

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

Supporting documentation for the
Third Report by the United Kingdom under
Article 17

on the implementation of the Directive
from January 2007 to December 2012
Conservation status assessment for

Species:

S1029 - Freshwater pearl mussel. (*Margaritifera margaritifera*)

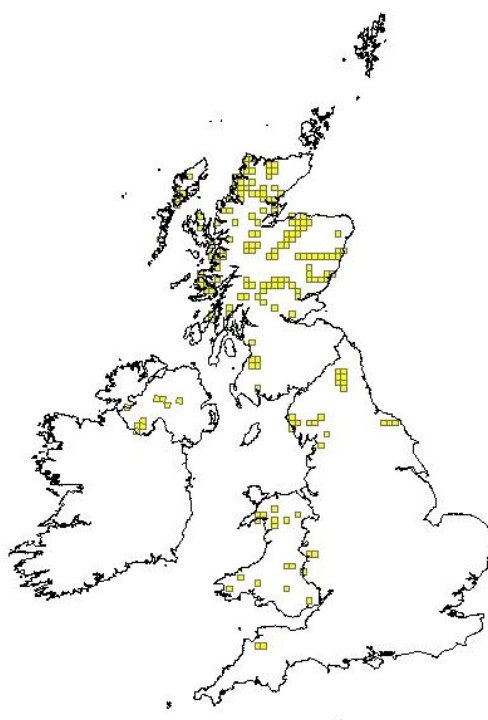
IMPORTANT NOTE – PLEASE READ

- The country-level reporting information contained in this document is a contribution to the Article 17 UK report for the habitat/species concerned.
- It has been provided by **Scottish Natural Heritage** and refers only to the state of the habitat/species in **Scotland** - it does not constitute an assessment for the whole of the UK.
- The Article 17 UK Approach document provides details on how this information has been used and, combined with information supplied by other Statutory Nature Conservation Bodies
- The format of the document is closely aligned to that set out by the European Commission for Member State reporting – as a result, some of the fields are not applicable at a country-level and have deliberately been left blank – in addition, the content of most fields is constrained by the EC reporting categories.

Reporting format on the 'main results of the surveillance under Article 11' for Annex II, IV & V species

<i>Field name</i>	<i>Brief explanations</i>	
0.2 Species	0.2.1 Species code	S1029
	0.2.2 Species scientific name	<i>Margaritifera margaritifera</i>
	0.2.3 Alternative species scientific name Optional	
	0.2.4 Common name Optional	Freshwater pearl mussel

1.1 Maps		
1.1.1 Distribution map		Sensitive True
<p>Freshwater pearl mussels occur in Scotland from Dumfries and Galloway to the Northern Isles and from the Western Isles to Aberdeenshire. They only occur in calcium deficient rivers, typically those draining relatively impervious rocks.</p> <p>The date range is to encapsulate the only national survey of the species in Scotland (1997). Some earlier accounts on NBN include records from some Caithness rivers which have been discounted from this audit as they have been confirmed to be misidentifications and are <i>Anodonta</i> spp..</p> <p>The survey method used in almost all cases has been wading surveys in relatively shallow water using glass-bottomed buckets. In three instances deep water surveys have been carried out using remote cameras deployed from a stationary boat.</p> <p>The survey methods have an inherent tendency to underestimate the presence or abundance of juvenile pearl mussels. However the threshold in this audit for being considered a 'viable population' is relatively low (recording at least one juvenile in a population) and therefore the analysis should provide a reasonable assessment of those populations where some recent recruitment has taken place.</p>		



