

Afon Teifi SAC population attribute condition assessment for brook, river and sea lamprey population 2014.

Habitats Directive third reporting cycle 2013 – 2018.

H. Garrett

NRW Evidence Report No. 106

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Crynodeb gweithredol

Mae tair rhywogaeth o llysywod pendoll yn byw yn nyfroedd Prydain: llysywen bendoll y môr (*Petromyzon marinus*), llysywen bendoll yr afon (*Lampetra fluviatilis*) a llysywen bendoll y nant (*Lampetra planeri*). Mae'r tair rhywogaeth o llysywod pendoll wedi eu rhestru yn Atodiad II Cyfarwyddeb yr Undeb Ewropeaidd (92/43/EEC) ar Warchod Cynefinoedd Naturiol a Phlanhigion ac Anifeiliaid Gwyllt (a adnabyddir fel y Gyfarwyddeb Cynefinoedd). Dan y gyfarwyddeb hon dynodir Afon Teifi fel Ardal Cadwraeth Arbennig (ACA) ac mae'r tair rhywogaeth hyn yn nodwedd o'r ACA hon.

Yn ôl y Gyfarwyddeb Cynefinoedd mae'n ofynnol i'r aelod-wladwriaethau fonitro rhywogaethau Atodiad II a gwerthuso eu statws cadwraeth. Mae'r canllawiau Monitro Safonau Cyffredin (JNC, 2015) yn nodi priodoleddau a thargedau poblogaethau y dylid eu defnyddio i asesu cyflwr. Mae'r asesiad hwn yn ystyried priodoleddau hyn y boblogaeth; strwythur oedran, dwysedd (rhywogaeth *Lampetra* yn unig), ehangder, rhwystrau ymfudiad a maint rhediad blynyddol.

Cafodd 16 o safleoedd samplu wedi'u gwasgaru drwy ACA Afon Teifi eu harolygu yn 2014. Cafodd larfae llysywod pendoll eu samplu gan ddefnyddio techneg bysgota drydan safonol. Cafodd yr holl llysywod pendoll eu mesur yn y maes ac amcangyfrifwyd dwyseddau'r poblogaethau gan ddefnyddio methodoleg darwagio Carle & Strube. Crëwyd histogramau hyd-amlder i glustnodi'r gwahanol gohortau oedran o fewn y daliad cyfan.

Roedd poblogaeth y *Lampetra* yn bodloni'r meini prawf ar gyfer maint gofodol poblogaeth, strwythur oedran poblogaeth, dwysedd poblogaeth (Pasio). Ni chafodd y maint y rhediad blynyddol ei asesu gan nad oedd data ar gael.

Dim ond un larfa llysywen bendoll a gofnodwyd (isel yn y dalgylch yn ACA, uned 2) felly nid oedd digon o ddata i asesu'r boblogaeth (Ddim wedi ei asesu).

Mae'r adroddiad hwn hefyd yn cynnwys nifer o argymhellion sy'n codi o newidiadau cyfundrefnol a luniwyd wrth greu Cyfoeth Naturiol Cymru (CNC) ac adolygiadau sylweddol i ganllawiau Monitro Safonau Cyffredin (CSM) yn 2015.

Executive summary

Three species of lamprey inhabit British waters, sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and brook lamprey (*Lampetra planeri*). All three lamprey species are listed in Annex II of the European Union Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (known as the Habitats Directive). Under this directive the Afon Teifi is designated as a Special Area for Conservation (SAC) and these three species are a feature of this SAC.

The Habitats Directive requires member states to monitor Annex II species and evaluate their conservation status. The Common Standards Monitoring guidance (JNC, 2015) sets out the population attributes and targets against which the condition assessment should be made. This assessment considers these population attributes: age structure, density (*Lampetra* species only), extent, barriers to migration and annual run size.

Sixteen sample sites spread throughout the Afon Teifi SAC boundary were surveyed in 2014. Lamprey larvae were sampled using a standard electric fishing technique. All lamprey were measured in the field and population densities were estimated using the Carle & Strube depletion methodology. Length-frequency histograms were created to identify the different age cohorts within the total catch.

The *Lampetra* population met the criteria for population spatial extent, population age structure, population density (Pass). The annual run size was not assessed because no data was available.

Only one sea lamprey larvae was recorded (low in the catchment in SAC unit 2) so there was insufficient data to assess the population (Not Assessed).

This report also includes several recommendations arising out of organisational changes wrought by the creation of Natural Resources Wales (NRW) and significant revisions to the Common Standards Monitoring (CSM) guidance in 2015.

1 Introduction

1.1 Lamprey species & their conservation status

Three species of lamprey inhabit British waters, sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and brook lamprey (*Lampetra planeri*). Both sea and river lamprey are anadromous with the adults feeding in coastal and off-shore waters whereas the brook lamprey spends its whole life-cycle in fresh waters.

All three lamprey species are listed in Annex II of the European Union Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (known as the Habitats Directive). River lamprey are also listed on Annex V of the Habitats Directive (species whose taking in the wild and exploitation may be subject to management measures). The Directive aims to help conserve the diversity of habitats and species across the European Union and requires measures to be taken to maintain or restore to favourable conservation status in their natural range, habitats and species of wild flora and fauna of Community interest as listed in the annexes of the Directive. These measures include the designation of Special Areas of Conservation (SACs) for the habitats and species listed in Annex I and II of the Directive.

1.2 Condition Assessment

Under the EU Habitats Directive member states are required to monitor Annex II species to make an evaluation of the conservation status of those species. In the UK a condition assessment is carried out for each designated feature at individual sites (rivers) and contributes to an overall assessment of the conservation status of each species across its geographical range in the UK.

To determine condition, the sites selected for survey must be tested against a predetermined set of conservation objectives. JNCC (2015) have produced guidance on conservation objectives for sites with lamprey species. How these targets apply to the Afon Teifi SAC lamprey populations is described in the NRW Core Management Plan (Turner, 2008).

The Common Standards Monitoring (CSM) Guidance for Freshwater Fauna (JNCC, 2015) provides guidance on the identification of attributes, targets and methods of assessment for river, brook and sea lamprey in SSSIs and SACs. Conservation objectives for monitoring these species are set out as a number of Favourable Condition targets. The targets cover a combination of direct (population) and indirect (habitat) attributes which enable an assessment of the condition of each feature to be made. For lamprey the population dynamic attributes used for assessing condition are: age structure, spatial extent within the catchment, larvae density, and annual run size. The habitat attributes are assessed by classifying water quality, flow, and river morphology. Negative indicators are also considered and include fine sediments, alien / locally non-native species, artificial in-channel structures / barriers, abstraction intakes and discharges and fisheries exploitation.

To be in favourable condition the general rule for freshwater faunal species features is that all mandatory attributes must meet their targets. NRW reports on the condition of designated features in a 6-yearly reporting cycle using the two available categories – favourable or unfavourable (with the trend described as “declining”, “maintained” or “recovering”). The feature was assessed for the first monitoring cycle in 2006, the second cycle in 2012 and the third (current) cycle runs from 2013 – 2018.

