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

Fourth Report by the United Kingdom under Article 17

on the implementation of the Directive
from January 2013 to December 2018

Supporting documentation for the
conservation status assessment for the species:

S6965 - Bullhead (*Cottus gobio*)

WALES

IMPORTANT NOTE - PLEASE READ

- The information in this document is a country-level contribution to the UK Report on the conservation status of this species, submitted to the European Commission as part of the 2019 UK Reporting under Article 17 of the EU Habitats Directive.
- The 2019 Article 17 UK Approach document provides details on how this supporting information was used to produce the UK Report.
- The UK Report on the conservation status of this species is provided in a separate document.
- The reporting fields and options used are aligned to those set out in the European Commission guidance.
- Explanatory notes (where provided) by the country are included at the end. These provide an audit trail of relevant supporting information.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; (ii) completion of the field was not obligatory; (iii) the field was not relevant to this species (section 12 Natura 2000 coverage for Annex II species) and/or (iv) the field was only relevant at UK-level (sections 9 Future prospects and 10 Conclusions).
- For technical reasons, the country-level future trends for Range, Population and Habitat for the species are only available in a separate spreadsheet that contains all the country-level supporting information.
- The country-level reporting information for all habitats and species is also available in spreadsheet format.

Visit the JNCC website, https://jncc.gov.uk/article17, for further information on UK Article 17 reporting.

Report on the main results of the surveillance under Article 11 for Annex II, IV and V species (Annex B)

NATIONAL LEVEL

1. General information

1.1 Member State	**UK (Wales information only)**
1.2 Species code	**6965**
1.3 Species scientific name	**Cottus gobio**
1.4 Alternative species scientific name	
1.5 Common name (in national language)	Bullhead

2. Maps

2.1 Sensitive species	No
2.2 Year or period	1998-2018
2.3 Distribution map	Yes
2.4 Distribution map Method used	Based mainly on extrapolation from a limited amount of data
2.5 Additional maps	No

3. Information related to Annex V Species (Art. 14)

3.1 Is the species taken in the wild/exploited?	No	
3.2 Which of the measures in Art. 14 have been taken?	a) regulations regarding access to property	No
	b) temporary or local prohibition of the taking of specimens in the wild and exploitation	No
	c) regulation of the periods and/or methods of taking specimens	No
	d) application of hunting and fishing rules which take account of the conservation of such populations	No
	e) establishment of a system of licences for taking specimens or of quotas	No
	f) regulation of the purchase, sale, offering for sale, keeping for sale or transport for sale of specimens	No
	g) breeding in captivity of animal species as well as artificial propagation of plant species	No
	h) other measures	No

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3.3 Hunting bag or quantity taken in the wild for Mammals and Acipenseridae (Fish)

a) Unit

b) Statistics/ quantity taken	Provide statistics/quantity per hunting season or per year (where season is not used) over the reporting period					
	Season/ year 1	Season/ year 2	Season/ year 3	Season/ year 4	Season/ year 5	Season/ year 6
Min. (raw, ie. not rounded)						
Max. (raw, ie. not rounded)						
Unknown	No	No	No	No	No	No

3.4. Hunting bag or quantity taken in the wild Method used

3.5. Additional information

BIOGEOGRAPHICAL LEVEL

4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs

Atlantic (ATL)

4.2 Sources of information

Garrett HM. In prep. Afonydd Cleddau SAC Monitoring Summary note. Bullhead (Cottus gobio) population condition assessment. Internal report.
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Wales. University of Liverpool.
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Natural Resources Wales. 2017. National Fish Populations database held on BIOSYS. Accessed December 2017.
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Natural Resources Wales. 2015. Water Watch Wales maps gallery. Cycle 2 waterbodies and rivers. https://nrw.maps.arcgis.com/apps/webappviewer/index.html?id=2176397a06d64731af8b21fd69a143f6
Utzinger J, Roth C, Peter A. 1998. Effects of environmental parameters on the distribution of bullhead Cottus gobio with particular consideration of the effects of obstructions. Journal of Applied Ecology 35, 882-892.
Mills CA & Mann RHK (1983). The bullhead Cottus gobio, a versatile and successful fish. Annual Reports of the Freshwater Biological Association 51, 76-88.
Garrett HM. 2018. S1163 Bullhead additional information: NRW statement on bullhead evidence. NRW. Unpub.

