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:

S1109 - Grayling (*Thymallus thymallus*)

IMPORTANT NOTE – PLEASE READ

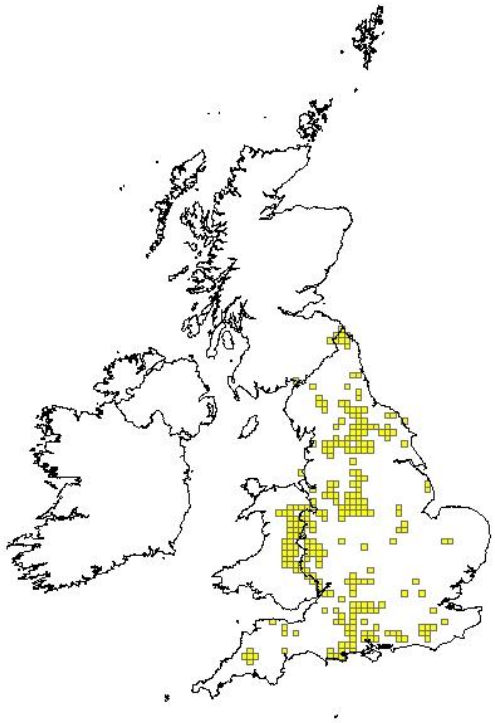
- The country-level reporting information contained in this document is a contribution to the Article 17 UK report for the habitat/species concerned.
- It has been provided by **Natural Resources Wales** and refers only to the state of the habitat/species in **Wales** - it does not constitute an assessment 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.

As of 1 April 2013, the Countryside Council for Wales, Environment Agency Wales and Forestry Commission Wales became Natural Resources Wales/Cyfoeth Naturiol Cymru

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

Field name	*Brief explanations*	
0.2 Species	**0.2.1 Species code**	**S1109**
	0.2.2 Species scientific name	***Thymallus thymallus***
	0.2.3 Alternative species scientific name Optional	
	0.2.4 Common name Optional	**Cangen Las, Grayling**

1.1 Maps			
1.1.1 Distribution map		**Sensitive**	**False**
	Grayling are poorly recorded in NBN, as they are difficult to electrofish and rod catch records are not georeferenced. This issue affects the quality of population and to a lesser extent distribution data.		



1.1.2 Method used - map	**Complete survey/Complete survey or a statistically robust estimate**
	Grayling are a difficult species to electrofish and so 10km records are heavily dependant on angler catch returns. Very little angler data is on NBN, so 10km squares for this species in Wales have had to be thoroughly revised based on data in Ibbotson et al. (2001), the Wye and Usk Foundation website (2012), Cove (unpublished data) and websites of angling clubs and rivers trusts. This has substantially improved the distribution of the species compared to JNCC (2007) with several

	incorrect records being removed and various gaps being filled.
1.1.3 Year or period	**2007-2012**
	Although older records have been incorporated, most records have been updated and the overwhelming majority of Welsh records are since 2006.
1.1.4 Additional distribution map	**False**
1.1.5 Range map	

