

**European Community Directive
on the Conservation of Natural Habitats
and of Wild Fauna and Flora
(92/43/EEC)**

**Second Report by the United Kingdom under
Article 17**

**on the implementation of the Directive
from January 2001 to December 2006**

Conservation status assessment for :

**S1029: *Margaritifera margaritifera* - Freshwater
pearl mussel.**

Please note that this is a section of the report. For the complete report visit <http://www.jncc.gov.uk/article17>

Please cite as: Joint Nature Conservation Committee. 2007. *Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006*. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17

S1029 *Margaritifera margaritifera* Freshwater pearl mussel

Audit trail compiled and edited by JNCC and the Freshwater Inter-Agency Working Group

This document is an audit of the data and judgements on conservation status in the UK's report on the implementation of the Habitats Directive (January 2001 to December 2006) for this species. Superscript numbers accompanying the headings below, cross-reference to headings in the corresponding Annex B reporting form. This supporting information should be read in conjunction with the UK approach for species (see 'Assessing Conservation Status: UK Approach').

1. Range Information^{2.3}

1.1 Surface area of range^{2.3.1}

Unknown

Available data is not sufficient for calculating a current (post-1994) extent of occurrence at the UK scale. The nearest alternate estimate is based on records collected from 1970 onwards (see Map 1.1). However, due to rapidly declining trends, this is not considered representative of current surface area. Therefore until outstanding data issues have been addressed, surface area can only be reported as unknown.

1.2 Date of range determination^{2.3.2}

Not applicable

1.3 Quality of range data^{2.3.3}

Poor

There have been no comprehensive surveys carried out across the UK in recent years. Data gathered e.g. from Scotland are not yet in a suitable format for mapping current extent. Therefore, for this purpose, data quality has been reported as poor.

1.4 Range trend^{2.3.4} & Range trend magnitude^{2.3.5}

Decreasing

Margaritifera margaritifera was formerly widespread throughout western and northern parts of the UK. However, England and Wales are each now believed to support only a single recruiting population and even here the number of recruits has declined over recent years. In Northern Ireland the species formerly occurred widely in several catchments, but is now restricted to only a few sites. Although there is no quantitative estimate for range trend since the Habitat Directive came into force, based on population studies and expert opinion, range has confidently been reported as decreasing.

1.5 Range trend period^{2.3.6}

1994 – 2006

1.6 Reasons for reported trend in range^{2.3.7}

3. Direct human influence (restoration, deterioration, destruction);

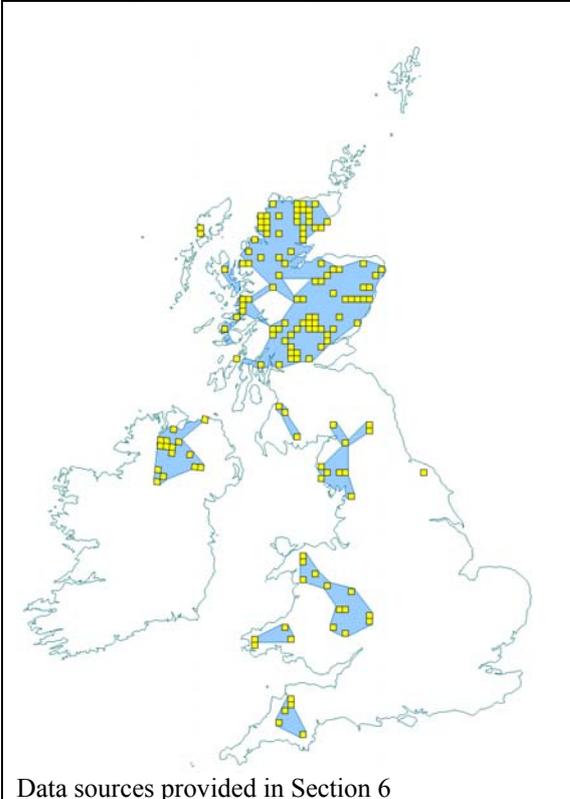
4. Indirect anthropo(zoo)genic influence

M. margaritifera declines have been attributed to: i) changes in the physical and chemical conditions of their habitat (e.g. poor water quality, including nutrient enrichment; sedimentation caused by catchment overgrazing; acidification, exacerbated by conifer afforestation; habitat removal and alteration through drainage schemes, flow regulation and fisheries management); (ii) amateur pearl fishing, aided by improved accessibility; and (iii) a decline in the numbers of juvenile salmon and trout, which provide the hosts for pearl mussel larvae. These declines have led to a reduction in range.