2 Objectives and condition assessment

The Afon Teifi is designated as a SAC for, amongst other features, sea lamprey, river lamprey and brook lamprey. The overall aim of this project was to undertake a monitoring programme to assess the population status of the three lamprey species within the SAC using data from an annual sampling programme from 2014 onwards. Condition assessments of each species will be undertaken using this data.

The specific objectives of the project were to:

- Use the targets from the Common Standards Monitoring (CSM) Guidance (JNCC, 2015) to assess the population demographic, distribution and abundance (density) of river, brook and sea lamprey on the Afon Teifi.
- Make recommendations in relation to the conservation objectives and future management of the river for these designated species

Attribute	Target	Sampling & analysis method
Attribute a: Population spatial extent	<p>Attribute a: Population spatial extent</p> <p><i>Petromyzon:</i></p> <ul style="list-style-type: none"> i. Should reflect distribution under near-natural conditions. <p><i>Lampetra:</i></p> <ul style="list-style-type: none"> i. Should reflect distribution under near-natural conditions. ii. As a minimum, <i>Lampetra</i> should be present in not less than 50% of all sampling sites surveyed with suitable habitat present within the natural range. iii. Where <i>Lampetra</i> have been found in the past they should be present in 90% of sampling sites if suitable habitat remains. 	Electrofishing of four discrete 1 m ² areas of suitable habitat within a 100 m length of water course.
Attribute b: Annual run size	Annual run size should reflect that expected under near-natural conditions.	DIDSON. Direct observation of spawning sites. Fyke net trapping. CPUE data from catch returns
Attribute c: <i>Lampetra</i> spp. only larvae population age structure.	<p>There should be evidence of recent recruitment in each assessment unit.</p> <p>For individual sites where 20 – 50 larvae are caught at least two distinct classes should be present.</p> <p>If more than 50 larvae are caught, at least three distinct classes should be present.</p>	Length-frequency analysis using 2 mm length categories.
Attribute d: Larval lamprey density (<i>Lampetra</i> spp. only)	¹ Overall assessment unit: mean in suitable habitat >5 per m ²	Electrofishing

Table 1: Common Standards Monitoring population attributes for brook, river and sea lamprey population condition assessment (JNCC, 2015)

The mandatory environmental attributes will be assessed in a separate report. These CSM rivers attribute targets have been recently revised to allow the assessments to be conducted using monitoring data collected for Water Framework Directive (WFD) purposes (JNCC, 2016). The targets in the N2K core conservation management plan can no longer be used because GQA type data is no longer available (Turner, 2008).

¹ The larval density of a sampling site is the means of the results derived for each patch of habitat expressed as larvae per m². The larval density of an assessment unit is the mean of the sampling site results expressed as larvae per m².

The CSM freshwater fauna was revised to accommodate WFD data and the revised population and habitat targets that replace the 2005 CSM guidance have been adopted by NRW (JNCC, 2015).

3 Site description

The Afon Teifi, at 122 km, is one of the longest rivers in Wales and one of its most productive salmon and sea trout fisheries. Its source is Llyn Teifi in the Cambrian Mountains at an altitude of 455 m from where it descends steeply through moorland and forestry to the geologically and ecologically important basin of Cors Caron. The river continues through rural areas largely supporting dairy and mixed stock farms. Rocky, tree-lined sections are a feature of the catchment and a number of impressive gorges, particularly at Alltycafán, Henllan, and Cilgerran, add significant environmental and landscape value. At Cardigan, the river forms an estuary that leads to the Cardigan Bay SAC (Turner, 2008).

The Afon Teifi, including ten of its tributaries, has been designated as a Special Area of Conservation for the three UK lamprey species, bullhead, otter, Atlantic salmon, floating water plantain, water crowfoot communities and for upland oligotrophic lake communities. At Cardigan, the river forms an estuary that leads to the Cardigan Bay SAC.

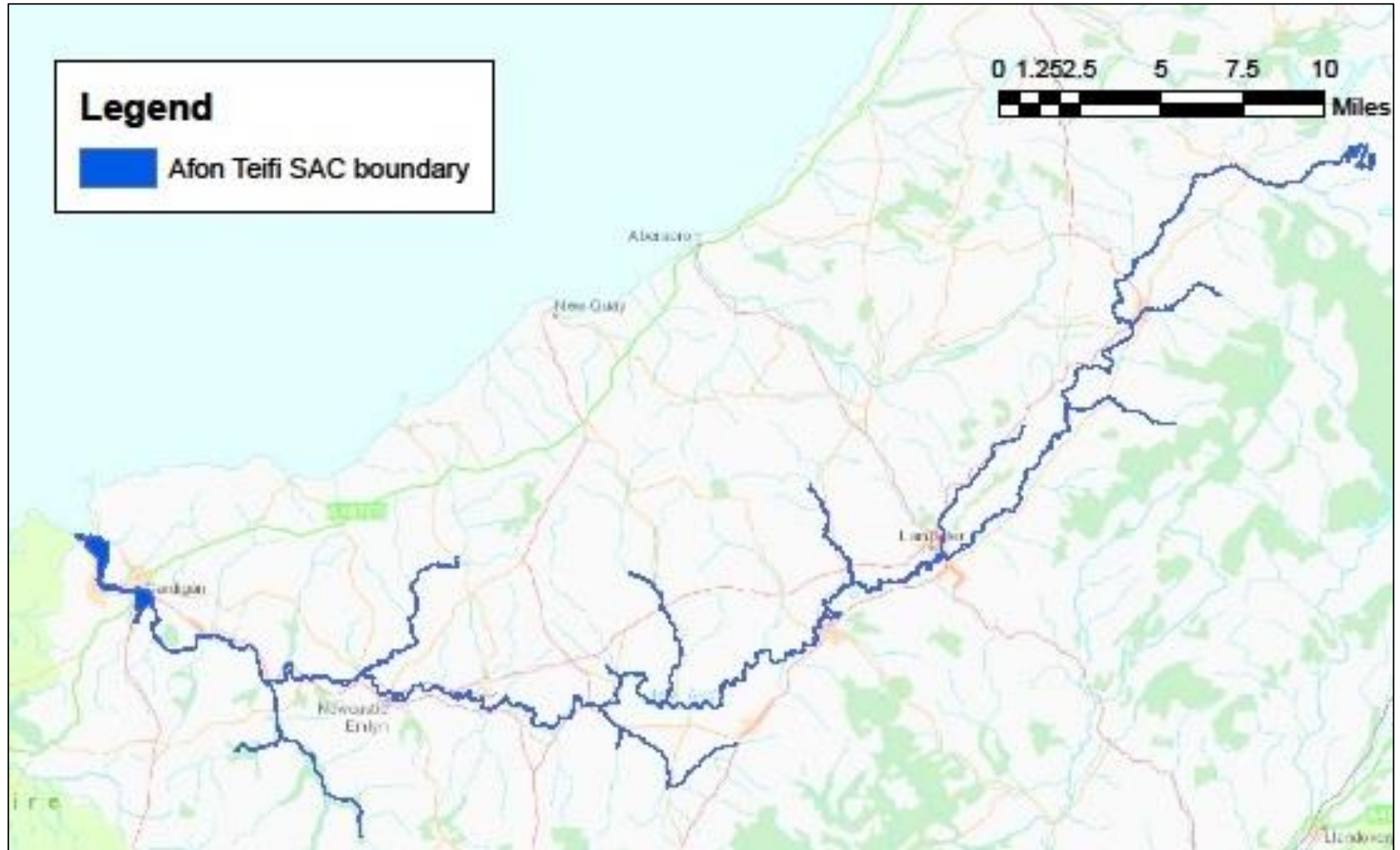


Figure 1: Afon Teifi SAC boundary

4 Previous lamprey monitoring projects

In the second reporting cycle of the Habitats Directive the population condition assessment for the Afon Teifi was completed on behalf of CCW by consultants (Webb *et al*, 2013). A summary of the results are shown in Table 2 (Thomas & Garrett, 2013). The assessment concluded that the *Lampetra* (brook and river lamprey) population met the targets (Pass), but that the *Petromyzon marinus* / sea lamprey did not (Fail). The attribute targets date from the 2005 CSM guidance (JNCC) (the term “ammocoete” relates to the larval stage in the lamprey lifecycle).

