Report under The Conservation of Habitats and Species Regulations 2017 (as amended), Regulation 9A

2019-2024

Conservation status assessment for the habitat:

H3130 - Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Wales

Cyfoeth Naturiol Cymru
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Important note - Please read

- The information in this document represents Wales Report under The Conservation of Habitats and Species Regulations 2017 (as amended), Regulation 9A, for the period 2019-2024.
- It is based on supporting information provided by Natural Resources Wales, which is documented separately.
- The Habitats Regulations reporting 2019-2024 Approach Document provides details on how this supporting information contributed to the UK Report and the fields that were completed for each parameter.
- Maps showing the distribution and range of the habitat are included.
- Explanatory notes (where provided) are included at the end. These provide additional audit trail information to that included within the assessments. Further underpinning explanatory notes are available in the related country reports.
- 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; and/or (iii) the field was not relevant to this habitat (section 11 National Site Network coverage for Annex I habitats).

Further details on the approach to the Habitats Regulations Reporting 2019-2024 are available on the JNCC website.

Assessment Summary: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

Distribution Map

Range Map

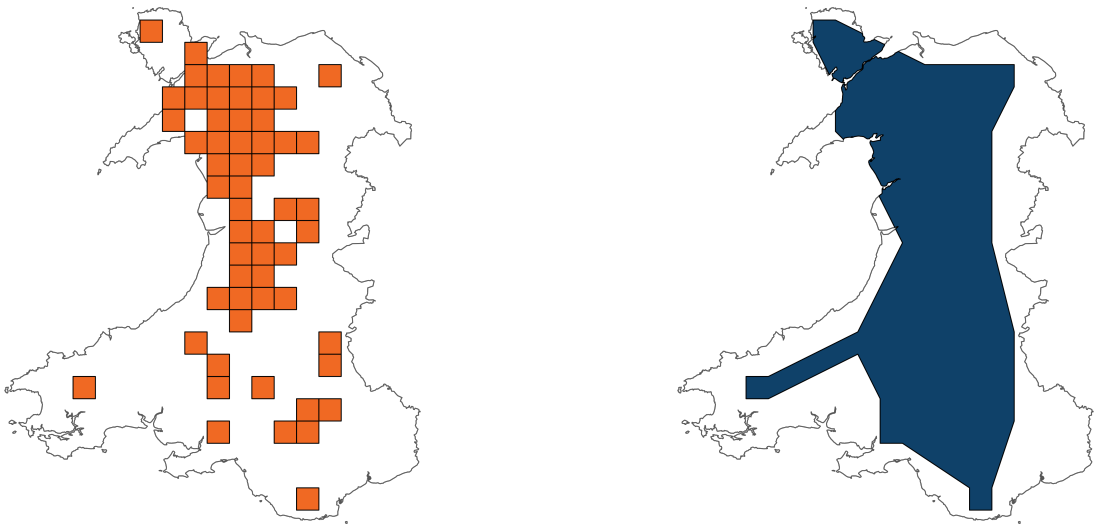

Figure 1: Wales distribution and range map for H3130 - Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*. Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority. The 10km grid square distribution map is based on available habitat records within the current reporting period.

Table 1: Table summarising the conservation status for H3130 - Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*. Overall conservation status for habitat is based on assessments of range, area covered by habitat, structure and functions, and future prospects.

Overall Conservation Status (see section 10)

Unfavourable-bad (U2)

Breakdown of Overall Conservation Status

Range (see section 4)	**Favourable (FV)**
Area covered by habitat (see section 5)	**Favourable (FV)**
Structure and functions (see section 6)	**Unfavourable-bad (U2)**
Future prospects (see section 9)	**Unfavourable-bad (U2)**

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National Level

1. General information

1.1 Country	Wales
1.2 Habitat code	H3130 - Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*

2. Maps

2.1 Year or period	2001-2024
2.2 Distribution map	Yes
2.3 Distribution map; Method used	Complete survey or a statistically robust estimate

