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:

S1095 - Sea lamprey (*Petromyzon marinus*)

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	**1095**
1.3 Species scientific name	**Petromyzon marinus**
1.4 Alternative species scientific name	
1.5 Common name (in national language)	Sea lamprey

2. Maps

2.1 Sensitive species	No
2.2 Year or period	2007-2018
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

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

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

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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	316
6.3 Type of estimate	Best estimate	

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

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	Unknown (x)	
6.9 Short-term trend Magnitude	a) Minimum	
	b) Maximum	
	c) Confidence interval	
6.10 Short-term trend Method used	Insufficient or no data available	
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	467 with unit (1x1km grids)
	b) Operator	
	c) Unknown	
	d) Method	
6.16 Change and reason for change in population size	Use of different method	
	The change is mainly due to:	Use of different method
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	Stable (0)	
7.5 Short-term trend Method used	Complete survey or a statistically robust estimate	
7.6 Long-term trend Period		
7.7 Long-term trend Direction		
7.8 Long-term trend Method used		

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

7.9 Additional information

8. Main pressures and threats

8.1 Characterisation of pressures/threats

Pressure	Ranking
Discharge of urban waste water (excluding storm overflows and/or urban run-offs) generating pollution to surface or ground water (F12)	M
Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01)	M
Change of habitat location, size, and / or quality due to climate change (N05)	M
Other climate related changes in abiotic conditions (N09)	H
Wind, wave and tidal power, including infrastructure (D01)	M
Development and operation of dams (K03)	H
Physical alteration of water bodies (K05)	M

Threat	Ranking
Discharge of urban waste water (excluding storm overflows and/or urban run-offs) generating pollution to surface or ground water (F12)	M
Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01)	M
Change of habitat location, size, and / or quality due to climate change (N05)	M
Other climate related changes in abiotic conditions (N09)	H
Wind, wave and tidal power, including infrastructure (D01)	H
Development and operation of dams (K03)	H
Physical alteration of water bodies (K05)	M

8.2 Sources of information

8.3 Additional information

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		Restore the habitat of the species (related to '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)
Other measures related to agricultural practices (CA16)
Manage water abstraction for resource extraction and energy production (CC13)
Improvement of habitat of species from the directives (CS03)
Other measures related to extraction and energy exploitation activities (CC14)
Reduce impact of multi-purpose hydrological changes (CJ02)

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

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	291

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

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	Uncertain (u)
12.5 Short-term trend of population size within the network Method used	Complete survey or a statistically robust estimate
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