Target	Results	Condition assessment / confidence level
<p>a. Age structure (<i>Lampetra</i> sp. only) 50 or less ammocoetes 2 size classes. If more than 50, 3 size classes.</p>	<p>1 age cohort at 2 sites 2 age cohorts at 5 sites 3 age cohorts at 6 sites 4 age cohorts at 9 sites 5 age cohorts at 4 sites 6 age cohorts at 1 site 25/27 sites (93%)</p>	<p><i>Lampetra</i> spp: PASS When target assessed at catchment & SAC boundary level. High</p>
<p>b. Distribution within catchment Present at not less than 2/3 of sites surveyed. No reduction in distribution of ammocoetes in catchment. If barriers to migration or pollution thought to be a problem population should be classed as unfavourable.</p>	<p><i>Lampetra</i> recorded at all sites where habitat present (27 sites). No sea lamprey recorded. <i>Lampetra</i> – no reduction evident</p>	<p><i>Lampetra</i>: PASS <i>Petromyzon</i>: FAIL High</p>
<p>c. Ammocoete density <u><i>Lampetra</i> spp:</u> Optimal habitat >10m⁻² Overall catchment mean >5m⁻² <u><i>Petromyzon</i>:</u> Ammocoetes should be present in at least 4 sampling sites each not less than 5km apart</p>	<p><i>Lampetra</i>: 17 m⁻² in optimal habitat 9 m⁻² overall in the catchment <i>Petromyzon</i>: Absent from all sites</p>	<p><i>Lampetra</i>: PASS High <i>Petromyzon</i>: FAIL LOW – due to potentially unsuitable sampling method</p>
<p>d. Spawning activity (sea lamprey only)* No reduction in extent of spawning activity year on year</p>	<p>Insufficient data to determine.</p>	<p>Not assessed</p>

Table 2: Population condition assessment for lamprey on the Afon Teifi 2007 - 2012

5 Methods

5.1 Data sources

The condition assessment draws on lamprey records collated from two types of surveys: 1) a survey conducted in 2014 where lamprey were the target species and 2) by-catch records from the National Fisheries Monitoring Programme where other fish species were the target. The latter survey did not yield many records but they are included for context.

5.2 Sample site selection for lamprey survey

Prior to the formation of Natural Resources Wales (NRW), the sampling frequency was one year in a six year cycle and 30 sample sites were surveyed by external contractors on behalf of the Countryside Council for Wales (CCW). NRW has the in-house skills to undertake these surveys and the South West Operational team for fisheries has set up a tri-annual sampling programme; approximately 15 sites on each of the Teifi, Cleddau (East & West) and the Tywi will be surveyed every 3 years. The Afon Teifi lamprey population will next be surveyed in Autumn 2017.

21 sampling sites representative of suitable habitat across the main SAC river corridor and tributaries were identified from previous survey results (Webb *et al*, 2013; APEM, 2005). In 2014, 16 of the sites were surveyed (Table 3 & Figure 2) and the remaining five sites along with a selection of repeatable sites will be surveyed for lamprey in 2017.

Site no.	SAC unit	WFD waterbody	River name	NGR
1	5	GB110062043520	Afon Teifi	SN7092066421
5	5	GB110062043562	Afon Teifi, Pont Einon	SN6715561408
6	4	GB110062043562	Pont Llanio	SN6519856921
7	-	GB110062043562	Nant Bryn-maen	SN6350755870
9	4	GB110062043562	Afon Teifi - Pont Gogoyan	SN6417354456
10	4	GB110062043562	Afon Teifi - conf Clywedog	SN6202151244
11	4	GB110062043562	Afon Teifi	SN5799147574
13	-	GB110062043562	Nant Cledlyn	SN4934842968
14	3	GB110062043565	Afon Teifi	SN4713941247
20	2	GB110062043561	Afon Teifi	SN2998741608
22	2	GB110062043561	Afon Teifi	SN2685241344
23	2	GB110062039040	Afon Cych	SN2493741143
24	2	GB110062039040	Afon Cych	SN2533438834
25	2	GB110062039010	Afon Dulas	SN2461938169
27	2	GB110062039170	Afon Teifi	SN2178843606
29	1	GB110062043561	Cilgerron	SN1949743265