2.4 Additional information

No additional information

Biogeographical Level

3. Biogeographical and marine regions

3.1 Biogeographical or marine region where the habitat occurs	ATL

3.2 Sources of information

See section 13 References

4. Range

4.1 Surface area (km²)	11,835.94
4.2 Short-term trend; Period	2014-2024
4.3 Short-term trend; Direction	Stable

4.4 Short-term trend; Magnitude	
a) Estimated minimum	
b) Estimated maximum	
c) Pre-defined range	
d) Unknown	
e) Type of estimate	
f) Rate of decrease	
4.5 Short-term trend; Method used	Based mainly on extrapolation from a limited amount of data
4.6 Long-term trend; Period	2003-2024
4.7 Long-term trend; Direction	Stable
4.8 Long-term trend; Magnitude	
a) Minimum	
b) Maximum	
c) Rate of decrease	
4.9 Long-term trend; Method used	Based mainly on extrapolation from a limited amount of data

4.10 Favourable Reference Range (FRR)

a) Area (km²)	
b) Pre-defined increment	Current range is less than 2% smaller than the FRR
c) Unknown	No
d) Method used	Reference-based approach
e) Quality of information	moderate

4.11 Change and reason for change in surface area of range

a) Change	No

b) Genuine change	
c) Improved knowledge or more accurate data	
d) Different method	
e) No information	
f) Other reason	
g) Main reason	

4.12 Additional information

No additional information

5. Area covered by habitat

5.1 Year or period	2001-2024
5.2 Surface area (km²)	
a) Minimum	
b) Maximum	
c) Best single value	19.83
5.3 Type of estimate	Minimum
5.4 Surface area; Method used	Complete survey or a statistically robust estimate
5.5 Short-term trend; Period	2014-2024
5.6 Short-term trend; Direction	Stable
5.7 Short-term trend; Magnitude	
a) Estimated minimum	
b) Estimated maximum	
c) Pre-defined range	
d) Unknown	
e) Type of estimate	
f) Rate of decrease	

5.8 Short-term trend; Method used	Based mainly on expert opinion with very limited data
5.9 Long-term trend; Period	2002-2024
5.10 Long-term trend; Direction	Stable
5.11 Long-term trend; Magnitude	
a) Minimum	
b) Maximum	
c) Confidence interval	
d) Rate of decrease	
5.12 Long-term trend; Method used	Based mainly on extrapolation from a limited amount of data
5.13 Favourable Reference Area (FRA)	
a) Area (km²)	
b) Pre-defined increment	Current area is less than 2% smaller than the FRA
c) Unknown	No
d) Method used	Expert opinion
e) Quality of information	

5.14 Change and reason for change in surface area of range

a) Change	No
b) Genuine change	
c) Improved knowledge or more accurate data	
d) Different method	
e) No information	
f) Other reason	
g) Main reason	

5.15 Additional information

No additional information

6. Structure and functions

6.1 Condition of habitat (km²)

Area in good condition	
ai) Minimum	3.35
aii) Maximum	3.35
Area not in good condition	
bi) Minimum	11.04
bii) Maximum	11.04
Area where condition is unknown	
ci) Minimum	5.45
cii) Maximum	5.45
6.2 Condition of habitat; Method used	Complete survey or a statistically robust estimate
6.3 Short-term trend of habitat area in good condition; Period	2014-2024
6.4 Short-term trend of habitat area in good condition; Direction	Decreasing
6.5 Short-term trend of habitat area in good condition; Method used	Complete survey or a statistically robust estimate

6.6 Typical species

Has the list of typical species changed in comparison to the previous reporting period?	No

6.7 Typical species; Method used

6.8 Additional information

Typical species were not used directly in the assessment of conservation status for habitat structure and function as a comprehensive list of typical species for each habitat was not available. However, the status of typical species was considered when the condition of individual sites was assessed using Common Standards Monitoring Guidance. Common Standards Monitoring (CSM) data was used to assess the area of habitat in 'good' and 'not good' condition (field 6.1). Species were a component of the attributes assessed under CSM. Therefore, an assessment of species is considered to have formed part of the reporting under field 6.1 which supported the Habitats Structure and Function assessment (field 10.3).

7. Main pressures

7.1 Characterisation of pressures

Table 2: Pressures affecting the habitat, including timing and importance/impact ranking. Pressures are defined as factors acting currently and/or during the reporting period (2019–2024). Rankings are: High (direct/immediate influence and/or large spatial extent) and Medium (moderate direct/immediate influence, mainly indirect and/or regional extent).