5. Range

5.1 Surface area (km²)		
5.2 Short-term trend Period		
5.3 Short-term trend Direction	Stable (0)	
5.4 Short-term trend Magnitude	a) Minimum	b) Maximum
5.5 Short-term trend Method used		
5.6 Long-term trend Period		
5.7 Long-term trend Direction		
5.8 Long-term trend Magnitude	a) Minimum	b) Maximum
5.9 Long-term trend Method used		
5.10 Favourable reference range	a) Area (km²) b) Operator	

	c) Unknown	
	d) Method	
5.11 Change and reason for change in surface area of range	No change	
	The change is mainly due to:	
5.12 Additional information		

6. Population

6.1 Year or period	2007-2018	
6.2 Population size (in reporting unit)	a) Unit	number of map 1x1 km grid cells (grids1x1)
	b) Minimum	
	c) Maximum	
	d) Best single value	2722
6.3 Type of estimate	Best estimate	
6.4 Additional population size (using population unit other than reporting unit)	a) Unit	
	b) Minimum	
	c) Maximum	
	d) Best single value	
6.5 Type of estimate		
6.6 Population size Method used	Based mainly on extrapolation from a limited amount of data	
6.7 Short-term trend Period	2007-2018	
6.8 Short-term trend Direction	Stable (0)	
6.9 Short-term trend Magnitude	a) Minimum	
	b) Maximum	
	c) Confidence interval	
6.10 Short-term trend Method used	Based mainly on extrapolation from a limited amount of data	
6.11 Long-term trend Period		
6.12 Long-term trend Direction		
6.13 Long-term trend Magnitude	a) Minimum	
	b) Maximum	
	c) Confidence interval	
6.14 Long-term trend Method used		
6.15 Favourable reference population (using the unit in 6.2 or 6.4)	a) Population size	3951 with unit N/A
	b) Operator	
	c) Unknown	
	d) Method	
6.16 Change and reason for change in population size	No change	
	The change is mainly due to:	

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6.17 Additional information

7. Habitat for the species

7.1 Sufficiency of area and quality of occupied habitat	a) Are area and quality of occupied habitat sufficient (to maintain the species at FCS)?	No
	b) Is there a sufficiently large area of occupied AND unoccupied habitat of suitable quality (to maintain the species at FCS)?	Yes
7.2 Sufficiency of area and quality of occupied habitat Method used	Complete survey or a statistically robust estimate	
7.3 Short-term trend Period	2007-2018	
7.4 Short-term trend Direction	Uncertain (u)	
7.5 Short-term trend Method used	Insufficient or no data available	
7.6 Long-term trend Period		
7.7 Long-term trend Direction		
7.8 Long-term trend Method used		
7.9 Additional information		

8. Main pressures and threats

8.1 Characterisation of pressures/threats

Pressure	Ranking
Physical alteration of water bodies (K05)	H
Modification of hydrological flow (K04)	H
Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01)	M
Development and operation of dams (K03)	M
Agricultural activities generating soil pollution (A29)	M
Abstraction from groundwater, surface water or mixed water (K01)	M

Threat	Ranking
Physical alteration of water bodies (K05)	H
Modification of hydrological flow (K04)	H
Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01)	H
Development and operation of dams (K03)	H
Agricultural activities generating soil pollution (A29)	M
Abstraction from groundwater, surface water or mixed water (K01)	M

8.2 Sources of information

8.3 Additional information

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9. Conservation measures

9.1 Status of measures	a) Are measures needed?	Yes
	b) Indicate the status of measures	Measures identified and taken
9.2 Main purpose of the measures taken		Maintain the current range, population and/or habitat for the species
9.3 Location of the measures taken		Both inside and outside Natura 2000
9.4 Response to the measures		Medium-term results (within the next two reporting periods, 2019-2030)

9.5 List of main conservation measures

Reduce impact of mixed source pollution (CJ01)

Restore habitats impacted by multi-purpose hydrological changes (CJ03)

Other measures related to mixed source pollution and multi-purpose human-induced changes in hydraulic conditions (CJ04)

Reduce/eliminate point pollution to surface or ground waters from agricultural activities (CA10)

Reduce diffuse pollution to surface or ground waters from agricultural activities (CA11)

9.6 Additional information

10. Future prospects

10.1 Future prospects of parameters

a) Range

b) Population

c) Habitat of the species

10.2 Additional information

11. Conclusions

11.1. Range

11.2. Population

11.3. Habitat for the species

11.4. Future prospects

11.5 Overall assessment of Conservation Status

11.6 Overall trend in Conservation Status

11.7 Change and reasons for change in conservation status and conservation status trend

a) Overall assessment of conservation status

No change

The change is mainly due to:

b) Overall trend in conservation status

No change

The change is mainly due to:

11.8 Additional information

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12. Natura 2000 (pSCIs, SCIs and SACs) coverage for Annex II species

12.1 Population size inside the pSCIs, SCIs and SACs network (on the biogeographical/marine level including all sites where the species is present)	a) Unit	number of map 1x1 km grid cells (grids1x1)
	b) Minimum	
	c) Maximum	
	d) Best single value	944
12.2 Type of estimate		Best estimate
12.3 Population size inside the network Method used		Based mainly on extrapolation from a limited amount of data
12.4 Short-term trend of population size within the network Direction		Unknown (x)
12.5 Short-term trend of population size within the network Method used		Insufficient or no data available
12.6 Additional information		

13. Complementary information

13.1 Justification of % thresholds for trends
13.2 Trans-boundary assessment
13.3 Other relevant Information

Distribution Map

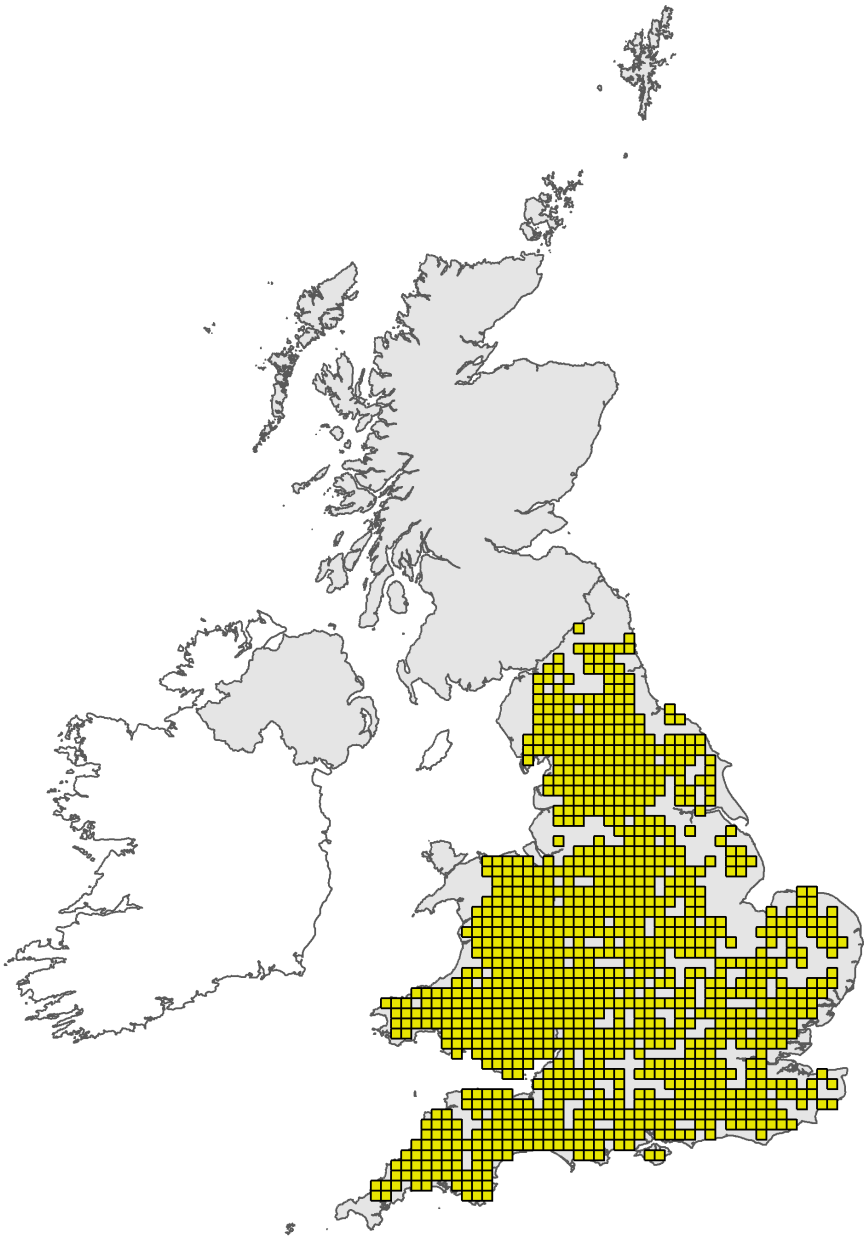

Figure 1: UK distribution map for S6965 - Bullhead (*Cottus gobio*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

The 10km grid square distribution map is based on available species records within the current reporting period. For further details see the 2019 Article 17 UK Approach document.