Table 3: 2014 sampling site on the Afon Teifi catchment

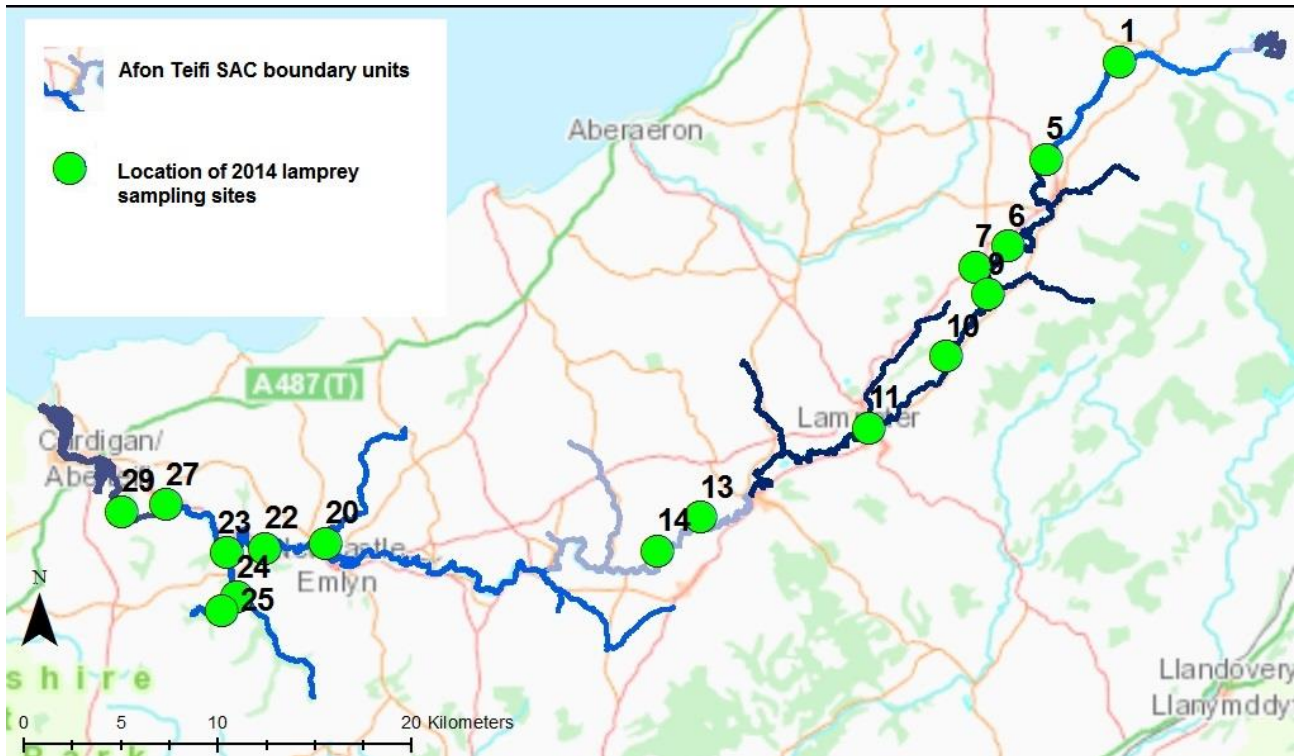


Figure 2: Location of the 2014 sampling sites with the SAC units are shown in shades of blue.

Additional by-catch records are available from the annual juvenile salmonid surveys. These records lack density estimates but help inform our understanding of distribution.

5.3 Field sampling methodology

NRW staff have agreed an electric fishing lamprey larvae sampling protocol which is based on the revised CSM guidance for freshwater fauna (Garrett *et al*, 2015).

6 Results

6.1 Results Afon Teifi lamprey survey 2014

All of the 2014 sample sites were within the boundary of the Afon Teifi SAC. Summaries of the results are shown in table 5.

Survey details	Results
Survey dates	14/10/14 - 26/11/14
No. survey days	6
Surveyors	Stuart Rees, Derek James, Eifion Davies, Emma Keenan and Adam Leyshon
Sites surveyed	1, 5, 6, 7, 9,10, 11,13,14, 20, 22, 23, 24, 25, 27, 29 (16 sites in total).
Total no. <i>Lampetra</i> larvae	419
Total no. <i>Lampetra</i> transformers	15
Highest density site (optimal habitat)	Site 27 with 108 m ²
Lowest density (optimal habitat)	Site 7 with 6 m ²
No. sites where larvae absent	Sites 25 & 29 (12.5%)
No. sites where larvae present	87.5% of sites
Shortest <i>Lampetra</i> larvae	16 mm
Longest <i>Lampetra</i> larvae	135 mm
Median length	85 mm
Mean length	80 mm
Total no. <i>Petromyzon</i> larvae	None
<i>Petromyzon</i> transformer	1 (86 mm length)

Table 4: Summary of the results Afon Teifi lamprey survey 2014

Twelve lamprey transformers were recorded at site 9 (SAC unit 4) and three were reported at site 11 (SAC unit 3). The length of river / brook lamprey transformers ranged from between 80 – 120 mm. The transformers could not be identified to species level because of the variability in colour, size and format at this life stage (Keenan, *pers comm*).

One sea lamprey was recorded at Cych, site 23 and measured 85 mm which is quite small for this species. No photographs are available and so the identification could not be independently verified.

6.2 Results from NRW National Fisheries Monitoring Programme (NFMP)

Lampreys were recorded as by-catch at two sites within the SAC boundary from between late July until the end of September for 2013. Eight *Lampetra* larvae were caught; one site containing two larvae was recorded at Tregaron (FAS2, SN6790959641, SAC unit 4), and six were found near Pont Ceri, upstream of Cwm Cou (TE08, SN3004942238, SAC unit 2). The records are in close proximity to existing lamprey survey sites with positive sightings so the additional data did not greatly increase our understanding of the population distribution.

6.3 Population spatial extent

Attribute a: Population spatial extent

Petromyzon:

- i. Should reflect distribution under near-natural conditions.

Lampetra:

- i. Should reflect distribution under near-natural conditions.
- ii. As a minimum, *Lampetra* should be present in not less than 50% of all sampling sites surveyed with suitable habitat present within the natural range.
- iii. Where *Lampetra* have been found in the past they should be present in 90% of sampling sites if suitable habitat remains.

“Near-natural conditions” are those which:

- Provide suitable habitat for each stage of the species’ lifecycle.
- Are accessible and present no artificial barriers to migration.

Cenarth Falls are thought to be a natural barrier to *Petromyzon* migration (Turner, 2008).

Petromyzon could not be fully assessed because only one record was available. A single sea lamprey transformer was found at site 23 (SAC unit 2, WB id no. GB110062039041) adjacent to Abercych in the lower catchment. No sea lamprey larvae were recorded during the monitoring surveys of 2004 or 2011. There are four *ad hoc* records for adult sea lamprey from the National Biodiversity network (NBN) gateway database dating from 2010. The observations were either at Cenarth or Abercych in SAC unit 2 (WFD WB id nos. GB110062039041 and GB110062043563) (NBN, 2016).

The core management plan describes lower catchment SAC units 1 & 2 as key for the management of sea lamprey (Turner, 2008). These records suggest that sea lamprey are unable to traverse Cenarth Falls.

Sea lamprey meet the spatial extent criterion but with low confidence because of the small number of records.

Larval *Lampetra* cannot be distinguished to species level in the field so this analysis assumes that the populations at each site are a mix of both river and brook lamprey species.

In 2013 - 14 *Lampetra* were present in 14 of the 16 sampled sites (87%) so *Lampetra* were detected in more than 50% of the sampling sites (Figure 3) and this minimum attribute has been met.

Fourteen of the sample sites were repeated from the previous 2012 survey and *Lampetra* were detected in 12 of them (87.5 %). The sample size is insufficient to accurately assess this attribute to 90% and the apparent failure is an artefact of the sampling strategy. In this context it has been decided that the attribute does meet the criteria. By comparison, in 2012 *Lampetra* were detected at all (100%) of the optimal habitat sites ($n = 21$) (Webb, *et al*).

The habitat at the two sites where *Lampetra* were absent were described as silt - 5%, sand - 25%, mud - 70%, organic material - 30% (site 23) and silt - 10%, sand - 10%, mud - 10%, gravel - 5% and organic material 10% (site 29). Site 23 was classified by the surveyors as having both optimal and sub-optimal habitat present, whereas site 29 had only sub-optimal habitat. The *Lampetra* population narrowly failed to meet the threshold target of 90%.

Overall *Lampetra* met the spatial extent criteria and this assessment has a high confidence level.