2.1 Biogeographical region & marine regions	**ATL**
2.2 Published sources	**"Cove R.J. (2007) National Grayling Anglers' Logbook Scheme Angler Report 2006/07. Environment Agency National Fisheries Technical Team Report. Environment Agency, Buckley.** **Dawnay, N., L. Dawnay, R. N. Hughes, R. Cove, and M. I. Taylor. 2011. Substantial genetic structure among stocked and native populations of the European grayling (Thymallus thymallus, Salmonidae) in the United Kingdom. Conservation Genetics. DOI: 10.1007/s10592-010-0179-4** **Duigan C, Monteith D.T., Carvalho L., Bennion H., Hutchinson J, Seda J.M., Evans F. (2003) The current ecological and conservation status of Llyn Tegid. In: Llyn Tegid Symposium: The ecology, conservation and environmental history of the largest natural lake in Wales. (Eds. Duigan C, Gritten R, Millband H). University of Liverpool, Liverpool.** **Huet, M. 1959. Profiles and biology of Western European streams as related to fish management. Transactions of the American Fisheries Society 88:155-163.** **Ibbotson, A. T., R. J. Cove, A. Ingraham, M. Gallagher, D. D. Hornby, M. Furse, and C. Williams. 2001. A review of grayling ecology: status and management practice.R&D Technical Report W245. Environment Agency, Bristol.** **Leah, R.T. (2003) A Review of the Ecology of Fish Populations of Llyn Tegid, with special emphasis on the Gwyniad. In: Llyn Tegid Symposium: The ecology, conservation and environmental history of the largest natural lake in Wales. (Eds. Duigan C, Gritten R, Millband H). University of Liverpool, Liverpool.** **Lucas, M. C., and D. H. Bubb. 2005. Seasonal movements and habitat use of grayling in the UK.Environment Agency Science Report SC030210/SR. Environment Agency, Bristol.** **Woolland, J. V., and J. W. Jones. 1975. Studies on grayling Thymallus thymallus in Llyn Tegid and the upper River Dee, North wales. Part 1. Age and growth. Journal of Fish Biology**

	7:749-773."

2.3 Range		
2.3.1 Surface area Range		
	Grayling are thought to be native to three catchments in Wales; the Wye, Severn and Dee (Ibbotson et al. 2001). Subsequent genetic analysis (Dawnay et al. 2011) supports this general view, although the status of the Dee population is ambiguous and is likely to at least have been genetically altered by stocking. Although we have a good knowledge of which catchments grayling occurs in, there is some uncertainty regarding their exact upstream limit in all three systems. Additionally, it is possible that at least some subpopulations are the result of introductions or translocations.	
2.3.2 Method used Surface area of Range	**Complete survey/Complete survey or a statistically robust estimate**	
	Grayling are a difficult species to electrofish and so 10km records are heavily dependant on angler catch returns. Very little angler data is on NBN, so 10km squares for this species in Wales have had to be thoroughly revised based on data in Ibbotson et al. (2001), the Wye and Usk Foundation website (2012), Cove (unpublished data) and websites of angling clubs and rivers trusts. This has substantially improved the distribution of the species compared to JNCC (2007) with several incorrect records being removed and various gaps being filled.	
2.3.3 Short-term trend Period	**1990-2012**	
	Although older records have been incorporated, most records have been updated and the overwhelming majority of Welsh records are since 2006. Some newer data lacks spatially explicit information linked to a 10km square (for example just a river name) but could nevertheless be used to generically confirm the continued presence of populations. For these reasons it was necessary to retain some older data.	
2.3.4 Short term trend Trend direction	**unknown**	
	Since the baseline data for range is relatively poor, it is difficult to make accurate estimates of changes to the range of this species. Greatly improved baseline data this time around should rectify this problem. However, the expert opinion of anglers and Environment Agency fisheries staff indicates that grayling range in Wales is likely to either be stable or to have increased slightly. The magnitude of any change is therefore unquantifiable but small and probably not significantly different to zero.	
2.3.5 Short-term trend Magnitude	**a) Minimum**	
	See 2.3.4.	
	b) Maximum	
	See 2.3.4.	