1.7 Favourable Reference Range^{2.7.1} 56,389 km²

The decision tree in Note 1 has been used as a guide in determining the favourable reference range estimate (see 'Assessing Conservation Status: UK Approach').

Map 1.1. Historic extent of occurrence and occupied 10 km-squares (1970-2002)



50 years ago, areas north and west of a line running from Scarborough, in Yorkshire, to Beer Head, in Devon were included within the UK range. In England, there are historical records of *M. margaritifera* from Devon, north Cornwall, the rivers Wye and Severn, the North Tyne, the river Lune (Lancashire), and streams in Cumbria and the North York Moors. In Wales, there is historical evidence of large populations in the rivers Conway and Wye, as well as records from Pembrokeshire, Carmarthenshire, Cardiganshire, Glamorganshire, Denbighshire, Snowdonia, and some tributaries of the River Severn. Populations in Northern Ireland were originally found in the Foyle, Bush and Erne catchments, and in the central Lough Neagh feeder streams. Historical records indicate that in Scotland freshwater pearl mussel was formerly present in more than 150 rivers throughout the mainland (except in the

River Tweed catchment and in the sandstone area of Caithness) and on some of the larger Western Isles.

Given present conditions of water quality, flow regime, habitat condition and sustainable host salmonid populations, the historical (post-1950) range would not be a suitable favourable reference range for this species. Suitable conditions are now largely, though not completely, confined to Scotland. In the absence of 1994 data, records from 1970 onwards (published by Jackson and McLeod in 2000), provide the only alternative guide for determining the favourable reference value (see Map 1.1).

Using Alpha hull software (where $\alpha=20$), extent of occurrence for this dataset was calculated at 56,389 km²; based on an expert understanding of the species and the information provided above, the favourable reference range should not be less than this extent which is considered to represent a viable range.

1.8 Range Conclusion^{2.8}

Unfavourable – Inadequate and deteriorating

Current extent of occurrence is not known. However, based on an understanding of current population numbers and distribution data published by Jackson and McLeod (2000), it can be reasonably inferred that declines in range has not exceed 1% per annum. Therefore, in accordance with Annex C, the assessment for range is Unfavourable-Inadequate and deteriorating. However, until current surface area, and hence trends, can be quantified this assessments comes with a caveat of low confidence.

2. Population of the species^{2.4}

2.1 Population estimate^{2.4.1}

66 viable populations

There were 132 populations in 2006, 66 of which were believed to be viable i.e. populations/rivers found to support juvenile pearl mussels (details are given in Table 2.1).

Table 2.1. 2006 National Status

Country	Population (number of rivers supporting populations)	No. of populations believed to be viable	Accuracy
England	11	1	Partial survey
Scotland	106	62	Sample or full survey
Wales	9	1	Full survey
Northern Ireland	5	2	Best guess
UK Total	132	66	Partial survey

The above estimate was calculated from the Biodiversity Action Reporting System (www.ukbap-reporting.org.uk National Biodiversity Action Plan - Status), and more recent 2006 surveys.

However, many of the populations across England and Wales have been identified as being in critical condition, and as a result, have since been (or are in the process of being) removed and placed into emergency, protective hatcheries. The reported total is therefore already likely to be an over-estimate.

2.2 Date of population estimate^{2.4.2}

2006

Data collected from 1992 onwards has been used to make an informed estimate of the 2006 population.

2.3 Method of population estimate^{2.4.3}

2 = extrapolation from surveys of part of the population, sampling

The standard technique for freshwater pearl mussel survey includes quantitative assessment based on transect counts. These also entail searching for the presence of juvenile mussels as a sign of recent recruitment and population viability.