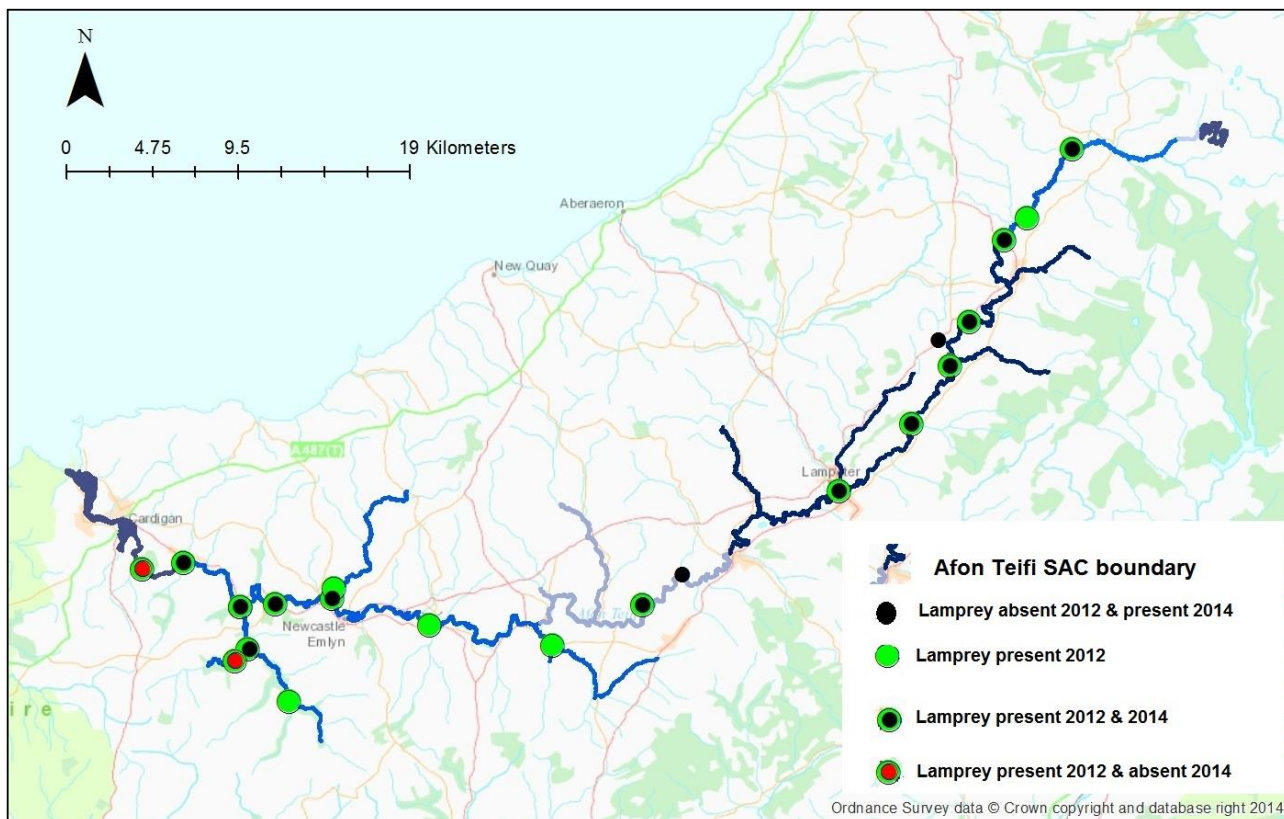


Figure 3: Presence and absence of *Lampetra* larvae at repeated sample sites 2012 and 2014.

6.4 Annual run size and barriers to migration

Attribute b: Annual run size *Petromyzon* & *L. fluviatilis*

Annual run size should reflect that expected under near-natural conditions.

No data were available to assess the run size and neither could the SAC river be evaluated for artificial barriers to migration for lamprey because all the artificial barriers are only assessed for their impact on salmonids (see recommendations). However, local staff were consulted for their expert judgement and it was stated that there are some issues with an incorrectly designed / constructed hydropower scheme on the Afon Cych, a tributary river, near Cwmorgan. There is an ongoing attempt to resolve the situation. In addition, a finer mesh fish screening has been installed on the mill leat at Dolbantau weir on the Afon Clettwr (Llanfihangel yr Arth, Pencader) and this is a positive improvement for lamprey species (Hyatt, *pers comm*).

Annual run size for sea and river lamprey were not assessed due to a lack of data.

6.5 Lampetra population structure

Attribute c: *Lampetra* spp. only larvae population age structure.

Target: There should be evidence of recent recruitment in each assessment unit. For individual sites where 20 – 50 larvae are caught at least two distinct classes should be present. If more than 50 larvae are caught, at least three distinct classes should be present.

Length data for *Lampetra* larvae was collated from all the sites and sorted using a bin range of 2 mm. The resulting histogram was analysed to identify age cohorts from 0+ to 6 (Figure 4 & Table 6). These length classes were then used to sort the length data in each sample and count the number of age classes (Table 7).