Range Map

Figure 2: UK range map for S6965 - Bullhead (*Cottus gobio*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

The range map has been produced by applying a bespoke range mapping tool for Article 17 reporting (produced by JNCC) to the 10km grid square distribution map presented in Figure 1. The alpha value for this species was 25km. For further details see the 2019 Article 17 UK Approach document.

Explanatory Notes

Species name: Cottus gobio (6965)

Field label	Note
2.4 Distribution map; Method used	There is no specific survey in place for bullhead in Wales, they are recorded as by-catch in routine surveys for salmonids and other fish species. As a non-target species bullheads tend to be under-represented in these surveys and only recorded on a presence/absence basis. The majority of data for the current cycle is compiled from four surveys for fish other than bullhead and has been extracted from the National Fish Populations database (NRW, 2017). This data has been used to model bullhead distribution based on assuming presence in 1km2 of suitable river habitat between known presence in 1km2 throughout the river network in Wales (IAFG, 2017). This provides a 1km2 population map for 2007-2018 showing a comprehensive and widespread distribution for bullhead (map 2). The use of the interpolation method where presence is assumed between known 1km2 helps to provide an accurate and consistent distribution; analysis of bullhead data in Wales suggests that the 1km2 measure is highly sensitive to survey effort and therefore is likely to show various spurious trends. This is particularly the case in rivers where survey effort varies and where monitoring networks tend to focus on measuring temporal trends rather than fine-scale distribution. Since it is known from routine surveys that the distribution of bullhead has remained constant over the last 20 years, the 1km2 Favourable Reference Population (FRP) map used in this report for bullhead in Wales is based on data from 1998-2018 (map 3). The 10km2 distribution map used in this report (map 1) is based directly on the FRP map.

Species name: Cottus gobio (6965) Region code: ATL

Field label	Note
5.11 Change and reason for change in surface area of range	Bullhead continue to be widely distributed across Wales and there is no evidence that the range has changed since the previous assessment although the range (10km x 10km) was not calculated in that report, the 1km x 1km presence has remained stable (NRW, 2013). In-river works for multiple fish species access, completed by NRW or others, during this reporting period may have improved access. In-river habitat improvement for multiple fish species again by NRW or others may have increased the amount of available habitat.
6.2 Population size	Individual 1 x 1 km grids = 2798, of which 976 were occupied (known presence). Note: 2722 1km squares wholly in Wales (reported on NRW spreadsheet). 76 1km squares transboundary with England This estimate includes both squares containing confirmed bullhead records (NRW, 2017), and squares along the river network that they have either accessed to reach these squares or are considered likely to use (IAFG, 2017). The resulting count gives a reasonable estimate of the number of occupied 1km squares of bullhead in Wales (map 2).