<p>1.1.2 Method used - map</p>	<p>Complete survey/Complete survey or a statistically robust estimate</p> <p>Cosgrove, P.J. & Young, M.R. 1998. The status of the freshwater pearl mussel <i>Margaritifera margaritifera</i> in Scotland. Confidential report to Scottish Natural Heritage.</p> <p>Cosgrove, P.J., Young, M.R., Hastie, L.C., Gaywood, M. & Boon, P.J. 2000. The status of the freshwater pearl mussel <i>Margaritifera margaritifera</i> Linn. in Scotland. Aquatic conservation: Marine and Freshwater Ecosystems, 10, 197-208.</p> <p>Cosgrove, P.J. & Hastie, L. 2000. National survey of the freshwater pearl mussel <i>Margaritifera margaritifera</i>: Phase II. Scottish Natural Heritage Commissioned Report F00PA22 (Unpublished report).</p> <p>SNH freshwater pearl mussel dataset</p>
<p>1.1.3 Year or period</p>	<p>1996-2012</p>
<p>1.1.4 Additional distribution map</p>	<p>False</p>
<p>1.1.5 Range map</p>	

<p>2.1 Biogeographical region & marine regions</p>	<p>ATL</p>
<p>2.2 Published sources</p>	<p>"Site Condition Monitoring Cycles 1 and 2</p> <p>Cosgrove et al. 2011. Scotland's freshwater pearl mussels: the</p>

	<p>challenge of climate change. In 'River Conservation and Management' eds. Boon, P. and Raven, P.</p> <p>Cosgrove, P.J. & Young, M.R. 1998. The status of the freshwater pearl mussel <i>Margaritifera margaritifera</i> in Scotland. Confidential report to Scottish Natural Heritage.</p> <p>Cosgrove, P.J. & Hastie, L. 2000. National survey of the freshwater pearl mussel <i>Margaritifera margaritifera</i>: Phase II. Scottish Natural Heritage Commissioned Report F00PA22 (Unpublished report).</p> <p>Cosgrove, P.J., Young, M.R., Hastie, L.C., Gaywood, M. & Boon, P.J. 2000. The status of the freshwater pearl mussel <i>Margaritifera margaritifera</i> Linn. in Scotland. Aquatic conservation: Marine and Freshwater Ecosystems, 10, 197-208 http://onlinelibrary.wiley.com/doi/10.1002/1099-0755(200005/06)10:3%3C197::AID-AQC405%3E3.0.CO;2-S/abstract</p> <p>Langan, S, Cooksley, S, Young, M, Stutter, M, Scougall, F, Dalziel, A, Feeney, I, Lilly, A and Dunn S. (2007). The management and conservation of the freshwater pearl mussel in Scottish catchments designated as Special Areas of Conservation or Sites of Special Scientific Interest. Scottish Natural Heritage Commissioned Report No.249 www.snh.gov.uk/publications-data-and-research/publications/search-the-catalogue/publication-detail/?id=943</p> <p>Several unpublished, confidential reports on Species Action Framework restoration projects.</p> <p>SNH freshwater pearl mussel dataset (unpublished)"</p>
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2.3 Range		
2.3.1 Surface area Range		
2.3.2 Method used Surface area of Range	Complete survey/ Complete survey or a statistically robust estimate	
2.3.3 Short-term trend Period		
2.3.4 Short term trend Trend direction	Range is likely to have appeared to increase since the last assessment, however this is principally due to new populations being found that were previously unrecorded (e.g. Northern Isles).	
2.3.5 Short-term trend Magnitude	a) Minimum	
	b) Maximum	
2.3.6 Long-term trend Period		
2.3.7 Long-term trend Trend direction		
2.3.8 Long-term trend Magnitude Optional	a) Minimum	
	b) Maximum	
2.3.9 Favourable reference	a) Value in km²	

range	FRV range was too small for Scotland	
	b) Operator for FRR	
	c) FRR is unknown (indicated by "true")	False
	d) Method used to set FRR	
2.3.10 Reason for change Is the difference between the reported value in 2.3.1 and the previous reporting round mainly due to...	a) Genuine change?	False
	b) Improved knowledge/more accurate data?	True
	The range has changed due to new records of the species in recent years.	
	c) Use of different method (e.g. "Range tool")?	False