Pressure	Timing	Ranking
PA17: Agricultural activities generating pollution to surface or ground waters (including marine)	Ongoing and likely to be in the future	High (H)
PE05: Land, water and air transport activities generating pollution to surface or ground waters	Ongoing and likely to be in the future	Medium (M)
PF17: Active abstraction of water for built-up areas	Ongoing and likely to be in the future	Medium (M)
PG09: Management of fishing stocks and game	Ongoing and likely to be in the future	Medium (M)
PI01: Invasive alien species of Union concern	Ongoing and likely to be in the future	High (H)
PI02: Other invasive alien species (other than species of Union concern)	Ongoing and likely to be in the future	High (H)
PL01: Abstraction from groundwater, surface water or mixed water (mixed or unknown drivers)	Ongoing and likely to be in the future	Medium (M)
PL04: Development and operation of dams (mixed or unknown drivers)	Ongoing and likely to be in the future	Medium (M)
PL06: Physical alteration of water bodies (mixed or unknown drivers)	Ongoing and likely to be in the future	Medium (M)

7.2 Sources of information

See section 13 References

7.3 Additional information

No additional information

8. Conservation measures

8.1: Status of measures

a) Are measures needed?	Yes
b) Indicate the status of measures	Measures identified and taken
8.2 Main purpose of the measures taken	Restore the structure and functions, including the status of typical species (related to 'Specific structure and functions')
8.3 Location of the measures taken	Both inside and outside National Site Network
8.4 Response to measures	Medium-term results (within the next two reporting periods, 2025–2036)

8.5 List of main conservation measures

Table 3: Key conservation measures addressing current pressures and/or anticipated threats during the next two reporting periods (2025–2036). Measures are ranked by importance/impact: High (direct/immediate influence and/or large spatial extent) and Medium (moderate direct/immediate influence, mainly indirect and/or regional extent).

Conservation measure	Ranking
MA10: Reduce/eliminate point or diffuse source pollution to surface or ground waters (including marine) from agricultural activities	High (H)
MA13: Manage agricultural drainage and water abstraction (incl. the restoration of drained or hydrologically altered habitats)	High (H)
MB09: Manage the use of natural and synthetic fertilisers, liming and pest control in forestry	Medium (M)
MB10: Reduce diffuse or point source pollution to surface or ground waters (incl. marine) from forestry activities	Medium (M)

MC09: Manage/reduce/eliminate air pollution from resource exploitation and energy production	Medium (M)
ME03: Manage/reduce/eliminate air pollution from transport	Medium (M)
MG02: Management of hunting, recreational fishing, and the recreational or commercial harvesting or collection of plants and fungi (incl. restoration of habitats)	Medium (M)
MG03: Reducing the impact of (re-) stocking for fishing and hunting, of artificial feeding and predator control	Medium (M)
MI01: Early detection and rapid eradication of invasive alien species of Union concern	Medium (M)
MI02: Management, control or eradication of established invasive alien species of Union concern	High (H)
MI03: Management, control or eradication of other invasive alien species	High (H)
MJ02: Implement climate change adaptation measures	Medium (M)
MK01: Reduce impact of mixed source pollution	Medium (M)
MK03: Restoration of habitats impacted by multi-purpose hydrological changes	High (H)
MK04: Other measures related to mixed source pollution.	Medium (M)

8.6 Additional information

Only part of the measures identified have been taken.

9. Future prospects

9.1a Future trends of parameters

ai) Range	Overall stable
bi) Area	Overall stable
ci) Structure and functions	Very negative - important deterioration

9.1b Future prospects of parameters

aii) Range	Good
bii) Area	Good
cii) Structure and functions	Bad

9.2 Additional information

No additional information

10. Conclusions

10.1 Range	Favourable (FV)
10.2 Area	Favourable (FV)
10.3 Specific structure and functions (incl. typical species)	Unfavourable-bad (U2)
10.4 Future prospects	Unfavourable-bad (U2)
10.5 Overall assessment of Conservation Status	Unfavourable-bad (U2)
10.6 Overall trend in Conservation Status	Deteriorating

10.7 Change and reason for change in conservation status

This field is not reported as the period 2019-2024 marks the first instance in which conservation status has been assessed at the national level, meaning no comparisons to previous reports can be drawn.

10.7 Change and reason for change in conservation status trend

This field is not reported as the period 2019-2024 marks the first instance in which conservation status has been assessed at the national level, meaning no comparisons to previous reports can be drawn.