2.4 Quality of population data^{2.4.4}

Moderate

There have been several extensive surveys to investigate sites with known historical records of freshwater pearl mussel. All of the known historic sites in Scotland (where the large majority of UK populations occur) were comprehensively surveyed in the late 1990s (Cosgrove and Young 1998, Cosgrove and Hastie 2000 Cosgrove *et al.* 2000). Further surveys on specific rivers have been carried out in Scotland more recently by Scottish Natural Heritage.

Surveys of the few remaining populations in England, Wales and Northern Ireland have been undertaken by the Environment Agency, English Nature (now Natural England), Countryside Council for Wales, and the Environment and Heritage Service, respectively. However, not all results from these surveys are available for analysis. Further, due to reasons provided in section 2.1, the 2006 population number may already be an over-estimate. Hence, data quality has been assessed as moderate rather than good.

2.5 Population trend^{2.4.5} and population trend magnitude^{2.4.6}

Decreasing

Recent survey of all rivers with historical records has been undertaken across the UK. Although some large, viable populations still survive (mainly in Scotland), pearl mussels are extinct or have non-viable (i.e. non-recruiting) populations at the great majority of sites occupied a century ago.

The latest UK trend reported via the Biodiversity Action Reporting System was “declining (continuing/accelerating)” (www.ukbap-reporting.org.uk/ National Biodiversity Action Plan - Trend)

2.6 Population trend period^{2.4.7}

2002 – 2006

This is the period of the last Biodiversity Action Plan round; this is also the period over which there has been much survey work. There is good evidence to suggest that the species has been declining since at least the mid-1950s and was not in a favourable state when the Habitats Directive came into force in 1994.

Table 2.2. Latest trend

Country	Trend	Accuracy	Data source/ comments
UK	Declining (continuing/ accelerating)	Partial survey	The UK trend assessment is based on information from England and Wales as the trend in Scottish populations is unknown at present.
England	Declining (continuing/ accelerating)	Partial survey	Although several populations (Ehen, Clun, North Tyne) have some recruitment, adult losses exceed recruitment levels. Other populations (rivers in south-west England, Yorkshire Esk, Lune, Dubbs Beck) appear to be close to local extinction. The Irt population has also declined considerably.
Northern Ireland	Declining (continuing/ accelerating)	Partial survey	Repeat surveys of the three SACs indicate large reductions in population levels.
Scotland	Trend unknown		Owing to the long life-span of the species, the sample-based nature of surveys and the fact that most populations have only recently been covered by a baseline survey, no trend information is available. Several large populations still exist (e.g. Spey, Kerry), and new populations have occasionally been recorded in recent years.
Wales	Declining (continuing/ accelerating)	Partial survey	Repeat surveys of occupied rivers show an average decline of 5-8% per annum (CCW surveys).

SOURCE: Biodiversity Action Plan 2005 reporting, and other surveys in 2006

2.7 Reasons for reported trend in population^{2.4.8}

3. Direct human influence (restoration, deterioration, destruction);

4. Indirect anthropo(zoo)genic influence

M. margaritifera declines have been attributed to: i) changes in the physical and chemical conditions of their habitat (e.g. poor water quality, including nutrient enrichment; sedimentation caused by catchment overgrazing, forestry activities and other land management practices; acidification, exacerbated by conifer afforestation; habitat removal and alteration through drainage schemes, flow regulation and fisheries management); (ii) amateur pearl fishing, aided by improved accessibility; and (iii) a decline in the numbers of juvenile salmon and trout, which provide the hosts for pearl mussel larvae.

2.8 Justification of % thresholds for trends^{2.4.9}

Not applicable

2.9 Main pressures^{2.4.10}

161 Planting

240 Taking/Removal of fauna, general

530 Improved access to site

701 Water pollution

830 Canalisation

850 Modification of hydrographic functioning, general

852 Modifying structures of inland water courses

910 Silting up

952 Eutrophication

953 Acidification

2.10 Threats^{2.4.11}

161 Planting

240 Taking/Removal of fauna, general

530 Improved access to site

701 Water pollution

830 Canalisation

850 Modification of hydrographic functioning, general

852 Modifying structures of inland water courses

910 Silting up

952 Eutrophication

953 Acidification

2.11 Favourable reference population^{2.7.2}

At least 80 viable populations

The decision tree in Note 1 has been used as a guide in determining the favourable reference population estimate (see ‘Assessing Conservation Status: UK Approach’).

