS).

Associated Action Plans within the Devon BAP:

- Rivers, streams, floodplain and fluvial processes
- Atlantic salmon
- Otter

10. Biodiversity objectives and targets for freshwater pearl mussel in Devon

Objective 1

Maintain existing populations and identify methods to encourage recruitment to the population.

Target:

- Identify a freshwater pearl mussel recovery programme for the River Torridge by 2006.

Objective 2

Raise the profile of the species amongst interested parties.

Target:

- Approach all organisations and individuals with involvement in river management by 2005.

Objective 3

Encourage research in Devon which can further inform conservation actions for the species.

Target:

- Contribute to national or regional research into the species' autecology. Ongoing.

11. Wider benefits from pursuing these objectives

The pursuit of the objectives and targets set out above will not only benefit the

fresh water pearl mussel. Conservation has wider benefits and advantages for society, by providing a resource which is the basis of many aspects of the local economy, and by adding to the quality of life of the people of Devon in ways which are beyond financial measure. Thus enhancing the interests of biodiversity also enhances the interests of society as a whole. Some of these wider benefits are as follows:

- Water quality improvements which bring direct benefits to humans as consumers, as well as to wildlife.

- Improved salmonid populations, helping to bolster the economies associated with these species and enhanced general appeal of many of the south west's major rivers.

12. Priority or indicative actions for freshwater pearl mussel in Devon

Action	Key Partners
1. Identify a recovery programme for the Torridge tied tightly to research knowledge that will give direction to future conservation action for the species.	EA; EN; DEFRA; Universities/specialists
2. Ensure that water quality standards and habitat quality are improved to support existing populations at known sites (i.e. Torridge).	EA; DEFRA; SWWSL; Land-owners
3. Protect and enhance salmonid populations and recruitment in existing rivers with pearl mussels and other potential mussel rivers.	EA; Riparian owners
4. Ensure information gathered during survey and monitoring is made available to the national databases through JNCC and DBRC.	EA; EN; DBRC
5. Promote awareness of the threats to the species and their current legally protected status, threatened status, distribution and habitat requirements.	EA; EN; FWAG
6. Providing advice to riparian owners, river engineers, etc., operating in mussel rivers and future potential mussel rivers to avoid damage, pollution or degradation of existing habitat for pearl mussels and salmonids. Support the Upper Torridge Project as part of this.	EA; DEFRA; EN; FWAG; NFU; WRT
7. Ensure that no development proposals or illegal activities will adversely affect current populations or future species recovery.	EA; LAs

Freshwater Pearl-Mussel Action Plan Champion - Environment Agency

Abbreviations used in text and table

BAP	Biodiversity Action Plan
DEFRA	Department of Environment, Food and Rural Affairs
DBRC	Devon Biodiversity Records Centre
EA	Environment Agency
EN	English Nature
FWAG	Farming and Wildlife Advisory Group

JNCC	Joint Nature Conservation Committee
LAs	Local Authorities
NFU	National Farmers Union
SWWSL	South West Water Services Ltd
WRT	Westcountry Rivers Trust