10.8 Additional information

No additional information

11. UK National Site Network (pSCIs, SCIs, SACs) coverage for Annex I habitat types

11.1 Surface area of the habitat type inside the pSCIs, SCIs and SACs network (km²)

a) Minimum	
b) Maximum	
c) Best single value	9.47
11.2 Type of estimate	Best estimate
11.3 Habitat area inside the network; Method used	Complete survey or a statistically robust estimate
11.4 Short-term trend of habitat area within the network; Direction	Stable
11.5 Short-term trend of habitat area within the network; Method used	Based mainly on extrapolation from a limited amount of data
11.6 Short-term trend of habitat area in good condition within the network; Direction	Decreasing
11.7 Short-term trend of habitat area in good condition within the network; Method used	Complete survey or a statistically robust estimate

11.8 Additional information

No additional information

12. Complementary information

12.1 Justification of percentage thresholds for trends

No justification information

12.2 Other relevant information

No other relevant information

13. References

Biogeographical and marine regions

3.2 Sources of information

Arts, GHP. 2002. Deterioration of Atlantic soft water macrophyte communities by acidification, eutrophication and alkalinisation. Aquatic Botany 73:373-393.

Battarbee RW. 2005. Mountain lakes, pristine or polluted? Limnetica, 24, 1-8.

Baxter E, Stewart N. 2015. Macrophyte Survey of Welsh Lakes for Habitats Directive and Water Framework Directive Monitoring, 2014. NRW Evidence Report No: 52, 78pp. Bangor: Natural Resources Wales.

Burgess A, Goldsmith B, Hatton-Ellis T. 2006. Site Condition Assessments of Welsh SAC and SSSI Standing Water Features. CCW Contract Science Report 705. Bangor: Countryside Council for Wales.

Burgess A, Goldsmith B, Hatton-Ellis T, Hughes M, Shilland E. 2009. CCW Standing Waters SSSI Monitoring 2007-08. CCW Contract Science Report 855. Bangor, Countryside Council for Wales.

Burgess A, Goldsmith B, Hatton-Ellis TW. 2013. Site Condition Assessments of Welsh SAC and SSSI Standing Water Features, 2007-2012. CCW Contract Science Report No. 983. Bangor: Countryside Council for Wales.

Carvalho L, Maberly S, May L, Reynolds C, Hughes M, Brazier R, Heathwaite L, Liu S, Hilton J, Hornby D, Bennion H, Elliott A, Willby N, Dils R, Phillips G, Pope L, Fozzard I. 2005. Risk Assessment Methodology for Determining Nutrient Impacts in Surface Water Bodies. Science Report SC020029/SR. Environment Agency, Bristol.

Centre for Ecology and Hydrology (CEH). 2018. Glastir Monitoring and Evaluation Programme: Freshwater. Available online at https://gmep.wales/freshwater/

Dines T. (2008) A Vascular Plant Red Data List for Wales. 80pp. Salisbury, Plantlife Wales.

Duigan C, Kovach W, Palmer M. 2006. Vegetation communities of British lakes: a revised classification scheme for conservation. Aquatic Conservation: Marine and Freshwater Ecosystems 17:147-173.

George DG, Rouen MA. 2011. Llyn Tegid monitoring station 2006-2010: Report no. 5. CCW Contract Science Report No. 959. Bangor: Countryside Council for Wales.

Goldsmith, B., Bennion, H., Hughes, M., Jones, V., Rose, C, Simpson G. 2006. Integrating Habitats Directive and Water Framework Directive Monitoring: Baseline Survey of Natura 2000 Standing Water Habitats in Wales. CCW Contract Science Report 704. Bangor, Countryside Council for Wales.

Goldsmith B, Salgado, J, Shilland, J, Bennion, H, Yang, H & Turner, SD. 2014a. Biodiversity Action Plan Lakes Survey 2012-14. NRW Evidence Report No: 27, 171pp. Bangor: Natural Resources Wales.

Goldsmith B, Salgado, Bennion, H. & Goodrich. 2014b. Lake Ecological Surveys (Wales) 2013 NRW Evidence Report No: 28.19 pp, Bangor: Natural Resources Wales.

Goldsmith B, Shilland EM, Yang H, Shilland J, Salgado J & Turner SD. 2014c. Condition Assessment of Eight Standing Waters in Sites of Special Scientific Interest (SSSIs). NRW Evidence Report No: 29, 147pp, Bangor: Natural Resources Wales.