Many UK rivers contain only a few scattered individuals, with no juvenile mussels recorded; such populations may become extinct owing to lack of recruitment. Of the 132 populations recorded only 66 are considered viable, i.e. capable of reproduction. Population levels at or around the time the Habitat Directive came into force in 1994 cannot be estimated with any degree of accuracy; the main period of survey was after that date. However, on the basis that trend has most likely exceeded 1% per annum (based on available information and expert opinion) the favourable reference population is considered to be at least 80 viable populations.

2.12 Population conclusion^{2.8}

Unfavourable – Bad and deteriorating

Most *M. margaritifera* populations are now suffering from low abundance and/or poor reproductive success, and, based on best available information, the current estimate is that the annual rate of decline in viable populations since 1994 is likely to have exceeded 1% per annum. Therefore, in accordance with Annex C, population is assessed as Unfavourable – Bad and deteriorating.

3. Habitat for the Species in the Biogeographic Region or Sea^{2.5}

The freshwater pearl mussel burrows into sandy substrates, often between boulders and pebbles, in fast-flowing rivers and streams. It requires cool, well-oxygenated soft water free of pollution or turbidity. The mussel spends its larval, or glochidial, stage attached to the gills of salmonid fish.

3.1 Surface area of habitat^{2.5.2}

Unknown

3.2 Date of estimation^{2.5.3}

Not applicable

3.3 Quality of data on habitat area^{2.5.4}

Poor

3.4 Habitat trend^{2.5.5}

Stable

Historically, organic pollution and industrial pollution have degraded freshwater habitat across the UK. Although pollution levels have been reduced in recent decades (as a result of a decline in heavy industry and investment in the treatment of sewage effluent), actions to control diffuse sources of pollution are in their early stages.

Although there are no quantitative habitat trend data for this species since the last biodiversity reporting round (2002-2006) expert opinion is that *M. margaritifera* habitat will most likely have remained stable, and possibly increased.

3.5 Habitat trend period^{2.5.6}

2002 – 2006

Owing to limited data, habitat trends are reported over a recent date-class, based on expert opinion.

3.6 Reasons for reported trend in habitat^{2.5.7}

3 = Direct human influence (restoration, deterioration, destruction)

4 = Indirect anthropo(zoo)genic influence

Nutrient enrichment, sedimentation caused by catchment overgrazing, forestry activities and other land management practices, acidification exacerbated by conifer afforestation, and habitat removal and alteration through drainage schemes, flow regulation and fisheries management, have all contributed to the decline in freshwater pearl mussel habitat.

3.7 Suitable habitat for the species (in km²)^{2.7.3}

Unknown

It is not possible to estimate the extent of suitable habitat without country-wide river surveys, specifically designed to assess the habitat characteristics known to be favourable to pearl mussel.

3.8 Habitat conclusion^{2.8}

Unfavourable – Bad

Although recent habitat trends have been identified as stable, it is unlikely that *M. margaritifera* habitat has been restored to favourable status across the UK.

Only one of the 19 SACs that support this species is known to be in favourable condition (based on JNCC's SAC site condition monitoring). Expert opinion is that this probably reflects the wider conservation status of the species in the UK. Further, accelerating population declines indicate that habitat is not currently sufficient to ensure the long-term survival of the species. On these grounds, habitat for the species has been assessed as Unfavourable – Bad.

4. Future Prospects^{2.6}

Bad prospects

“Long-term viability at risk; species likely to become extinct”.

M. margaritifera is the subject of a Species Action Plan under the UK Biodiversity Action Plan (it is also included on the revised UKBAP list).

Range is continuing to decline and most populations are suffering from low abundance and/or poor reproductive success. If conditions do not change, *M. margaritifera*'s long-term viability is at risk.

