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 :

S1095: *Petromyzon marinus* - Sea lamprey.

S1095 *Petromyzon marinus* Sea lamprey

Audit trail compiled and edited by JNCC and 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]

Petromyzon marinus is reasonably widespread in UK rivers. Records are concentrated in East Anglia, the South-West and south and east Scotland. The rivers Wye and Severn are particular strongholds, together with several rivers in Wales (Davies *et al.*, 2004).

There are no records from the Northern Isles and the inner Hebrides, and it appears to be absent from much of North-West England and the Midlands, with only sparse records from the southern counties of England (Davies *et al.*, 2004).

1.1 Surface area of range[2.3.1]

24,987 km^2

The above estimate was calculated within the Alpha Hull software. Extent of occurrence was used as a proxy measure for range (see Map 1.1). The value of alpha was set at 25 km to reflect the mobility of this species. The range area was clipped to include only inland areas. The marine phase of the life history is not mapped.

1.2 Date of range determination[2.3.2]

1990 – 2003

Records from 1990 to 2003 were used to calculate the current extent of occurrence; 2002 was the most recent available record. These provide the best representation of current range, as it is understood by species experts.

1.3 Quality of range data[2.3.3]

Moderate

The Database for the Atlas of Freshwater Fishes (from which all GB data has been extracted), provides a relatively good data source for most fish across Britain However, it does not represent a complete inventory. Similarly, data published in Jackson and McLeod (2000) (used for NI mapping only) were compiled from a variety of sources. For these reasons, data quality has been reported as moderate, rather than good.

1.4 Range trend[2.3.4] and range trend magnitude[2.3.5]

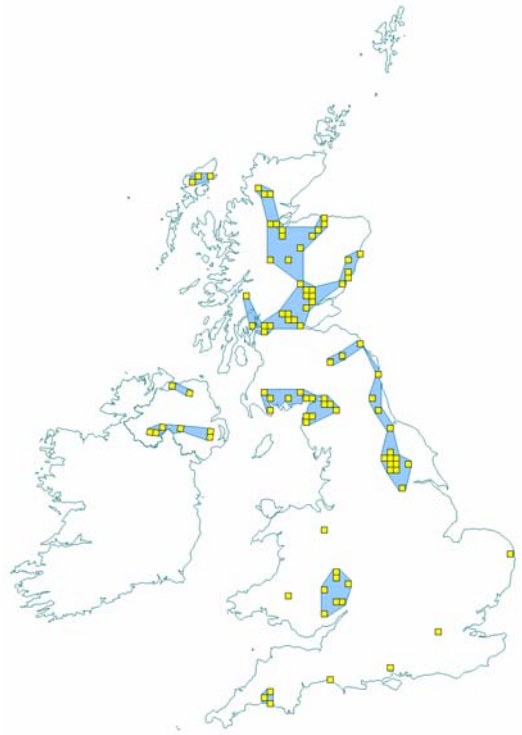
Increasing

Recent observations suggest that range is increasing. In 2000, *P. marinus* was observed in the River Thames, and this is thought to be the first record in modern times (Davies *et al.*, 2004). On this basis, the post-1994 trend has been reported as increasing, but with low confidence.

Records from the NBN (including the Database and Atlas of Freshwater Fish) were examined over three discrete time periods: pre-1972 (1972 was the publication date of Peter Maitland's FBA key to freshwater fish, and this included distribution maps); 1972 to 1991; and post-1992 (when the Habitats Directive was introduced). However, the data was found to be insufficient for determining trends due to the relative lack of historic lamprey surveys.

Historically, this species has declined in parts of its range, and has become extinct in a number of rivers (Maitland, 1980). The time period to which Maitland refers is not known.

Map 1.1 Current extent of occurrence and occupied 10-km squares (1990-2003)



Data sources provided in Section 6

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

Historic declines have been attributed to pollution and engineering barriers (Maitland, 1980). The more recent increases are thought to be due to improved water quality, and in Scotland, increased survey effort (Ecological Research Associates, 2005).