2.3.6 Long-term trend Period	**1989-2012**	
	No reliable long term range trend data are available.	
2.3.7 Long-term trend Trend direction	**unknown**	
	See 2.3.6.	
2.3.8 Long-term trend Magnitude Optional	**a) Minimum**	
	See 2.3.6.	
	b) Maximum	
	See 2.3.6.	
2.3.9 Favourable reference range	**a) Value in km²**	
	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**
	Any changes in range within Wales are thought to be primarily due to improved knowledge. A few additional squares are related to recovery from acidification and resultant upstream recolonisation.	
	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 *(if 2.4.1 filled in)*	**a) Unit**	**number of map 10x10 km grid cells**
	53 records at 1km2 resolution or better were found covering the period 1988 to 1998, most of which were collated as part of the Database and Atlas of Freshwater Fish project. No Welsh records were available since 1998. Since the Wye and Dee both support important grayling fisheries and is contradicted by other reliable data (e.g. Cove 2007; Dawnay et al. 2011) this dataset is not considered credible and further analysis has not been attempted. We have therefore reported our results as 10km2 data based on the range assessment. However, this data was unsuitable for trend assessment (see 2.4.5).	
	b) Minimum	**46**
	c) Maximum	**46**
2.4.3 Additional information on population estimates / conversion Optional	**a) Definition of "locality"**	
	b) Method to convert data	
	c) Problems encountered to provide population size estimation	**Lack of adequate data on NBN. See note.**
2.4.4 Year or period	**1990-2012**	
2.4.5 Method used Population size	**Complete survey/Complete survey or a statistically robust estimate**	
	Population size was originally agreed to be based on 1km2 data. To assess this, records were extracted from relevant datasets on the National Biodiversity Network (NBN). Records outside Wales, older than 1988 or at worse than 1km2 resolution were screened out.Records collated during the range assessment exercise under 2.3 could not be used because these records were at 10km2 resolution. The use of number of occupied grid square data as a surrogate for population in the absence of methods to control for sampling effort is methologically flawed, because changes in occupancy could be due either to genuine change or changes in sampling effort. It is reported here only in the interests of consistency. Further technical work is required to establish a suitable technical method to assess grayling	

	populations, using a standardised sampling method such as an angler logbook scheme that can provide acceptable population estimates. It should be noted that even then, it may be difficult to confidently identify trends to the level of precision envisaged by the Commission, as grayling populations vary naturally (Ibbotson et al. 2001).
2.4.6 Short-term trend Period	**2001-2012**
	The requested time period was used in this assessment.
2.4.7 Short-term trend Trend direction	**stable**
	See note for 2.4.2a and 2.4.5. Cove (2007) compiled grayling records between 2001 and 2007 for the Environment Agency and calculated grayling catch per hour. Welsh records are spread between two different Environment Agency regions, Wales (Dee and Wye) and Midlands (Severn). Some records from waters where grayling have been introduced will also be included in the Wales regional records. Mean catch per hour varied between about 1.4 and 2.2 fish per hour in different years for both regions. No clear trend in population as measured by catch per hour was evident. However, this data was collected over a relatively short period. On the balance of probabilities the short term trend direction is assumed to be stable (See 2.4.9).
2.4.8 Short-term trend Magnitude	**a) Minimum**
	No quantitative data are available on population trend. The apparent increase in number of occupied squares is the result of a complete revision of grayling range in Wales based on best available data, rather than a real change.
	b) Maximum
	See note 2.4.8a.
	c) Confidence interval
2.4.9 Short-term trend Method used	**Estimate based on expert opinion with no or minimal sampling**
	Further technical work is required to establish a suitable technical method to assess grayling populations, using a standardised sampling method that can provide acceptable population estimates. It should be noted that even then, it may be difficult to confidently identify trends, as grayling populations vary naturally (Ibbotson et al. 2001). The above notwithstanding, the general consensus amongst both Environment Agency fisheries staff (R. Cove pers com; P. Greest pers com) and rivers trusts (S. Marsh-Smith pers com) is that grayling populations are either stable or increasing. This trend is probably present within the 10km square data but detecting it is hampered by the poor quality of the original baseline data. On the balance of probabilities the short-term trend is considered to be