6.6 Population size; Method used	There is no specific survey in place for bullhead in Wales, they are recorded as by-catch in routine surveys for salmonids and other fish species. As a non-target species bullheads tend to be under-represented in these surveys and only recorded on a presence/absence basis. The majority of data for the current cycle is compiled from four surveys for fish other than bullhead (lamprey, coarse fish, juvenile salmonid surveys and invertebrate kick sampling) and has been extracted from the National Fish Populations database (NRW, 2017). Standard monitoring programmes often generate a number of bullhead by-catch records e.g. invertebrate kick sampling and juvenile salmonid electrofishing surveys. The invertebrate kick sampling records can only be used to confirm presence but the juvenile salmonid data offer the opportunity for assessing population distribution, structure and density. Use of bullhead records extracted from juvenile salmonid monitoring surveys can result in under-recording of bullheads due to differences in bullhead biology and ecology. Juvenile salmonid electrofishing surveys are usually conducted between June and September and three survey methods are used: quantitative (Q), semi-quantitative (SQ) and timed electrofishing (5-minute fishing - 5MF). Densities cannot be calculated using the 5MF data as the area is not measured. Bullhead do not respond to the electric current as well as salmonids and so the catch total may be lower than the habitat conditions suggest. The optimal survey period for juvenile salmonid survey is June and July whereas bullhead should ideally be surveyed between mid-August and October. Surveys before the August period are more likely to pick up juvenile bullheads and there is the potential for damage to juvenile development. For further details see Appendix 1 for statement on bullhead evidence.
6.8 Short term trend; Direction	The current estimate of population size based on 2007-2018 data is 2722 1km squares, a considerable increase from the 1090 1km squares reported in 2013. This increase is largely due to a change in calculation methodology. The 2013 report is based only on occupied 1km squares whereas the current report includes both 1km squares containing actual bullhead records, and 1km squares in sections along the river network between actual records (and where bullhead are assumed to be present). This methodology is outlined in an interagency paper (IAFG 2018) which agreed to standardise freshwater species methods in rivers, including bullhead, using the EU reporting unit where available. See map 2 and section 6.2 for reported population metrics for 2007-2018. Comparison of only occupied 1km squares indicates that the population size has remained stable between the two reporting periods. Analysis of 2001-2012 data for the last reporting period showed presence of bullhead in 1090 1km squares; which is broadly similar with 976 occupied 1km squares in the current period (NRW 2013).
6.15 Favourable reference population	Individual 1km2 = 3951 (map 3) Note: Same analysis method was used as described in 6.2 but also including National Biodiversity Network Wales Atlas bullhead records from 1998 onwards.
6.17 Additional information	There are no known issues with reproduction, mortality or age structure in the major populations.

7.1 Sufficiency of area and quality of occupied habitat	a) Are area and quality of occupied habitat sufficient (to maintain the species at FCS)? YES/NO/Unknown - area = no, partial and permanent artificial barriers reduce bullhead access to suitable freshwater habitat that would be necessary to maintain the species at FCS. -quality = water quality requirements are unknown but it is assumed that Good Ecological Status (GES) is required as a minimum (WFD classification). Most river waterbodies in Wales are on the Good / Moderate border. Reasons for failure to reach GES include levels of Dissolved Inorganic Nitrogen, mercury compounds, tributyltin based biocides & organobromine compounds. In Wales, bullhead occur in 528 Water Framework Directive (WFD) river water bodies, constituting about 5800km of habitat. WFD classification data from 2015 indicates that 223 (42%) of these water bodies were at Good Status, 262 (50%) at Moderate Status, 40 at Poor Status and 3 at Bad Status. Failing WFD elements included phosphate, copper, macrophytes & phytobenthos, zinc, priority substances and fish. WFD Tools are optimised to measure river ecological quality in generic terms and therefore the applicability of these data to bullhead distribution data is uncertain. The current distribution of bullhead throughout Moderate Status waterbodies suggests that they can tolerate certain levels of pollution; although the level of tolerance would be affected by both the pressure type driving this classification and the altitude of the water body type. A limiting factor appears to be Dissolved Oxygen; bullheads can tolerate high concentrations of nitrogen compounds as long as oxygen saturation remains high. Of the waterbodies bullhead are present in, only 17 (3%) failed on Dissolved Oxygen. Furthermore bullhead are known to be sensitive to siltation of river habitats which is not measured in WFD assessments. Bullhead are probably more sensitive to morphological than water quality impacts which is supported by the fact that 50 (10%) of these water bodies were classed as Heavily Modified and where Morphology or Hydrological Regime had been assessed, 435 water bodies were considered to support Good Status and 1 waterbody considered to support High Status for hydromorphology. Bullhead favour natural channel forms with associated riffle and pool structures which provides the necessary substrates and flows (Tomlinson and Perrow 2003). Furthermore, the population data in this report is based on distribution data rather than densities. This could be masking the impact of habitat quality since it is likely that bullhead will be present in sub optimal habitat but in lower numbers. Overall = No b) If NO, is there a sufficiently large area of occupied & unoccupied habitat of suitable quality (to maintain the species at FCS)? YES/NO/Unknown sufficient occupied = better habitat quality probably required. sufficient unoccupied= modifications to artificial river obstructions would allow access to additional suitable habitat. The ecological status of the 717 river water bodies in Wales were classified as follows; 3 Bad (49km length), 55 Poor (523 km length), 374 Moderate (3837 km length), 286 Good (2736 km length), 0 High. In Wales most of the river habitat quality can be classed as close to the Good-Moderate boundary (NRW, 2015). The applicability of river habitat data to bullhead is uncertain but it is assumed that Good Ecological Status (GES) represents habitat quality sufficient to support the feature in favourable conservation status. Overall = Yes
7.2 Sufficiency of area and quality of occupied habitat; Method used	Water Framework Directive monitoring data provides a detailed and spatially widespread baseline, subject to the caveats regarding its ecological relevance noted above.
7.5 Short term trend; Method used	No repeat habitat survey datasets are available to analyse trends. Comparison of changes in ecological status of waterbodies as a method for assessing changes to suitable habitat is not recommended because of the uncertainty around presumed habitat occupation and whether Moderate or Good status provides suitable habitat.