2.4 Population		
2.4.1 Population size estimation (using individuals or agreed exceptions where possible)	a) Unit	
	b) Minimum	
	c) Maximum	
2.4.2 Population size estimation (using population unit other than individuals) Optional (<i>if 2.4.1 filled in</i>)	a) Unit	number of colonies
	Viable populations	
	b) Minimum	72
	c) Maximum	72
2.4.3 Additional information on population estimates / conversion	a) Definition of "locality"	Viable populations

Optional	b) Method to convert data	
	c) Problems encountered to provide population size estimation	
2.4.4 Year or period	1996-2012	
2.4.5 Method used Population size	Complete survey/Complete survey or a statistically robust estimate	
	SNH freshwater pearl mussel dataset The population size estimate is of viable populations in Scotland. There are also other non-viable populations (ie. not recruiting populations) and extinct populations, and these make up the majority in rivers that are known to have supported freshwater pearl mussel populations 100 years ago. The dates for the population description are used to encapsulate the only national freshwater pearl mussel survey (1997).	
2.4.6 Short-term trend Period	2001-2012	
2.4.7 Short-term trend Trend direction	decrease 1% or less/year	
	During the short-term trend period at least one viable population has been lost. A reintroduction has also taken place (to another river) but it is too early to detect (due to the species' long lifecycle) whether it has been successful in establishing a viable, recruiting population.	
2.4.8 Short-term trend Magnitude	a) Minimum	
	b) Maximum	
	c) Confidence interval	
2.4.9 Short-term trend Method used	Estimate based on partial data with some extrapolation and/or modelling	
	During the short-term trend period at least one viable population has been lost (approx 2003). A reintroduction also took place in 2010 (to another river) but it is too early to detect (due to the species' long lifecycle) whether it has been successful in establishing a viable, recruiting population	

2.4.10 Long-term trend – Period		
2.4.11 Long-term trend Trend direction		decrease
2.4.12 Long-term trend Magnitude Optional	a) Minimum	
	b) Maximum	
	c) Confidence interval	
2.4.13 Long term trend Method used		
2.4.14 Favourable reference population	a) Number of individuals/agreed exceptions/other units	
	b) Operator	
	c) FRP is unknown indicated by "true"	False
	d) Method used to set FRP	
2.4.15 Reason for change Is the difference between the value reported at 2.4.1 or 2.4.2 and the previous reporting round mainly due to:	a) Genuine change?	True
	There is a greater number of viable populations in Scotland in this assessment, due to new records of previously unknown populations. This change masks the extinction of one previously viable population in approx 2003.	
	b) Improved knowledge/more accurate data?	True

	There is a greater number of viable populations in Scotland in this assessment, due to new records of previously unknown populations. This change masks the extinction of one previously viable population in approx 2003.	
	c) Use of different method (e.g. "Range tool")?	False

2.5 Habitat for the species		
2.5.1 Area estimation	<p>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.</p> <p>There is not thought to be a sufficient amount of habitat in the UK to support a viable population of the species. Unknown</p> <p>There is not thought to be a sufficient amount of habitat in the UK to support a viable population of the species. There are a number of non-viable populations that could be restored to become viable populations (and hence help us attain the FRV for the species), and potentially make an important contribution to maintaining or improving the range in Scotland. But a lack of 'rivers' is not a reason for this, rather it's the quality of the river habitat.</p> <p>There is not thought to be a sufficient amount of habitat in the UK to support a viable population of the species.</p>	
2.5.2 Year or period		
2.5.3 Method used Habitat for the species	Estimate based on expert opinion with no or minimal sampling	
2.5.4 Quality of the habitat	a) Habitat quality	Bad
	This is based on expert opinion. Given that a population has become extinct due to poor habitat quality (over-abstraction) and other populations are in decline due to poor water quality and river morphology, this is taken to be symptomatic of wider habitat quality, and the conclusion is that it is bad. SCM data show that water quality and morphological damage are contributory factors to the unfavourable status of a number of SACs. Again this is likely to reflect wider issues with habitat quality for the species outside such sites.	
	b) Assessment method	This is based on expert opinion. Given that a population has become extinct due to poor habitat quality (over-abstraction) and other populations are in decline due to poor water quality and river