	stable.	
2.4.10 Long-term trend – Period	**1988-2012**	
2.4.11 Long-term trend Trend direction	**stable**	
	No quantitative data are available on long-term trend, and grayling populations are notoriously variable (Ibbotson et al. 2001). Anecdotal evidence suggests that some grayling populations have expanded into the upper reaches of river systems as they recover from acidification, but also that fish eating birds may be affecting recruitment by predating juveniles. The relative importance of these pressures with respect to their impact on populations is unknown. In Wales the status of grayling in the Severn subcatchment is considered to be of most concern, as the grayling population there is more fragmented (Ibbotson et al. 2001).	
2.4.12 Long-term trend Magnitude Optional	**a) Minimum**	
	No quantitative data are available on trend.	
	b) Maximum	
	c) Confidence interval	
2.4.13 Long term trend Method used	**1**	
	Further technical work is required to establish a suitable technical method to assess grayling populations, using a standardised sampling method that can provide acceptable population estimates. It should be noted that even then, it may be difficult to confidently identify trends, as grayling populations vary naturally (Ibbotson et al. 2001). The above notwithstanding, the general consensus amongst both Environment Agency fisheries staff (R. Cove pers com; P. Greest pers com) and rivers trusts (S. Marsh-Smith pers com) is that grayling populations are broadly stable.	
2.4.14 Favourable reference population	**a) Number of individuals/agreed exceptions/other units**	
	Due to the lack of population size data, estimation of a favourable reference population is not possible. However, given that most available habitat for the species within the native range in Wales seems to be well utilised (see section 2.5), and also that such data as are available indicate that populations are strong (see previous comments), the current population size is considered to be within the range of values consistent with favourable reference population. The limited evidence available indicates that both habitat occupancy and populations are	

	stable or better since 1992. If 10km squares are used again, the current occupancy represents FRV.	
	b) Operator	
	c) FRP is unknown indicated by "true"	**True**
	d) Method used to set FRP	**See previous comments regarding the difficulty of sampling this species. The improved 10km2 baseline this time around means that future assessments using this metric could be much more accurate, but the use of a logbook scheme such as that of Cove (2007) is far superior because it provides a direct estimate of population trend.**
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?**	**False**
	The Wye and Usk foundation has reported the up-catchment spread of grayling in recent years. This is thought to be linked to recovery from acidification and possibly other improvements in water quality and abstraction management. However, this is likely to have affected only a few 10km squares (probably no more than 5).	
	b) Improved knowledge/more accurate data?	**False**
	The majority of the population "change" is due to a QA and revision of grayling records for Wales against existing datasets not on NBN, especially Ibbotson et al. (2001) and the Wye & Usk Foundation (2012). This has resulted in the removal of 14 incorrect 10km squares and the addition of 27.	
	c) Use of different method (e.g. "Range tool")?	**False**

2.5 Habitat for the species	
2.5.1 Area estimation	**15**
	Surface area is subject to natural variation due to (i) river flow and ; (ii) river erosional and depositional processes (especially in the Severn and some of the Wye tributaries). Several of the rivers involved are the boundary between England and Wales and this further complicates this issue. Habitat surface area would also be affected by the interpretation

	of Llyn Tegid as grayling habitat (see 2.5.3). There is some uncertainty regarding the upstream limit of occurrence in all systems, but the relatively small area involved means that this is not a significant source of error. No detailed analysis of error in the calculation of habitat area has been carried out, but it is likely that the figure quoted is accurate to within +/- 25% and may be a slight underestimate of the actual area. There is thought to be a sufficient amount of habitat in the UK to support a viable population of the species.
2.5.2 Year or period	**2012-**
	The GIS work underpinning this estimate was carried out in October 2012 based on the data by Ibbotson et al. (2001).
2.5.3 Method used Habitat for the species	**Complete survey/Complete survey or a statistically robust estimate**
	Running water habitat polygons were extracted from the CCW Phase I Habitats Survey database. These were then subject to the following screening process: 1. Polygons outside the grayling 10km square range used for 2.3 were deleted. 2. Within each 10km square, polygons above the reported upstream limit were deleted. 3. Polygons representing habitat considered unsuitable for grayling (e.g. very small streams) were removed. A quality assurance process was also applied to ensure that river networks were fully covered. Grayling also occur in Llyn Tegid, the largest natural lake in Wales and the only natural lake in Britain with a permanent population (Leah, 2003). Leah (2003) notes that grayling mainly use the littoral zone to 3m and are rarely caught in the open water of the lake. In view of the large surface area of Llyn Tegid (4.14km2) it was felt that to include the entire surface area of the lake would seriously bias the estimate of grayling habitat in Wales and also include large areas of unsuitable or poor quality habitat. No accurate digitised bathymetry of Llyn Tegid is available. Consequently, shallow water areas of Llyn Tegid were digitised by eye using the bathymetric map published in Duigan et al. (2003). This is intended to provide a broad representation of the area of the lake 3m deep or less. Although this estimate is imprecise, since lake levels of Llyn Tegid are regulated for flood defence and water resources purposes, this area will in any case be mobile. The estimated habitat area for grayling is shown in the MapInfo layer grayling_area.tab. It represents a complete survey of habitat within the native range, subject to the caveats discussed.
2.5.4 Quality of the habitat	**a) Habitat quality** **Moderate**
	Habitat quality was assessed using the Environment Agency's WFD classification data for 2010 (the most recent date for which classification data were available) for all water bodies where grayling were assessed as being naturally present in 2012. 39 such water bodies totalling 873km river length* were identified in Wales. Of this 179.6km was considered Good Ecological Status, 499.9km Moderate status and 193.5km Poor status. No sections supporting grayling were considered either High or Bad Ecological Status. Llyn Tegid was seperately assessed in 2010 as being at moderate