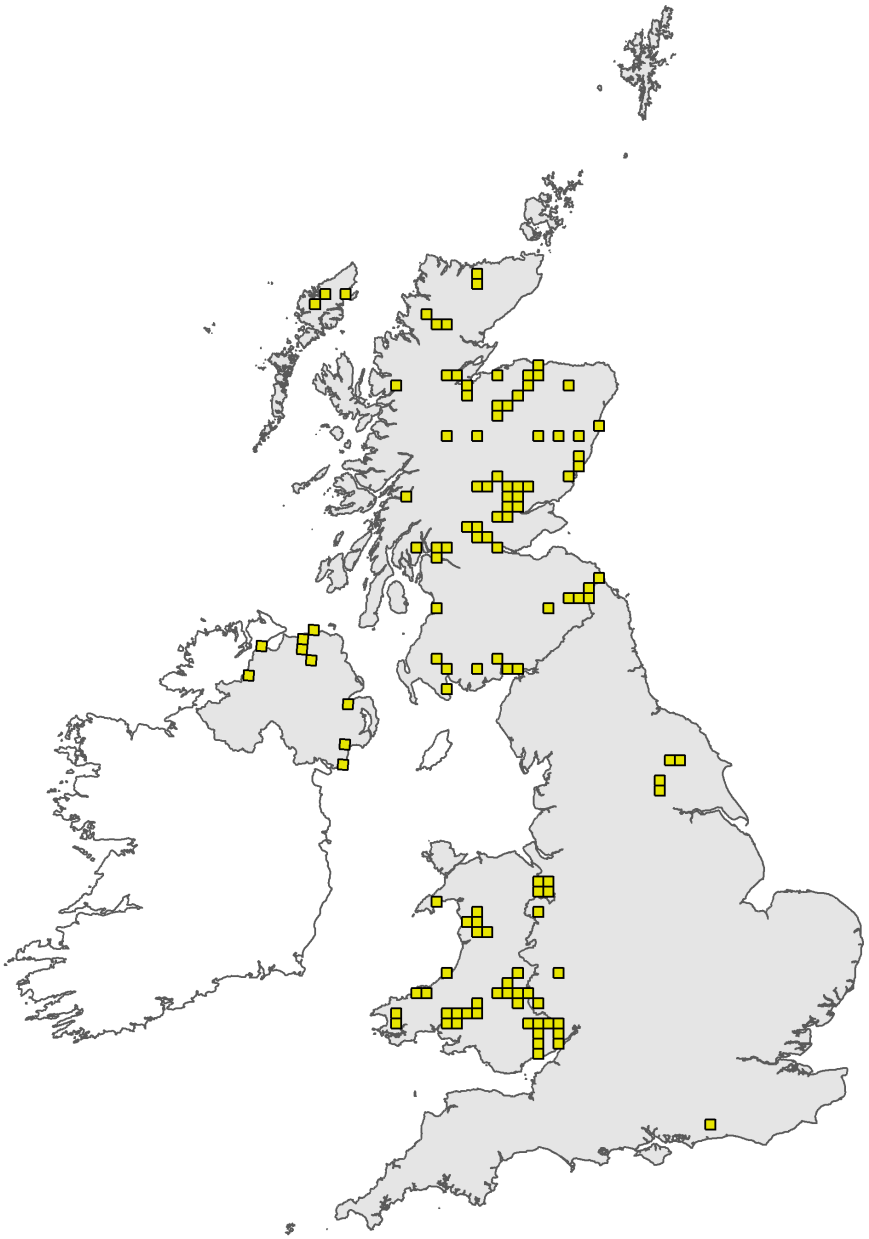

Figure 1: UK distribution map for S1095 - Sea lamprey (*Petromyzon marinus*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