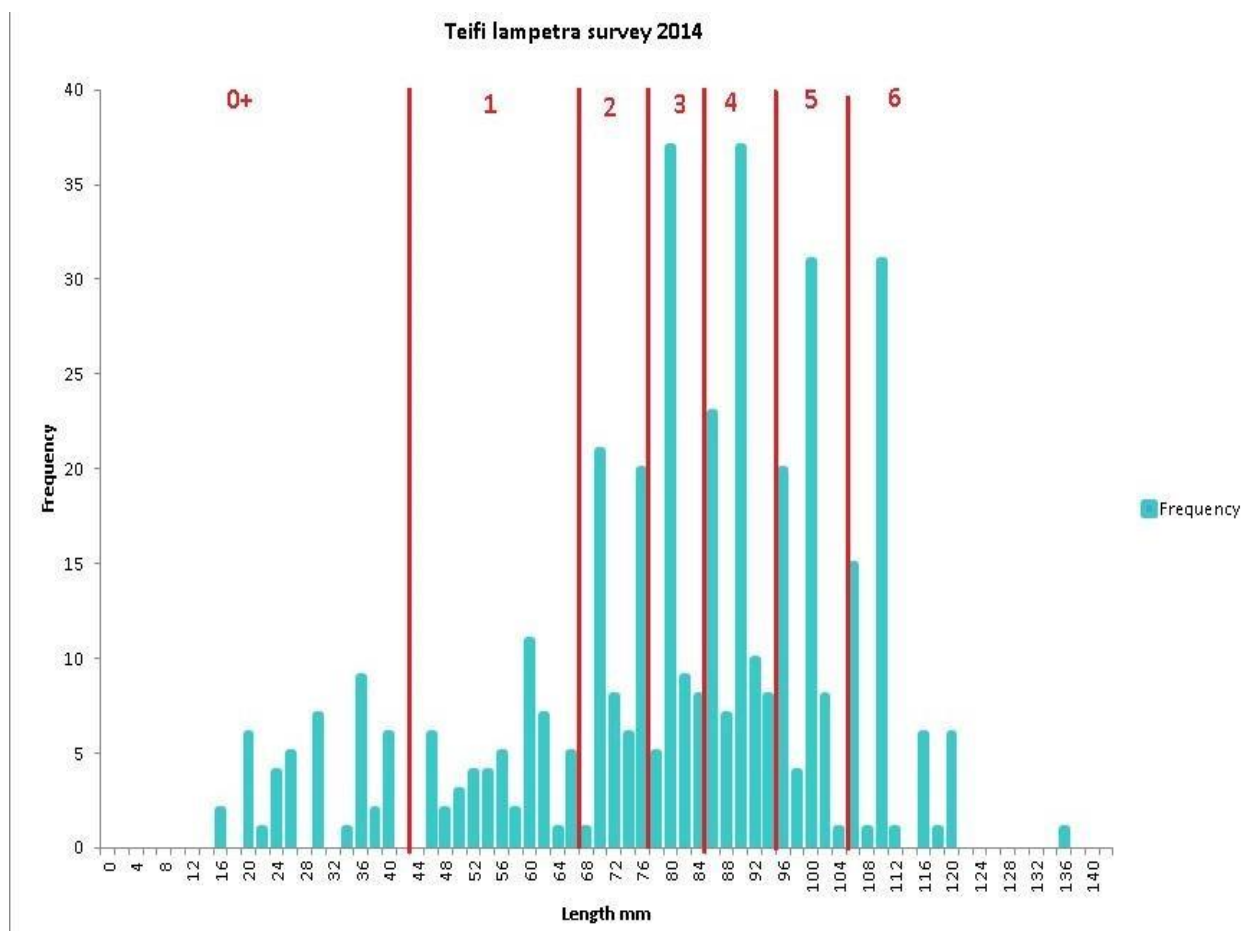


Figure 4: Length distributions of *Lampetra* larvae in the Teifi from 2014 surveys

Age cohort	Length range (mm)
0+	0 - 42
1	43 - 66
2	67 - 76
3	77 - 84
4	85 - 94
5	95 - 106
6	107+

Table 5: Lamprey age cohort in relation to length, Afon Teifi 2014

Site No.	Total no. Lamprey in sample	Age cohorts present	No. age cohorts present	20 - 50 larvae target = 2 classes present	>50 larvae target = 3 classes present
1	20	0+,1,2,3,4,6	6	Pass	-
5	4	2,3,4	3	N/A	-
6	11	0+,1,2,3,5,6	6	N/A	-
7	8	0+,6	2	N/A	-
9	22	1,2,3,4,6	5	Pass	-
10	39	0+,1,2,3,4,5,6	7	Pass	-
11	25	0+,1,2,4,5,6	6	Pass	-
13	36	0+,1,2,3,4,5,6	7	Pass	-
14	18	1,3,4,5,6	5	N/A	-
20	52	4,5,6,	3	-	Pass
22	50	0+,1,2,3,4,5,6	7	-	Pass
23	18	2,3,4,5	4	N/A	-
24	35	0+,1,2,3,4,6	6	Pass	-
25	0	0	0	N/A	
27	81	0+,1,2,3,4,5,6	7	-	Pass
29	0	0	0	N/A	

Table 6: Assessment of the number of age classes at each sample site, Afon Teifi 2014.

All of the samples exceeded the target for the relevant sample size. The site with the greatest number of age classes was site 27 and the smallest number was at site 7 although the total catch fell below the criteria for inclusion in the assessment.

Sites 20 – 29 are below Cenarth falls, which is considered a partial barrier to river lamprey migration (Webb *et al*, 2013). It is possible that the population above the falls could be predominantly brook lamprey. Brook lamprey are a smaller species and transform at lengths between 130 – 150 mm (Gardiner, 200). A length-frequency histogram was created for populations above and below the falls (Figures 5 & 6) to explore whether the up-stream populations were brook lamprey only. (Transformer identification could not be determined to species level in the field).

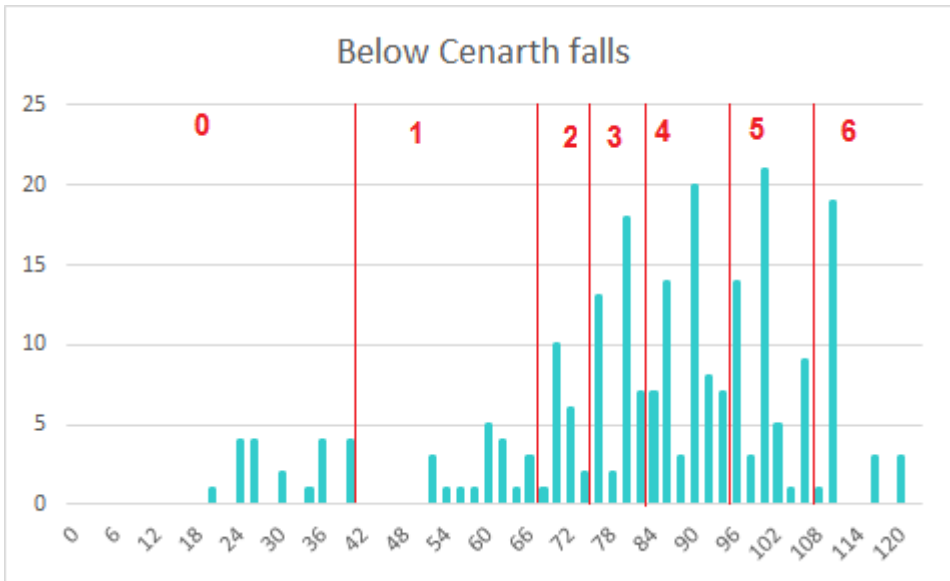


Figure 5: Length-frequency histogram for Lampetra populations below Cenarth falls.

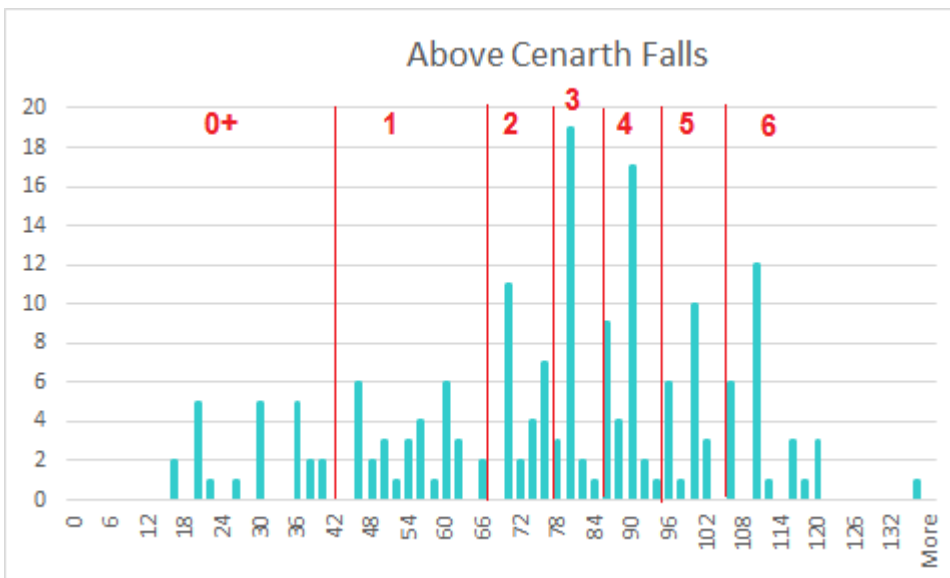


Figure 6: Length-frequency histogram for Lampetra populations above Cenarth falls.

There is very little difference in the length-frequency histogram data between the populations above and below the falls and there are very few larvae above 120 mm. This analysis suggests the presence of river lamprey transformers above Cenarth falls.

There is evidence of *Lampetra* recruitment in each SAC unit and the **population age structure attribute thresholds have been met** with high confidence.