Goldsmith B, Turner S, Shilland E, Goodrich S. 2016. Ecological Surveys of Welsh Lakes 2015. NRW Evidence Report No 145. 25 pp, Bangor: Natural Resources Wales.

Goldsmith B, Stewart NF, Hatton-Ellis TW. 2019. Ecological Surveys of Welsh Lakes 2018. NRW Evidence Report No 343. 113 pp, Natural Resources Wales, Bangor.

Hatton-Ellis TW. 2011. Condition Assessment: Afon Gwyrfai a Llyn Cwellyn SAC. Feature: 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea. CCW Internal Report, stored on electronic document management system.

Hatton-Ellis TW. 2016. Evidence Review of Lake Nitrate Vulnerable Zones in Wales. NRW Evidence Report No: 135, 163pp, Natural Resources Wales, Bangor.

Hatton-Ellis TW. 2014. Lake BAP Priority Areas in Wales – a strategic overview. Cardiff: Wales Biodiversity Partnership. Available online at http://www.biodiversitywales.org.uk/File/453/en-GB

Hatton-Ellis TW. 2019. 2013-2018 Supporting evidence pack for Annex B & D feature reports. H3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea. Natural Resources Wales.

Hatton-Ellis, TW. 2025. Evidence Pack for the Conservation Status Assessment of H3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea – First Habitats Regulations 9A Report for Wales. Unpublished internal document, Natural Resources Wales.

Hughes, M., Hornby, D. D., Bennion, H., Kernan, M., Hilton, J., Phillips, G., and Thomas, R. 2004. The development of a GIS-based inventory of standing waters in Great Britain

together with a risk-based prioritisation protocol. Water, Air and Soil Pollution: Focus 4:73-84.

Interagency Freshwater Group. 2015. Common Standards Monitoring Guidance for Freshwater Lakes. JNCC, Peterborough. Available online at https://data.jncc.gov.uk/data/1b15dd18-48e3-4479-a168-79789216bc3d/CSM-FreshwaterLakes-2015.pdf

Jeppesen E, Søndergaard M, Jensen JP, Havens KE, Anneville O, Carvalho L, Coveney MF, Deneke R, Dokulil M, Foy B, Gerdeaux D, Hampton SE, Hilt S, Kangur K, Kohler J, Lammens EHHR, Lauridsen T L, Manca M, Miracle MR, Moss B, Noges P, Persson G, Phillips G, Portielje R, Romo S, Schelske CL, Straile D, Tatrai I, Willen E, Winder M. 2005. Lake responses to reduced nutrient loading – an analysis of contemporary long-term data from 35 case studies. Freshwater Biology 50:1747-1771,

Joint Nature Conservation Committee (JNCC) 2005. Common Standards Monitoring Guidance for Standing Waters. Version March 2005. JNCC, Peterborough. 80 pp. ISSN 1743-8160.

Joint Nature Conservation Committee. 2007. Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: https://webarchive.nationalarchives.gov.uk/ukgwa/20180804091020/http://jncc.defra.gov.uk/page-4060

Kelly MG, Juggins S, Bennion H, Burgess A, Yallop ML, Hirst H, King L, Jamieson BJ, Guthrie R, Rippey B. 2008. Use of diatoms for evaluating ecological status in UK freshwaters. SC030103/SR4. Bristol: Environment Agency.

Kernan M, Battarbee RW, Curtis CJ, Monteith DT, Shilland EM. 2010. Recovery of lakes and streams in the UK from the effects of acid rain. UK Acid Waters Monitoring Network 20 Year Interpretative Report. Report to Defra. ISSN: 1366-7300. Available online at: https://uk-air.defra.gov.uk/assets/documents/reports/cat13/1206251208_20yearInterpRpt.pdf

Leira M, Jordan P, Taylor D, Dalton C, Bennion H, Rose N, Irvine K. 2006. Assessing the ecological status of candidate reference lakes in Ireland using palaeolimnology. Journal of Applied Ecology 43:816-827.

McFarland B, Carse F, Sandin L. 2009. Littoral macroinvertebrates as indicators of lake acidification within the UK. Aquatic Conservation: Marine and Freshwater Ecosystems 20: S105-S116.

Murphy KJ. 2002. Plant communities and plant diversity in softwater lakes of northern Europe. Aquatic Botany 73:287-324.