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

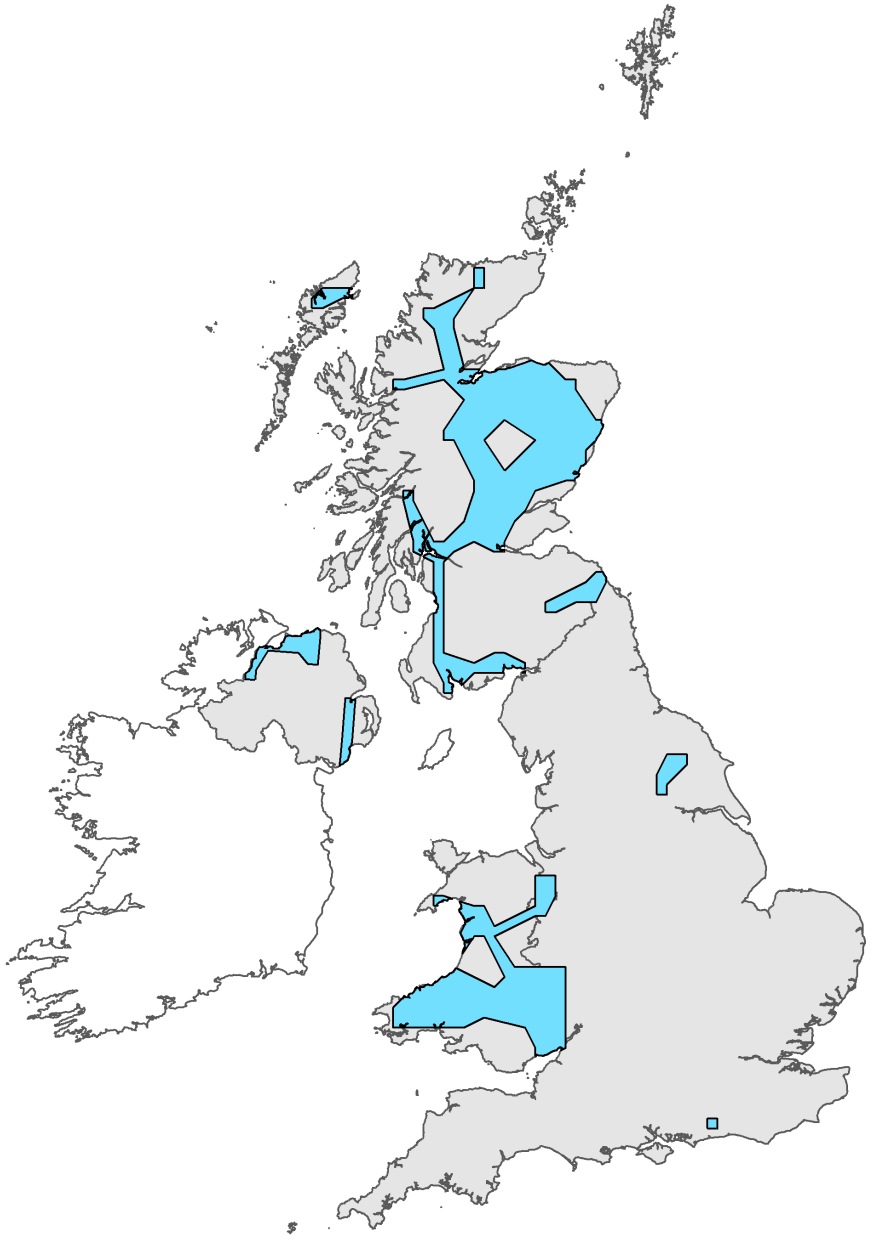

Figure 2: UK range map for S1095 - Sea lamprey (*Petromyzon marinus*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

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: Petromyzon marinus (1095)

Field label	Note
2.4 Distribution map; Method used	The 10 km square mapped range (Figure 3) is based on a combination of larvae records (IAFG, 2017; NRW, 2017) and modelled distribution. This widespread species is expected to be present in most water courses although it is expected that sea lamprey would be naturally absent from upland streams and above natural or artificial barriers.

Species name: Petromyzon marinus (1095) Region code: ATL

Field label	Note
5.3 Short term trend; Direction	See 5.11
5.11 Change and reason for change in surface area of range	Sea lamprey continue to be widely distributed across Wales and there is no evidence that the range has changed since the previous assessment (NRW, 2013). In-river works for multiple fish species access, completed by NRW or others, during this reporting period may have improved access. Sea lamprey are significantly under-recorded in Wales and there is very little monitoring outside the SAC network. The range is therefore likely to be an underestimate.
6.2 Population size	Note: 316 1km squares wholly in Wales. 15 1km squares transboundary with England. This estimate includes both squares containing confirmed larval sea lamprey 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 sea lamprey in Wales (See section 2, Figure 2) There are 15 transboundary 1 x 1 km squares on two cross-border rivers: Dee - 9, Wye - 6. Sea lamprey are significantly under-recorded in Wales and there is very little monitoring outside the SAC network. The population is therefore likely to be an underestimate.
6.6 Population size; Method used	The extent of inter-annual variation in migration is not clearly understood and so larval populations may vary both temporally & spatially within the monitoring cycle, however, this is not likely to have had an impact on the overall dataset. The sampling method may also be an issue because sea lamprey larvae are relatively difficult to detect using the standard electric-fishing technique (APEM, 2014). As a consequence, these estimates are based upon a small number of larvae. Lamprey data were extracted from the National Fish Populations Database (NFPD) 2007 - 2017 which consists of data collected by Environment Agency Wales & its successor body Natural Resources Wales (NRW, 2017). Using Arc View GIS, the records were converted to 1 x 1 km squares. Counts of 1 x 1 km grids with positive records (occupied) & assumed occupation were completed to calculate the population size. This data was interpreted using guidance agreed with Inter-Agency Freshwater Group (IAFG, 2018).Hydroacoustic fish counting equipment has been trialled on the Afon Tywi and based on this data it is estimated that annual spawning runs in Wales can vary between 5, 000 - 30, 000 adults (Davies & Griffiths, 2012; Davies, 2016; Griffiths et al, 2009). The same equipment was used on the Western Cleddau and a small number of adults were detected, but no larvae were recorded using electric-fishing methods (Clabburn, 2015; Garrett et al, 2013a).
6.8 Short term trend; Direction	Trends in the size of the freshwater population cannot be detected using the small amount of data available. There is evidence of population decline in the marine environment (OSPAR comission, 2009).