	ecological status. Overall, habitat in Wales is therefore considered to be moderate. For a discussion of the reasons for this, see section 2.6. The grayling zone sensu Huet (1959) corresponds more or less with H3260 Rivers with Ranunculion vegetation, although they avoid macrophyte beds (Ibbotson et al. 2001). * NB some of these water bodies formed part of the England / Wales border or overlapped into England - the overall figure does not account for this. Llyn Tegid is also excluded from this figure.	
	b) Assessment method	**See note at 2.5.4a).**
2.5.5 Short-term trend Period	**2001-2012**	
	The requested time period was used in this assessment.	
2.5.6 Short-term trend Trend direction	**unknown**	
	Although data on river quality are available for this time period, the assessment method has changed fundamentally to Water Framework Directive compliant methods. Therefore, no assessment of trends is possible using the available datasets. General assessments of trends in river quality in Wales (e.g. Ormerod & Juttner 2009) describe an improvement in the poorest quality sites, and a deterioration in the wider countryside, especially in the number of near-pristine sites. The impact of these changes on grayling is unclear.	
2.5.7 Long-term trend Period	**1989-2012**	
2.5.8 Long-term trend Trend direction	**unknown**	
	See 2.5.6.	
2.5.9 Area of suitable habitat for the species	**a) Value in km²**	**15**
	Habitat occupancy is considered to be high for this species and therefore the area of occupied habitat is considered to be the same as the total habitat resource. Populations are generally relatively well connected along river systems.	
	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?	**True**

	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	
H01: Pollution to surface waters (limnic & terrestrial, marine & brackish)	H	OPTX
M01: Changes in abiotic conditions	H	
I01: invasive non-native species	M	
I02: problematic native species	M	
J02: human induced changes in hydraulic conditions	M	
J03: Other ecosystem modifications	M	
F02: Fishing and harvesting aquatic resources	L	

The range of grayling in Wales coincides with some of the most regulated river systems. 403km of grayling habitat was classified as Heavily Modified Water Body (HMWB), mostly due to the effects of flow regulation for public water supply. For 266km the target was for this to be restored to Good status, with the remainder having a derogation of Moderate status. HMWBs supporting grayling did not have detectably worse ecological quality than non HMWBs, probably because public water supply reservoirs are predominantly situated in upland areas with good water quality and fewer agricultural impacts. Thus, large-scale river regulation does not seem to have a serious impact on grayling in Wales. In Llyn Tegid, the pattern of lake level management may have resulted in an increase in the grayling population. A more important issue may be the effect of smaller barriers to migration such as weirs but there is little quantified information on the magnitude of these effects.