		<p>morphology, this is taken to be symptomatic of wider habitat quality, and the conclusion is that it is bad. SCM data show that water quality and morphological damage are contributory factors to the unfavourable status of a number of SACs. Again this is likely to reflect wider issues with habitat quality for the species outside such sites.</p>
<p>2.5.5 Short-term trend Period</p>	<p>1996-2012</p>	
<p>2.5.6 Short-term trend Trend direction</p>	<p>stable</p> <p>It is not possible to estimate that overall habitat area for the species. The quality of the habitat for freshwater pearl mussels cannot really be assessed without specific habitat surveys for the species. However the quality of the habitat is assessed as being bad because of the fragile state of many viable freshwater pearl mussel populations, likely due to siltation and enrichment.</p> <p>This is based on expert opinion. Given that a population has become extinct due to poor habitat quality (over-abstraction) and other populations are in decline due to poor water quality and river morphology, this is taken to be symptomatic of wider habitat quality, and the conclusion is that it is bad. SCM data show that water quality and morphological damage are contributory factors to the unfavourable status of a number of SACs. Again this is likely to reflect wider issues with habitat quality for the species outside such sites.</p> <p>There is no information on the short term habitat for the species trend and this is based on expert opinion. Historically, organic and industrial pollution have degraded freshwater habitat in Scotland and elsewhere. Although pollution levels in recent decades have reduced, action to control diffuse sources has only commenced in the last 2-3 years.</p> <p>Although there are no quantitative habitat trend data for this species since the last reporting round, expert opinion is that habitat will most likely have remained broadly stable.</p> <p>However it is important to note that freshwater pearl mussels are extremely sensitive to changes in some habitat determinands (e.g. nutrients, organic pollution). Outside Special Areas of Conservation, such determinands are controlled and regulated in accordance with the aims of the Water Framework Directive. It is considered that the habitat requirements of the freshwater pearl mussel are so high that much of the restorative action required to meet WFD objectives (i.e. good ecological status) will be insufficient to restore the habitat such that freshwater pearl mussel populations will become viable. For this species, this is an important policy gap at present.</p>	
<p>2.5.7 Long-term trend Period</p>		
<p>2.5.8 Long-term trend Trend direction</p>		

2.5.9 Area of suitable habitat for the species	a) Value in km²	
	Unknown	
	b) Absence of data indicated as '0'	
2.5.10 Reason for change Is the difference between the value reported at 2.5.1 and the previous reporting round mainly due to	a) Genuine change?	False
	b) Improved knowledge/more accurate data?	False
	c) Use of different method (e.g. "Range tool")?	False

2.6 Main pressures		
a) Pressure	b) Ranking	c) Pollution qualifier
	H = high importance M = medium importance L = low importance	
A06: annual and perennial non-timber crops	H	X
F06: Hunting, fishing or collecting activities not referred to above	H	
H01: Pollution to surface waters (limnic & terrestrial, marine & brackish)	H	PX
J02: human induced changes in hydraulic conditions	H	
B02: Forest and Plantation management & use	M	
F01: Marine and Freshwater Aquaculture	M	
A04: grazing	L	

Pressures were ranked, principally on the prevalence and significance of recorded problems they are causing in Scotland. Pearl fishing and unauthorised river engineering have been recorded as damaging 75% of the SACs & SSSIs that were surveyed during the last monitoring cycle. It is also widely recognised that organic pollution, siltation and nutrient enrichment are the main problems preventing many populations from recruiting properly and therefore activities that give rise to those problems generally received a high rating. These pressures are the most significant and widespread pressures affecting pearl mussels in Scotland.

H01.08 refers to discharges from domestic septic tanks which appear to limit survival and recruitment in some small, vulnerable pearl mussel streams.