6.15 Favourable reference population	Individual 1 x 1 km grids = 486 (See figure 4). Note: 467 1km squares wholly in Wales. 19 1km squares transboundary with England Same analysis method was used as described in 6.2 but using National Biodiversity Network Wales Atlas sea lamprey records from 1990 onwards.
6.16 Change and reason for change in population size	Presumed occupation was not calculated in 2013 so any apparant increase in population size in 2018 is mainly due to the change in method.
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 - area = No, partial and permanent artificial barriers reduce sea lamprey access to suitable freshwater habitat. -quality = water quality requirements in the freshwater and marine environment are unknown but it is assumed that Good Ecological Status (GES) is required (WFD classification). Most river waterbodies in Wales are on the Good / Moderate border. Transitional and coastal water bodies are also mostly classed as Moderate except Bury Inlet which is Poor (NRW, 2015; 2017a;2017b;2017c;2017d;2017e). Reasons for failure to reach GES include levels of Dissolved Inorganic Nitrogen, mercury compounds, tributyltin based biocides & organobromine compounds. 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. Overall = Yes Sea lamprey depend on different habitats at each stage in their complex life history. These habitats are: clean river gravels for spawning and organic silt & sand beds in deeper river water (> 1 metre) for the lengthy larval stage. Adults inhabit the pelagic zone of oceans with a wide range of prey fish species e.g. mackerel, salmon and including larger species such as basking sharks (Maitland, 2003). There is no reliable sea lamprey freshwater habitat dataset for Wales although there is no reason to believe that extent of sea lamprey is declining. There is very little known about sea lamprey marine habitat and their requirements are largely unknown. Records of host fish species with lesions caused by hematophagous feeding by sea lamprey were reviewed by Silva et al (2014). The host species of fish and cetaceans were from diverse taxonomic groups which exhibited different morphological, physiological and ecological patterns. It is not known how changes in ocean currents and temperature regimes may affect adult sea lamprey survival (Limburg & Waldman, 2009). These records possibly demonstrate that sea lamprey have the capacity to inhabit a broad range of aquatic ecosystems and exploit different host species. (Silva et al, 2014).
7.2 Sufficiency of area and quality of occupied habitat; Method used	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 sea lamprey is uncertain but it is assumed that Good Ecological Status (GES) represented habitat quality sufficient to support the feature in favourable conservation status. In the transitional waters all the waterbodies are moderate with the exception of Burry Inlet which is Poor. Most of the coastal waterbodies are rated Moderate with only The Skerries, Anglesey rated as High Ecological Status (HES) (NRW, 2015).