1.7 Favourable reference range[2.7.1]

24,987 km^2 (Equal to current)

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').

Although it is hoped that this species can be re-established into rivers from which it has been excluded historically, there is no evidence to suggest that current range is not sufficiently large, or has insufficient coverage, to support the species in the longer term. The current estimate has therefore set as a minimum favourable reference value for this species.

1.8 Range conclusion[2.8]

Favourable

Subsequent to historic declines, anecdotal evidence suggests a slight increase in range in recent years. Since the current estimate has been set as a minimum favourable reference range, the range assessment is therefore favourable.

2. Population of the Species[2.4]

2.1 Population estimate[2.4.1]

Unknown

There are no comprehensive population size estimates available for this species in the UK.

2.2 Date of population estimate[2.4.2]

Not applicable

2.3 Method of population estimate[2.4.3]

Not applicable

2.4 Quality of population data[2.4.4]

Poor

In general, lampreys are rarely observed, and furthermore, observations are rarely recorded. It is only in recent years that widespread surveys specifically aimed at lampreys have taken place (*e.g.* Ecological Research Associates, 2005). Where lamprey surveys are undertaken, they tend to focus on ammocoetes. Such surveys have found that *P. marinus* ammocoetes are far less abundant than *Lampetra* ammocoetes (Harvey & Cowx, 2003). This has recently been well illustrated with an example from the River Ouse and Derwent catchments where an electrofishing survey failed to record *P. marinus* ammocoetes (Harvey *et al*., 2006) but a survey of spawning activity recorded *P. marinus* spawning in several of the same rivers (BEST, 2005). Therefore, even when surveys are designed specifically for *P. marinus* ammocoetes, they often fail to find them, or only record a small number of individuals. The reasons for the apparent low abundance of *P. marinus* ammocoetes relative to *Lampetra* is unknown.

2.5 Population Trend[2.4.5] and Population Trend Magnitude[2.4.6]

Unknown

Historically, *P. marinus* appears to have become extinct from north-west England and the Midlands (Maitland and Campbell, 1992; Davies *et al*., 2004). However, despite problems with detection, there is some evidence to suggest recent population changes; numbers of *P. marinus* are reported to have increased in the Yorkshire Ouse and Derwent in the 1990s and *P. marinus* was observed for the first time in modern times in the River Thames in 2000 (Davies *et al*., 2004). These changes are thought to be due to improved water quality.

However there are other, anecdotal, reports of a recent decline in *P. marinus* numbers in a number of rivers, particularly in the North and West of Scotland (Ecological Research

Associates, 2005). For example, on the River Eachaig in Argyll, spawning *P. marinus* were once viewed as a pest at coastal salmon nets. During a 2004 survey, no *P. marinus* ammocoetes were found, and spawning adults have not been seen in recent years (Ecological Research Associates, 2005). Furthermore, in recent surveys, *P. marinus* has not been recorded in three Welsh riverine SACs that were designated for the species (APEM, 2005) although there are some records since notification of the sites.

Given the lack of quantitative data and also the conflicting regional reports, trends can only be reported as unknown at a UK level.

2.6 Population trend period[2.4.7]

Not applicable

2.7 Reasons for reported trend in population[2.4.8]

Not applicable

The reported increases are attributed to improved water quality, and increased survey effort (Ecological Research Associates, 2005). The suspected decreases in the River Eachaig are, as yet, unaccounted for.