Measures are in place to try and address these pressures (see conservation measures). Other pressures include the harvesting/clear felling of mature plantation woodlands (B02.02). In some pearl mussel catchments this landuse can be very significant. This activity needs to take place for the benefit of the pearl mussels to remove legacy planting right up to the riverbank in many places. Measures to help ensure that pearl mussels aren't adversely affected by pollution from the harvesting are being put in place including training of operators.

Some of the pressures may also be those that are leading to reduced numbers of juvenile salmon and/or trout in some pearl mussel streams (e.g. poor marine survival, aquaculture F01.01).

2.6.1 Method used – Pressures

based exclusively or to a larger extent on real data from sites/occurrences or other data sources

Site condition monitoring data, pressures noted in other surveys, findings of UK priority plan for the species (wildlife crime).

2.7 Threats		
a) Threat	b) Ranking	c) Pollution qualifier
	H = high importance M = medium importance L = low importance	
A06: annual and perennial non-timber crops	H	X
F06: Hunting, fishing or collecting activities not referred to above	H	
H01: Pollution to surface waters (limnic & terrestrial, marine & brackish)	H	PX
J02: human induced changes in hydraulic conditions	H	
B02: Forest and Plantation management & use	M	
F01: Marine and Freshwater Aquaculture	M	
M01: Changes in abiotic conditions	M	
A04: grazing	L	

The threats largely mirror the current pressures, although it is expected that some threats will continue to emerge from climate change. There are measures either in place, or being implemented, to try and reduce these threats. They include ongoing action to try and reduce the impact of illegal damage to pearl mussels and/or their habitat. Other measures are being taken to reduce diffuse pollution problems and reduce the threat posed by engineering and engineered structures (e.g. weirs). However some of these measures will not be implemented by 2015.

2.7.1 Method used – Threats	expert opinion
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2.8 Complementary information	
2.8.1 Justification of % thresholds for trends	
2.8.2 Other relevant information	<p>Scotland remains host to some of the most important, large populations of this species, with many of those located in the North-West Highlands. Designated sites mainly represent the most important remaining populations.</p> <p>Recent trends indicate that the status of some populations in designated sites continues to decline. This is despite considerable efforts to improve conditions, including concerted action to combat wildlife crime, improved regulation of river engineering and the start of action to reduce diffuse pollution.</p> <p>The principal pressures continue to be pearl fishing and poor habitat quality. Serious reductions in salmonid numbers in some locations, principally along the west coast have contributed to pearl mussel decline due to the relationship between pearl mussel glochidia and juvenile salmonids.</p> <p>Conservation measures, particularly targeting designated sites, will be implemented as part of a LIFE+ Nature project (Pearls in Peril) until 2016. It is envisaged that this concerted and targeted action will lead to significant improvements in the status of several populations within designated sites.</p> <p>Action has also taken place to address pressures in populations outwith designated sites. This includes action to combat wildlife crime and to improve habitat quality. The relative effect of this on status is more difficult to understand without concerted monitoring - which will take place in 2013/14. But, given the situation recorded in designated sites, it is likely there has been some decline in populations outside designated sites. An important gap for populations outside designated areas is that the objectives in the Scotland River Basin Plan (ie. no deterioration in ecological status and/or restoration to good ecological status) are not sufficient to produce satisfactory habitat quality for freshwater pearl mussels. It is envisaged that further targeted action will be needed on selected rivers to overcome this current policy gap. Overall, it is hoped that the rate of contraction will slow and action has already taken place to reintroduce the species to a river from which it was previously lost.</p> <p>However, even in rivers subject to pearl mussel restoration work, it is important to note that 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,</p>

appropriate catchment management must extend consistently over the long term, owing to the age at which breeding commences 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.

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2.8.3 Trans-boundary assessment**2.9 Conclusions (assessment of conservation status at end of reporting period)**

Please refer to the United Kingdom assessment for this species.