Despite serious declines both in distribution and total population, Scotland is one of the remaining European strongholds (the Irish Republic is the other) for *M. margaritifera*, supporting functional populations in more than 60 rivers, mainly in the North-West Highlands. Across the UK, designated sites represent the most important remaining populations. Further, as discussed in Section 2, a number of populations across Wales and England have now been removed to protective hatcheries. It is hoped that this early action will help to preserve genetic stock and that through a captive breeding program, the species can eventually be returned to its natural range. In Northern Ireland a preliminary captive breeding programme has already successfully reared 4-5 year old pearl mussels which will be released into a watercourse, and in Scotland, pearl mussels have been successfully returned to two rivers in the Cairngorms. The programmes in England and Wales, however, are still in their infancy, and likely progress over the next 12 years is still largely unknown.

Pearl fishing continues to be a factor in pearl mussel decline, although evidence suggests that this now operates at a greatly reduced level. Apart from pearl fishing, water quality and river management (e.g. channel engineering) have been recorded as particular concerns at many sites. Agricultural activities and catchment developments have also been listed as pressures on some designated sites. Serious reductions in salmonid populations, especially on the west coast of Scotland, are believed to have contributed to pearl mussel decline because of the relationship between young salmonids and pearl mussel glochidia.

It is hoped that the rate of contraction might slow as a result of the full protection afforded to the species under the Wildlife and Countryside Act, together with concerted efforts to reverse problems of water quality and physical habitat structure under the freshwater pearl mussel Species Action Plan. It is hoped that in the longer term, river basin management plans implemented under the Water Framework Directive, coupled with long-term projects to restore pearl mussel populations in rivers in which they have become extinct, might help to begin to reverse this trend.

However, even in rivers subject to pearl mussel restoration work, success will be determined by a wide range of factors ensuring the improvement and maintenance of suitable water quality, flow regime, physical habitat and host salmonid populations. Adverse changes in any one of these would be sufficient to arrest or reverse improvements in the size and viability of pearl mussel populations. In addition, for restoration to be effective, appropriate catchment management must extend consistently over the long term, owing to the age at which breeding commences in *M. margaritifera* and the length of the pearl mussel life-span. This has implications, too, for monitoring future trends in pearl mussel populations, where a commitment to long-term programmes is critical.

For these reasons, prospects can only be considered to be bad over the next 12 years.

4.1 Future prospects conclusion^{2.8}

Unfavourable – Bad

The species has been declining since the mid-1900s and continues to do so. If conditions do not change, there are very bad prospects for its future, and the species' long-term viability is at risk. For this reason, the assessment is Unfavourable-Bad.

A high level of effort is being invested into understanding and managing this species however, and provided commitments to long-term monitoring programs are made, prospects may be expected to improve.

5. Overall Conclusion^{2.8}

Unfavourable – Bad

Table 5.1. Summary of conclusions

Parameter	Judgement	Grounds for Judgement (in accordance with Annex C)	Reliability*
Range	Unfavourable – Inadequate and deteriorating	Any other combination	3
Population	Unfavourable – Bad and deteriorating	Population is declining at greater than 1% per annum.	2
Habitat	Unfavourable – Bad	Habitat quality is bad, clearly not allowing long-term survival of the species	1
Future Prospects	Unfavourable – Bad	Severe influence of pressures and threats to the species; very bad prospects for its future, long-term viability at risk.	2
Overall Assessment	Unfavourable – Bad	One or more Unfavourable - Bad	1

*1=High, 2=Moderate, 3=Low

High – Expert opinion is that the concluding judgement accurately reflects the current situation based on a professional understanding of the species. For range, population, and habitat, quality of data used to establish the current estimate has been identified as “good”; data used to inform trends is comprehensive and up to date.

Moderate – A greater understanding of the feature, or the factors affecting it, is required before a confident concluding judgement can be made by experts. For range, population, and habitat, the current estimate and/or trend are based on recent, but incomplete or limited survey data; or alternately, a comprehensive, but outdated (pre-1994) review.

Low – Judgements, and comprising estimates, are based predominately on expert opinion.

N/A – Assessment conclusion is “unknown”, on the basis of insufficient reliable information

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Map Data Source

Jackson & McLeod. 2000.