2.8 Justification of % thresholds for trends[2.4.9]

Not applicable

2.9 Main pressures[2.4.10]

221 Bait digging
300 Sand and gravel extraction
420 Discharges
701 Water pollution
811 Management of aquatic and bank vegetation for drainage purposes
820 Removal of sediments (mud...)
830 Canalisation
850 Modification of hydrographic functioning, general
852 Modifying structures of inland water courses
853 Management of water levels
951 Drying out / accumulation of organic material
952 Eutrophication
953 Acidification

2.10 Threats[2.4.11]

221 Bait digging
300 Sand and gravel extraction
420 Discharges
701 Water pollution
811 Management of aquatic and bank vegetation for drainage purposes
820 Removal of sediments (mud...)
830 Canalisation
850 Modification of hydrographic functioning, general
852 Modifying structures of inland water courses
853 Management of water levels
951 Drying out / accumulation of organic material

952 Eutrophication
953 Acidification

2.11 Favourable reference population[2.7.2]

Unknown

Although some *P. marinus* populations are in good condition (*e.g.* River Spey, River Teith, River Usk), it cannot confidently be reported that this is representative of the wider UK situation. Further, because there is no current estimate of population size, any favourable reference value provided at this time would have limited meaning. It is therefore reported as unknown until more information is available on this species.

2.12 Population conclusion[2.8]

Unknown

There is insufficient information on *P. marinus* populations to make a judgment at this time. However, based on expert opinion, it would most likely be Unfavourable-Bad.

3. Habitat for the Species in the Biogeographic Region or Sea[2.5]

Clean well-oxygenated river gravels for spawning with suitable nearby hiding places. Good water quality, and slower flowing nursery areas of sandy silt for juveniles. The adult stage migrates to, and feeds in, the sea. Therefore they also require a clear migration route from the sea to their spawning grounds, with suitable river flows and no barriers. Relatively little is known about the marine habitats occupied by *P. marinus* nor is it certain which fish are the main prey species (Maitland, 2003).

3.1 Surface area of habitat[2.5.2]

Unknown

The accessible wetted area for England and Wales has been estimated (117.4km^2 based on CEFAS and Environment Agency, 2006) and, based on surface area, this can be extrapolated to account for Scotland and Wales (increasing the value by a factor of 2.5).

However, even then, not all of these wetted areas would be suitable for *P. marinus*; this species is thought to mainly utilise the lower reaches of large river systems, tending not to penetrate into the middle reaches (in large numbers at least), and generally unable to penetrate the upper reaches of large systems.

Furthermore, little is known about *P. marinus*' marine habitat. Area estimate is therefore unknown.

3.2 Date of estimation[2.5.3]

Not applicable

3.3 Quality of data on habitat area[2.5.4]

Poor

Relatively little is known about the marine habitats occupied by *P. marinus*, and total habitat area is unknown.

3.4 Habitat trend[2.5.5]

Increasing

Historically, organic pollution and industrial pollution have degraded fresh water habitat across the UK. Impoundments have also limited the area of fresh water habitat available for *P. marinus*; weirs that can be ascended by migratory salmonids often still represent an impassable barrier to *P. marinus.*

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. However, based on expert opinion, conditions are now considered to be improving. Therefore the trend in habitat is assessed as increasing.

3.5 Habitat trend period[2.5.6]

2002 – 2006

Due to limited data, habitat trends are reported over the last biodiversity action reporting round, based on expert opinion. (With the information available, it is difficult to comment on post-1994 trends with any degree of confidence, hence the shorter time period has been reported).

3.6 Reasons for reported trend in habitat[2.5.7]

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

Historic declines resulted from organic pollution, industrial pollution and restriction of access by weirs etc. Improvements in more recent years are attributed to active conservation management.

3.7 Suitable habitat for the species (in km^2)[2.7.3]

Unknown

3.8 Habitat conclusion[2.8]

Unfavourable - Inadequate but improving

Historically, *P. marinus* freshwater habitat is thought to have declined in both area and quality, due to the construction of barriers and pollution. Although conditions are now considered to be improving, 13 of 18 SACs designated for *P. marinus* (73%) were assessed as unfavourable during 2007 site condition assessments (two further SACs designated for this species were not assessed). One of the main reasons was inadequacy of supporting habitat (either water quality or water quantity). Although these SAC assessments are not necessarily indicative of habitat at a species specific level, the conclusions make it difficult to justify a judgment of Favourable at this time. A precautionary approach is therefore taken, and habitat is assessed as Unfavourable-Inadequate, but improving.