6.6 Lampetra condition assessment for density

Attribute d: Larval lamprey density (*Lampetra* spp. only)

Overall assessment unit: mean suitable habitat $>5 \text{ m}^{-2}$.

At sample site level the density ranged from 4 – 82.4 m^{-2} and four of the sites had density values of less than 5 m^{-2} (Figure 7). The site with the greatest density value (82.5 m^{-2}) was found in the lower catchment near Cardigan.

The catchment is the overall assessment unit and the skewed data was normalised using log transformation and the 95% confidence interval was calculated. The back transformed mean = 9.1 m^{-2} , 95% CI [15.60, 5.30].

The catchment mean was greater than 5 m^{-2} and so the larval *Lampetra* population met the density attribute target with a high confidence level.

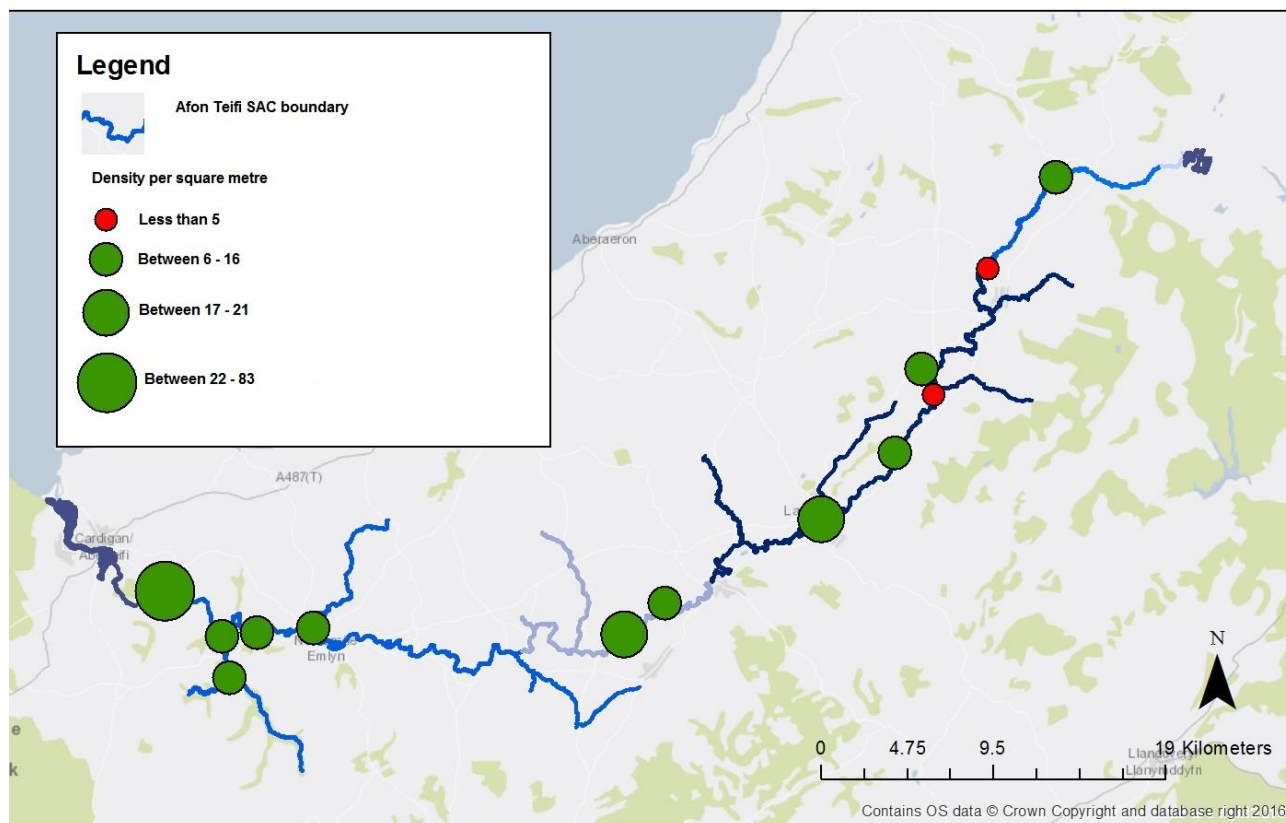


Figure 7: Lampetra densities at each sample site 2014

6.7 Summary of results

The presence of *Lampetra* larvae in SAC and WFD waterbody units are summarised in Table 8. SAC units are used for the condition assessment but the cross reference is provided here for future reference when the units are harmonised to create one reporting system.

Site no.	NGR	SAC unit	WFD waterbody	Watercourse name	<i>Lampetra</i> present 2014
1	SN7092066421	5	GB110062043520	Afon Teifi	Present
5	SN6715561408	5	GB110062043562	Afon Teifi, Pont Einon	Present
6	SN6519856921	4	GB110062043562	Pont Llanio	Present
7	SN6350755870	Outside SAC	GB110062043562	Nant Bryn maen	Present
9	SN6417354456	4	GB110062043562	Afon Teifi - Pont Gogoyan	Present
10	SN6202151244	4	GB110062043562	Afon Teifi - conf Clywedog	Present
11	SN5799147574	4	GB110062043562	Afon Teifi	Present
13	SN4934842968	Outside SAC	GB110062043562	Nant Cledlyn	Present
14	SN4713941247	3	GB110062043562	Afon Teifi	Present
20	SN2998741608	2	GB110062043561	Afon Teifi	Present
22	SN2685241344	2	GB110062043561	Afon Teifi	Present
23	SN2493741143	2	GB110062039040	Afon Cych	Present
24	SN2533438834	2	GB110062039040	Afon Cych	Present
25	SN2461938169	2	GB110062039010	Afon Dulas	Absent
27	SN2178843606	2	GB110062039170	Afon Teifi	Present
29	SN1949743265	1	GB110062043561	Cilgerron	Absent

Table 7: *Lampetra* presence / absence by SAC & WFD waterbody unit 2014

Figure 8 summarises the condition assessment against each of the attribute criteria. The confidence rating is based on sample size and is not a statistical categorization.