Water quality is a significant concern for grayling habitat in Wales. 500km of river water body failed good ecological status due to the impact of WFD Annex 8 and / or Annex 10 substances, predominantly copper and zinc but to a lesser extent cadmium and pesticides.

Grayling are widely fished in Wales and are increasingly a valued target species, as evidenced by the anglers comments published on the WUF website (Wye & Usk foundation, 2012). As grayling are quite a delicate species, some mortality or stress may be caused by handling, thereby reducing lifespan (Ibbotson et al. 2001). However, fewer than 5% of grayling caught by anglers in Wales are killed (Cove, 2007).

Predation of fish, including grayling, by piscivorous birds is a highly contentious issue. Piscivorous birds are highly mobile species that do not depend on a single food source outside the breeding season, hence there is the potential for them to have significant local impacts on fish populations. Two species, goosander Mergus merganser and cormorants Phalacrocorax carbo, have spread into Wales in recent years and have

increased in numbers, though national trends suggest their numbers are now levelling off. Several studies have indicated that fish-eating birds may affect the size and stability of grayling populations (see Ibbotson et al. 2001 for a summary). However, fish eating birds are an extremely conspicuous pressure and their true impact in comparison to other pressures may be exaggerated.

Warmer river temperatures caused by climate change are likely to affect grayling, as these fish are longer-lived in colder water conditions (Ibbotson et al. 2001). In the Dee, grayling mature at age 2-5 (Wooland 1972), compared to 1-2 years in southern England (Ibbotson et al. 2001). Temperature is also likely to affect the length of the growing season and spawning timing (Ibbotson et al. 2001).

Riverine habitat structure is also likely to affect grayling. Lack of bankside shading will result in elevated temperatures, and removal of woody debris for flood control purposes reduces cover from predators such as fish eating birds, and promotes competition with other fish such as trout (Ibbotson et al. 2001). Grayling also require adequate riffle habitat for spawning, and pool habitat for fry development.

Invasive non-native species are a widespread pressure on Welsh freshwaters. Their impacts are complex and species-specific, but since they may reach large densities they are likely to affect various species including grayling either through direct impacts or by modifications to the food chain. A particularly problematic species is likely to be signal crayfish, which is capable of predating grayling eggs and competing with it for food.

2.6.1 Method used – Pressures	**mainly based on expert judgement and other data**
	Pressures were assessed using data from the Environment Agency's WFD classification data for water bodies assessed as supporting grayling. See previous sections. CCW condition assessments were also used where available (Wye, Dee). Due to the lack of detailed data on the ecological requirements of grayling, it has been assumed that a general requirement of good ecological status for WFD is sufficient. Additional information was collected from Ibbotson et al. (2001).

2.7 Threats

a) Threat	b) Ranking H = high importance M = medium importance L = low importance	c) Pollution qualifier
I01: invasive non-native species	H	
J03: Other ecosystem modifications	H	
M01: Changes in abiotic conditions	H	
H01: Pollution to surface waters (limnic & terrestrial, marine & brackish)	M	OPTX
J02: human induced changes in hydraulic conditions	M	
F02: Fishing and harvesting aquatic resources	L	

I02: problematic native species	L	

See commentary for 2.6. Threat categories have been adjusted reflecting likely scale of these threats in the future, so for example climate change is expected to increase and water pollution to decrease. However, information on threats to this species is limited.	
2.7.1 Method used – Threats	**expert opinion**
	No detailed studies of threats to grayling are available.

2.8 Complementary information	
2.8.1 Justification of % thresholds for trends	
2.8.2 Other relevant information	**Limited understanding of the ecological requirements of this species, coupled with the difficulties involved for monitoring this species,make a detailed assessment of future prospects difficult. However, there is good reason to believe that this species will in general achieve FCS provided that its habitat is at Good Ecological Status in medium to large rivers as defined under the Water Framework Directive. The future prospects for this species are therefore closely linked to the UK's ability to deliver WFD.**
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**	
	b) Minimum	

	c) Maximum	
3.1.2 Method used		
3.1.3 Trend of population size within the network (short-term trend)		

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**