8.1 Characterisation of pressures/ threats	Pressures: Bullhead require clean, hard substrates of clean gravel and stones to complete their reproductive cycle (Mills and Mann 1983) and are therfore sensitive to modifications that reduce habitat availability (K05). Changes in flow (K04) also have a negative effect due to lack of natural processes (washing out of silt which cleans gravels) as well as too low flows and higher temperatures etc. Natural, unmodified channels with appropriate substrates and flows as well as wooded riparian corridors and shade support greater densities of bullhead. Physical modifications that impair fish passage (K01, K03, K04, K05) are also significant pressures since they lead to fragmentation of populations. Vertical structures of 18-20 cm in height are impassable to bullhead, with populations upstream of such structures vulnerable to population fragmentation, isolation and ultimately extinction (Utzinger et al. 1998). Consequently, obstructions that other fish pass with relative ease can be partial or complete barriers to bullhead. These particularly include weirs and dams constructed for various purposes (K03), but even bridge footings (K04, K05) can have a significant impact. Bullhead also prefer moderate flow velocities and will suffer in very low flows (K04) when oxygen concentrations reduce and temperature increases. They are not strong swimmers and are adapted to seeking refuge behind large stones, woody debris and macrophytes/leaf litter. Siltation is a significant problem for bullhead with silt deposition over hard, coarse substrate reducing the available habitat that is necessary for reproduction and shelter. Intensive agriculture in the catchment can cause increased levels of silt input to rivers (A29); impacts are exacerbated by modifications to morphology and flow (K01, K03, K04, K05). The impact of climate change on bullhead is uncertain, although altered flow regimes would negatively affect habitat quality and increased temperatures would be detrimental. Threats: All of the above pressures are also threats for the future.
9.5 List of main conservation measures	Measures selected are specifically to address pressures identified in Section 8. The highest priority actions are to continue to improve habitat quality for bullhead (CJ03) which is acheived through works designed to improve habitat for other fish including salmon and trout as well as pollution management (CJ01, CJ04, CA10, CA11). Appropriate conservation measures could be implemented during river restoration projects and as good practice for river management during other infrastructure development / maintenance projects.
10.1 Future prospects of parameters	Bullhead are a widespread species which does not appear to be under any immediate threat. The population seems to be stable in Wales and is expected to remain so. Pressures and threats have been identified along with suitable conservation measures that will help safeguard habitat and prevent population decline. Appropriate conservation measures could be indentified / implemented during river restoration projects and as good practice for river management during other infrastructure development / maintenance projects. These measures would potentially have a positive impact on habitat over the medium term and improve population resilience.
12.1 Population size inside the pSCIs, SCIs and SACs network	Individual 1 x 1 km grids = 962, of which 356 were occupied (known presence). There are 18 transboundary 1 km squares on two cross-border rivers. By-catch records from surveys where bullhead are not the target species introduces a sampling bias so the population size is probably under-estimated.

12.3 Population size inside the network; Method used	Common Standards Monitoring guidance recommends that agencies assess bullhead populations using either data from a systematic quantitative sampling survey or utilise any available non-quantitative (by-catch) records generated primarily by salmonid surveys (JNCC, 2015). NRW uses by-catch records from the following surveys within the SAC river boundary: lamprey, coarse fish, juvenile salmonid surveys and invertebrate kick sampling. All bullhead samples should be counted and a sub-sample of bullhead are measured so that the population demographic can be evaluated for evidence of recruitment. For further details, see additional information statement on bullhead evidence (Garrett, 2018). This estimate includes both squares containing confirmed bullhead records (NRW, 2017), and squares along the river network that they have either accessed to reach these squares or are considered likely to use (IAFG, 2017). The resulting count gives a reasonable estimate of the number of occupied 1km squares of bullhead in Wales (map 2).
12.4 Short term trend of the population size within the network; Direction	It is not possible to define a trend because complete feature condition assessments have not been repeated for every SAC river between 2007 - 2018.