8.1 Characterisation of pressures/ threats	Sea lamprey are exposed to a wide variety of pressures, reflecting the range of habitats that they use for spawning, larval feeding & migration. Pressures: Barriers to fish migration (river connectivity) (K01, K03, K05): physical modifications (e.g. dams, weirs & other waterbody modifications) resulting in morphological changes & artificial barriers are the leading pressure on sea lamprey in the freshwater & estuarine environment (Maitland, 2003). Other physical modifications to the water course, can affect instream carrying capacity by reducing wetted area, and changing the characteristics and dispersal of silts. Abstractions and discharges are regulated but physical modifications are unlikley to have been through a similar process so these impacts should be a prioritised when river restoration opportunities for fish arise . There is an increasing demand for water resources from water transfers and local abstractions (K01). The resulting lower flows could have a negative effect on sea lamprey life stages. Lamprey species are also known to become entrained in abstraction infrastructure if inappropriate screening is in-situ. (Hardisty, 2006; Garrett & Thomas, 2012). Diffuse pollution (J01 & F12): General water pollution may affect larval habitat & development although they are not thought to be particularly sensitive to water pollution (Dawson et al, 2015; Maitland, 2003). Microplastics are a newly identified threat which is likley to affect all fish species as plastics are ingested via the food chain. Currently there is very little research on the impact in rivers although researchers from the University of Manchester have called for tighter regulations on waste flowing into urban waterways, after the first study of its kind found that microplastics from urban river channels are a major contributor to the pollution problem in the oceans (Hurley et al, 2018). Studies into the impact of marine plastics show overwhelming evidence that this pollution is a threat to marine biodiversity which is already at risk from overfishing, climate change and other forms of anthropogenic disturbance (Derraik, 2002). Climate change (N01, N05, N09): Climate change is a pressure on both the freshwater & marine environment; the impact of increased precipitation leading to exceptional flooding events & warmer than average river water temperatures is uncertain for sea lamprey. Altered flow could negatively affect nursery habitat quality e.g. wash out of silt beds with loss of larvae & habitat during flood events and / or habitat fragmentation due to drought etc (Dawson et al, 2015; Hardisty, 2006; Wilson et al, 2013). Marine ecosystems, in the Northeast Atlantic, have responded to ocean temperature changes by a shift towards a warmer regime leading to marked changes in the distribution of other fish species and oscillations in oceanic currents (Davidson & Hazlewood, 2007; Delworth et al, 2016). This could affect prey availability and quality for sea lamprey. Threats: Threats are generally similar to pressures although horizon scanning suggests that the impact of some pressures may increase in the next decade. Energy production (D01): the impacts of coastal renewable energy developments are largely unknown, although it is thought that electro-magnetic pollution from power cables may be disorientating and disrupt feeding and prey species (Tricas et al, 2011). The impacts on sea lamprey and potential adaptive management techniques require further investigation (Gill & Bartlett, 2012). The number of hydropower installations may also increase in the near future to help meet the demands of the Welsh Government's aspiration for Wales to generate 22.5 Gigawatts of installed capacity from different renewable energy technologies. (NAW, 2013). Poor operational or infrastructure design could negatively impact sea lamprey through entrainment, adverse changes to flow regimes & habitat, changes to river connectivity, disturbance etc. Climate change (N01, N05, N09):): changes in our global climate is leading to oscillations in ocean currents alongside further increases in temperature and acifidication levels (Delworth et al, 2016). The overall impact on sea lamprey populations is unknown although as a thermophilous species its possible that some aspects of climate change could benefit the species (Moss, 2015: NRW, 2013).

9.5 List of main conservation measures	Measures required / in place to improve sea lamprey condition predominantly relate to modifications to flow regimes (CJ02, CJ03), especially conditions in abstraction permits; improvements to abstraction structures for fish screening to reduce mortality (CC13); and alterations to barriers to migration (CJ03). For example, the current NRW co-ordinated LIFE bid for the Dee river restoration project in relation to weirs in the lower catchment (Hearn, pers comm). Although sea lamprey is not thought to be particularly pollution sensitive in comparison to other fish species, the Water Framework Directive (NRW, 2015) & agri-environment measures to improve biological quality & fisheries (Emmett et al, 2017) could benefit sea lamprey if adopted in appropriate locations. In addition, there have been specific projects to improve river habitat quality e.g. Wye & Usk Foundation Irfon Special Area of Conservation (ISAC) LIFE project (WUF, 2009) and other Rivers Trust projects across Wales (CA10, CJ01, CA16). Fish pass installation opportunities are identified in the annual Sustainable Fisheries Programme by each NRW Operational area. Where possible, fish passes are designed to accommodate multiple fish species. Most schemes are realised through collaboration with local authorities and other agencies or NGOs when wider projects arise (Charlesworth pers comm, 2018) (CJ02, CJ03, CJ04). Appropriate conservation measures could be implemented during river restoration projects and as good practice for river management during other infrastructure development / maintenance projects (CN01).
10.1 Future prospects of parameters	The range for sea lamprey is not expected to alter significantly in Wales in the next 12 years. The population appears to be stable but this assessment is based on a very small evidence base comprising entirely of freshwater records. Although there are some potential threats to sea lamprey, there is insufficient evidence to estimate their overall importance and some factors suggest there could be an increase in population, therefore, an overall trend of stable is considered most appropriate.
12.1 Population size inside the pSCIs, SCIs and SACs network	No. of mapped 1 x 1 km grid cells = 306 occupied or assumed occupation, of which 15 are partial transboundary cells. Total = 291 1x1 km cells wholly in Wales. Note: 37 = occupied, 269 assumed occupation.