Target	Assessment	Condition	Level of confidence
<p>Attribute a: Population spatial extent</p> <p><i>Petromyzon</i>:</p> <p>i. Should reflect distribution under near-natural conditions.</p> <p><i>Lampetra</i>:</p> <p>ii. Should reflect distribution under near-natural conditions.</p> <p>iii. As a minimum, <i>Lampetra</i> should be present in not less than 50% of all sampling sites surveyed with suitable habitat present within the natural range.</p> <p>iv. Where <i>Lampetra</i> have been found in the past they should be present in 90% of sampling sites if suitable habitat remains.</p>	<p>One <i>Petromyzon</i> larva records in SAC unit 2.</p> <p>No decline in range compared to 2012.</p> <p>Present 14/16 sample sites (87%) but assessment based on attribute iv only</p> <p>Present 12/14 repeat sites with suitable habitat (85.7%).</p>	<p>Pass²</p> <p>Pass</p> <p>Not Assessed</p> <p>Pass</p>	<p>Very low (only 1 record)</p> <p>High</p>
<p>Attribute b: Annual run size <i>Petromyzon</i> & <i>L. fluviatilis</i></p> <p>Annual run size should reflect that expected under near-natural conditions.</p>	<p>Run size was not assessed because no data was available.</p>	<p>Not assessed</p>	<p>N/A</p>
<p>Attribute c: <i>Lampetra</i> larvae population age structure.</p> <p>There should be evidence of recent recruitment in each assessment unit.</p> <p>For individual sites where 20 – 50 larvae are caught at least two distinct classes should be present.</p> <p>If more than 50 larvae are caught, at least three distinct classes should be present.</p>	<p>Recruitment recorded in each SAC unit</p> <p>0 ages cohorts at 2 sites 2 age cohorts at 2 sites 3 age cohorts at 2 sites 4 age cohorts at 1 site 5 age cohorts at 2 sites 6 age cohorts at 3 sites 7 age cohorts at 4 sites</p>	<p>Pass</p>	<p>High</p>
<p>Attribute d: <i>Lampetra</i> larval lamprey density.</p> <p>Overall assessment unit: mean suitable habitat >5 m².</p>	<p>Catchment density mean = 14.91 m⁻²</p>	<p>Pass</p>	<p>High</p>

Figure 8: Summary of population attributes condition assessment 2014

² Given the very low quality data, expert judgement has been used to give the sea population an overall assessment of Fail.

7 Discussion

This assessment of the 2014 results is a contribution to the overall assessment of the population that will be completed when the data 2017 is available from the tri-annual sampling programme.

The results from 2014 are very similar to those for the 2012 survey (Webb *et al*, 2013) and there does not appear to be any decline in the condition of the *Lampetra* population. There have been no other technical reports relating to lamprey, flow, water quality or migration obstructions since 2013.

7.1 Catch size

This assessment is based on a relatively small number of survey sites although the abundance of larvae is similar to the number recorded in 2011 when twice the number of sites were sampled. (399 *Lampetra* larvae were sampled at 30 sites in 2012 and 419 were recorded at 16 sites in 2014). Webb *et al.* (2013) found that that the Afon Teifi population distribution was clumped. This abundance may be explained by the sampling site selection, as the 2014 survey was based on repeating many of the better quality 2012 sites. In addition, inter-annual population variation will account for some of the differences. Better understanding of the population dynamic will be possible when more of the annual sampling data has been collected and analysed.

7.2 Population extent

The extent of the *Lampetra* population had not declined and larvae were present in more than 50% of the sites. The population narrowly failed to meet the 90% threshold for the revised CSM repeated sites target (JNCC, 2015). Site 23 had a mix of optimal and sub-optimal habitat present but site 29 contained only sub-optimal habitat. The revised CSM (JNCC, 2015) has a wider interpretation of what is regarded as suitable lamprey habitat so sub-optimal habitat was treated as “suitable habitat” for this assessment. In the previous cycle the population extent met all the criteria of the CSM (2005). The sample size of 14 repeated sites introduced a sampling artefact that reduced the accuracy with which the target could be achieved by approximately 6%. It was decided that the population extent target had been met with 85.7% occupation of repeat survey sites.

Although transformers do not have a CSM target it is worth noting the significance of the 2014 records for transformers above Cenarth falls. No *Lampetra* transformers were found above these falls in the previous two monitoring cycles and so if the identification of the transformers had been accurately determined then it would confirm the presence of river lamprey populations and not just brook lamprey ones throughout the catchment. It had been hypothesised that the falls were a partial natural barrier to migration and this type of evidence could confirm that the falls must be passable under some conditions. It is recommended that the sampling protocol is updated and guidance on collecting transformer data is included. In addition, research into emerging new identification methods could be undertaken by Evidence & Knowledge staff. See recommendations.

Petromyzon were not recorded in the 2012 survey and it was thought that the shallow water sampling technique was biased against the deeper water habitat that this species prefers (Hardisty, 1986). The presence of one *Petromyzon* larvae in SAC unit 2 confirms population recruitment and this small amount of evidence was further underpinned by the *ad hoc* spawning records of four adult sea lamprey submitted by volunteers to the National

Biodiversity Network database. The evidence for sea lamprey distribution is very poor so expert judgement was used to classify the population overall as a Fail.

7.3 Annual run size

Currently there are no data available for assessing this attribute although NRW has the in-house skills and dual frequency identification sonar (DIDSON) equipment to conduct this work. See recommendations.

7.4 Age structure

At least two age classes were found at 14 of the sites and continuous annual recruitment on the Afon Teifi is corroborated by the length-frequency histograms. The histograms had a similar pattern both above and below the Cenarth falls and this underpins the observation that it is only a partial natural barrier to river lamprey migration.

7.5 *Lampetra* larval density

The mean catchment density was 14.91 m⁻² and this value compares favourably with the 2012 survey where the catchment mean was 16 m⁻². In both assessments the density means exceeded the CSM target of 5 m⁻². See recommendations.

8 Recommendations

The process for undertaking population condition assessment of SAC freshwater species in this third reporting cycle has undergone some changes during the creation of Natural Resources Wales. Staff from legacy bodies have worked together to fulfil the requirement under the Habitats Directive for monitoring and reporting on lamprey populations. In previous monitoring cycles, sampling and analysis was undertaken by external consultants, but in this cycle a tri-annual in-house sampling programme was set up at a slightly reduced number of sites on the Teifi. During the same period the CSM guidance for lampreys was significantly revised. This assessment of the Afon Teifi population is the first lamprey population assessment by NRW using the revised criteria. This assessment raises a small number of recommendations that relate not just to the Afon Teifi lamprey population but all SAC rivers where these species are a designated feature:

The production of this report was delayed by the difficulty in obtaining the survey records and the necessary density calculations. The density calculations rely on the BOXI tool managed by the Environment Agency and there is only one member of NRW staff who has the skills to use it.

Better support for processing field data and extracting records from the fisheries database would result in more of the data being utilised in SAC species population condition assessments. It is envisaged that the new WISKI database being developed by NRW to replace the EA database will have this facility in KiECO.

Recommendation 1: Ensure that the new Ki ECO database and training is available to all staff with a requirement to extract fish survey records.

Recommendation 2: Ensure that a greater number of staff are trained to use the replacement for BOXI tool.

Recommendation 3: Explore the possibility of collecting data in the field using electronic devices to reduce the amount of time required to handle and store data.

Recommendation 4: Agree a simpler standard format for analysing and documenting this data to enable staff to report on features using more of the data in the tight reporting time scale set by the EU.

Two habitat types were defined in the previous CSM guidance but the description of “suitable habitat” has been broadened in the revised version (JNCC, 2015).

Recommendation 5: Revised descriptions of suitable habitat should be included in the NRW lamprey monitoring protocol so that the assessment of extent in suitable habitat can be confirmed.

The annual run size attribute could not be assessed because no data was available although the necessary sampling skills and equipment can be found in-house.

Recommendation 6: NRW should agree a standard process for requesting monitoring programmes to be included in Ops teams work programmes including FAT, the all-Wales central fisheries team.

Recommendation 7: NRW staff should research techniques for more accurate identification of lamprey transformers.

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Data Archive Appendix

Data outputs associated with this project are archived in 116819 on server-based storage at Natural Resources Wales.



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