4. Future Prospects[2.6]

Poor prospects

"Species likely to struggle unless conditions change."

P. marinus is listed under Annex II of the Habitats Directive, and is being considered as a priority species under the UK Biodiversity Action Plan. Restoring the freshwater habitat of *P. marinus* is the priority within designated sites as this is the principal reason for unfavourable condition on most SACs. There seem to be reasonable prospects for the restoration of this habitat, although it is in the very early stages. Judging success will be difficult, due to the difficulties in identifying *P. marinus* and some of the unknowns about their exact habitat requirements (e.g. ability to negotiate obstacles). Outside of SACs,

restoring access to catchments, and areas of catchments, that *P. marinus* has occupied in the past seems a major means by which Favourable condition will be achieved.

In England, Wales and Scotland a review of all consents or licences for discharge and abstractions affecting SACs is underway which should lead to significant reductions in water quality and water resources stresses on this species. Aside from the above reviews or activities affecting SACs the Water Framework Directive is adding impetus to the drive for controlling the ecological impacts of pollution and abstraction.

However, restoring access to obstructed waterways is hampered by *P. marinus'* low public profile (particularly when compared to salmon and sea trout) and also a poor understanding of their actual water quantity requirements (Maitland, 2003).

A further concern about *P. marinus* is the low abundance of ammoecetes in rivers. The failure of recent monitoring to record *P. marinus* from three Welsh riverine SACs (APEM, 2005) that are designated for the species are likely to be because the species is present at such low abundances that monitoring failed to record it (there are other contemporary records from most of the SACs). This has been found to be the case on the River Ouse where ammocoete surveys did not record *P. marinus* but adults spawning was recorded (section 2.4). Therefore there is some uncertainty about the status of several *P. marinus* populations and there needs to be further research to establish why *P. marinus* ammocoetes occur at such low densities.

P. marinus is an anadromous fish species that feeds in the sea and therefore prey availability could limit the size of a population. Very little is known about what the prey species *P. marinus* feeds on and how far out to see the species migrates. In this assessment, pressures in the freshwater environment have been assumed the principal ones limiting the species.

Therefore, in summary, there seem to be reasonable prospects for restoration of the species' supporting habitat in SACs (water quality and water resources). But the extent to which the species' habitat is restored outwith the designated site network through the implementation of the Water Framework Directive is unclear at present. Restoring access for the species to areas from which it is excluded by barriers is another potential future restoration action. Action to restore the morphology of rivers to achieve the objectives of the Water Framework Directive may help deliver this, but a lack of understanding of the water quantity needs of *P. marinus* is a potential hindrance. The difficulty in confidently recording *P. marinus* ammocoetes, and hence assessing their population status and range, is a further hindrance. Based on this information, it is difficult to confidently justify a judgment of good (defined by the Commission as "species is expected to survive and prosper"). Hence, a more precautionary approach is taken, and prospects are reported as poor. However, with conservation measures firmly in place, and with habitat conditions showing signs of improvement, prospects are also expected to improve over the next 12 years.

4.1 Future prospects conclusion[2.8]

Unfavourable - Inadequate but improving

5. Overall Conclusion [2.8]

Unfavourable - Inadequate but improving

Range is Favourable; population, unknown; habitat and future prospects are both Unfavourable – Inadequate but improving. Therefore, in accordance with guidance, the overall conclusion is Unfavourable – Inadequate but improving.