3 Natura 2000 coverage & conservation measures - Annex II species (only applies to species listed under Annex II of the Directive)**3.1 Population****3.1.1 Population size**

Estimation of population size included in the SAC network

a) Unit**number of colonies**

Viable populations

b) Minimum**27****c) Maximum****27****3.1.2 Method used****Complete survey/Complete survey or a statistically robust estimate**

Site condition monitoring data

Langan, S, Cooksley, S, Young, M, Stutter, M, Scougall, F, Dalziel, A, Feeney, I, Lilly, A and Dunn S. (2007). The management and conservation of the freshwater pearl mussel in Scottish catchments designated as Special Areas of Conservation or Sites of Special Scientific Interest. Scottish Natural Heritage Commissioned Report No.249 www.snh.gov.uk/publications-data-and-research/publications/search-the-catalogue/publication-detail/?id=943

3.1.3 Trend of population size within the network (short-term trend)**decrease**

Although there are 19 SACs for the species in Scotland, a number include more than one population of mussels. Therefore the SAC network supports 27 viable pearl mussel populations in Scotland (there are also two unviable populations within the network which do not qualify for inclusion in the population estimate). The data quality is relatively good, with nearly all of the SACs having been surveyed in the time period. However only about half the SACs have been surveyed more than once during the time period making the trend in population size less robust. However what trend data exists shows that in some populations there has been a clear decline in conservation status during the time period. There has been no reduction in the number of viable populations, however some populations have lost a considerable proportion of their populations over the reporting period (50% in one case). While there have also been improvements

elsewhere, the overall picture is of declining status despite the implementation of measures to improve status.

3.2 Conservation measures

Conservation measures taken (i.e. already being implemented) within the reporting period and provided information about their importance, location and evaluation.

3.2.1 Measure	3.2.2 Type					3.2.3 Ranking H = high importance M = medium importance L = low importance	3.2.4 Location where the measure is PRIMARILY applied			3.2.5 Broad evaluation of the measure					
	a) Legal/statutory	b) Administrative	c) Contractual	d) Recurrent	e) One-off		a) Inside	b) Outside	c) Both inside & outside	a) Maintain	b) Enhance	c) Long term	d) No effect	e) Unknown	f) Not evaluated
3.1: Restoring/improving forest habitats		Y				M			Y	Y					
3.2: Adapt forest management		Y	Y			M			Y	Y					
4.0: Other wetland-related measures		Y				M	Y				Y				
4.1: Restoring/improving water quality		Y				H			Y		Y				
4.2: Restoring/improving the hydrological regime			Y			H	Y			Y					Y
6.3: Legal protection of habitats and species	Y	Y				H			Y	Y					

Site condition monitoring data

3.1 Restoring forest habitats - several pearl mussel catchments have commercial forest plantations as

a significant land-use. As these plantations are restructured native riparian woodlands will be introduced to benefit pearl mussel.

3.2 Adapting forest management - action is underway that aims to improve the way forest harvesting operations are conducted, lowering the risk to pearl mussels from pollution that may arise during such operations.

4.1 Restoring/improving water quality - in many SACs and SSSIs water quality is not good enough to support pearl mussel recruitment. A variety of measures are underway to improve water quality that will require careful monitoring to ensure they are sufficient, given the very high water quality needs of freshwater pearl mussel.

4.2 Restoring/improving hydrological regime - some populations have been damaged by inadequate river flows. Measures are planned to restore a more suitable flow regime.

4.0 Some populations have been damaged by unauthorised river engineering, sometimes severely.

This is despite awareness raising of the threat that river engineering can pose to the species.

Measures have been implemented to remove structures that impede natural sediment transport and install a fish pass to restore access to a catchment by anadromous salmonids.

6.3 Legal protection of habitats and species - freshwater pearl mussels are fully protected under the Wildlife and Countryside Act. Despite this illegal pearl-fishing continues and is one of the most significant threats to the survival of many populations. Action will continue, with the species a UK wildlife crime priority, to reduce the threat posed by criminal activity.