Table 5.1 Summary of conclusions

Parameter	Judgement	Grounds for Judgement (in accordance with Annex C)	Reliability*
Range	Favourable	Range is increasing and not smaller than the favourable reference range	2
Population	Unknown	Insufficient reliable information available	N/A
Habitat	Unfavourable - Inadequate but improving	Any other combination Some improvement in habitat quality is still required before it can confidently be reported as "suitable for the long term survival of the species"	2
Future Prospects	Unfavourable - Inadequate but improving	Any other combination Prospects are currently poor, but with conservation measures now in place, this is expected to improve over the next 12 years.	2
Overall Assessment	Unfavourable - Inadequate but improving	One or more ' Unfavourable - Inadequate' but no ' Unfavourable - Bad'	2

*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.

6. References

APEM. 2004. *Assessment of sea lamprey distribution and abundance in the River Spey: Phase II*. Scottish Natural Heritage Commissioned Report No. 027.

APEM. 2005. *Lamprey survey of the Rivers Tywi, Teifi and Cleddau.* Review of consents report no. 7 for Environment Agency and Countryside Council for Wales.

Bellflask Ecological Survey Team (BEST). 2005. *Survey of adult sea lamprey spawning and habitat availability in the Rivers Ure, Swale, Wharfe, Nidd and Derwent.* Report for ALSF, English Nature and The Environment Agency.

Centre for Environment Fisheries and Aquatic Science (CEFAS) and Environment Agency. 2006. *Annual assessment of salmon stocks and fisheries in England and Wales, 2005.* Environment Agency, Cardiff.

DAVIES, CE, SHELLEY, J, HARDING, PT, MCLEAN, IFG, GARDINER, R AND PEIRSON, G (eds.). 2004. *Freshwater fishes in Britain. The species and their distribution.* Harley Books, Colchester.

Ecological Research Associates (ERA). 2005. *A national lamprey survey of Scotland.* Report for Scottish Natural Heritage, Clydebank.

HARVEY J AND COWX I. 2003. Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus. *Conserving Natura 2000 Rivers Monitoring Series No. 5*, English Nature, Peterborough.
http://www.english-nature.org.uk/lifeinukrivers/publications/lamprey_monitoring.pdf

HARVEY, JP, NUNN, AD AND COWX, I. 2006. *Survey of larval lamprey (ammocoetes and transformers) in the Yorkshire Ouse and Derwent catchments, 2004.* Report to the Environment Agency (Dales Area).

LAUGHTON, R. AND BURNS, S. 2003. Assessment of sea lamprey distribution and abundance in the River Spey: Phase III. *Scottish Natural Heritage Commissioned Report No. 043.*

MAITLAND, PS. 1980. Review of the ecology of lampreys in northern Europe. *Canadian Journal of Fisheries and Aquatic Sciences*. **37**, 1944-1952.

MAITLAND, PS. 2000. *Guide to Freshwater Fish of Britain and Europe.* Hamlyn, London.

MAITLAND, PS. 2003. Ecology of the River, Brook and Sea Lamprey. *Conserving Natura 2000 Rivers, Ecology Series No. 5*. English Nature, Peterborough.
http://www.english-nature.org.uk/LIFEinUKRivers/publications/lamprey.pdf

MAITLAND, PS AND CAMPBELL, RN. 1992. *Freshwater Fishes of the British Isles.* Harper Collins, London.

MCLEOD, CR, YEO, M, BROWN, AE, BURN, AJ, HOPKINS, JJ, AND WAY, SF (eds.). 2007 *The Habitats Directive: selection of Special Areas of Conservation in the UK*. 2nd edn. Joint Nature Conservation Committee, Peterborough www.jncc.gov.uk/SACselection.

Map Data Sources

GB records:
Biological Records Centre - Database for the Atlas of Freshwater Fishes (1637-2003) (via NBN Gateway).

Northern Ireland records:
Jackson, D.L. and McLeod, C.R. (eds.). 2000. Report 312 - Handbook on the UK status of EC Habitats Directive interest features: provisional data on the UK distribution and extent of

Annex I habitats and the UK distribution and population size of Annex II species. Revised 2002. Peterborough: Joint Nature Conservation Committee. Available online at: http://www.jncc.gov.uk/page-2447