Nõges P, Nõges T, Cid N, Cardoso AC, Kernan M. 2014. Adaptive strategies to Mitigate the Impacts of Climate Change on European Freshwater Ecosystems. Deliverable 7.21:

Policy brief on the need for establishing stricter nutrient loading limits for lakes in a changing climate. EU REFRESH Project Work Package 7.

Roberts, G. 1995. The Lakes of Eryri. Gwasg Carreg Gwalch, Llanrwst.

Shilland EM, Goldsmith B, Hatton-Ellis TW. 2019. Ecological Surveys of Welsh Lakes 2017. NRW Evidence Report No 257. 103pp, Natural Resources Wales, Bangor

Smolders AJP, Lucassen, ECHET, Roelofs JGM. 2002. The isoetid environment: biogeochemistry and threats. Aquatic Botany 73:325-350.

Smolders AJP, Lucassen, ECHET, Roelofs JGM. 2002. The isoetid environment: biogeochemistry and threats. Aquatic Botany 73:325-350.

Solheim AL, Rekolainen S, Moe SJ, Carvalho L, Phillips G, Ptacnik R, Penning WE, Toth LG, O'Toole C, Schartau AL, Hesthagen T. 2008. Ecological threshold responses in European lakes and their applicability for the Water Framework Directive (WFD) implementation: synthesis of lakes results from the REBECCA project. Aquatic Ecology 42:317-334.

Stewart NF, Hatton-Ellis TW. 2020. A Red List of Stoneworts in Wales. NRW Evidence Report No: 406, 105pp, Natural Resources Wales, Bangor.

Whitehead PG, Wilby RL, Battarbee RW, Kernan M, Wade AJ. 2009. A review of the potential impacts of climate change on surface water quality. Hydrological Sciences Journal 54:101-123.

Willby NJ, Pitt J-A, Phillips G. 2009. The ecological classification of UK lakes using aquatic macrophytes. SC010080/SR. Bristol: Environment Agency.

Main pressures

7.2 Sources of information

No sources of information

14. Explanatory Notes

Field label	Note
2.1: Year or period	Most of the data is post 2007. The status of this and other Habitats Directive habitats in Wales were reviewed by Hatton-Ellis (2014).
2.3: Distribution map; Method used	Based on data from the Welsh updated lakes inventory (Hatton-Ellis, 2014) and surveys of individual lakes (Goldsmith et al. 2006; 2014a; 2014b; 2014c; 2016; 2019; Shilland et al. 2019; NRW unpublished data). Uncertainties reflect the difficulty of correctly assigning water bodies to a Habitats Directive type, and the close relationship between this habitat and 3160 (see the report for 3160 and also JNCC 2007). However, this is unlikely to have a significant impact on estimates of range. This is a widely distributed habitat across Wales, especially in upland areas in the north and west where it is the predominant lake type. In southern and eastern areas, examples are typically smaller, more fragmented, and more likely to be artificial in origin. There is a marked difference in the distribution of the moderate and low alkalinity subtypes (Hatton-Ellis 2019), with the moderate alkalinity subtype being more scattered in its occurrence.
4.1: Surface area	This habitat is wide-ranging in and around upland areas in Wales, with occasional examples in base-poor lowland habitats such as heathland pools. See Figures 2 and 3.
4.2: Short-term trend; Period	The standard period has been used.
4.3: Short-term trend; Direction	There has been no significant short-term change in range of this habitat within Wales. Lowland, more moderate alkalinity examples (for example in Powys) are scarcer and most at risk (see sections 6-7). Whilst the range within the heartland of this habitat type

	(upland areas, especially Snowdonia and the Cambrian mountains) remains stable, more isolated moderate alkalinity examples in lowland areas will have been lost to nutrient enrichment. This is likely to affect range more than surface area. However, this effect may be masked at the 10km2 scale. Construction and subsequent abandonment of industrial and public water supply reservoirs in upland areas in South Wales (e.g. Brecon Beacons) may have extended its range somewhat in this area where there are few natural water bodies although these are usually functionally damaged, species-poor and do not compensate for loss of moderate alkalinity examples.
4.4: Short-term trend; Magnitude	Not applicable.
4.5: Short-term trend; Method used	Based on data from the Welsh updated lakes inventory (Hatton-Ellis, 2014) and surveys of individual lakes (Goldsmith et al. 2006; 2014a; 2014b; 2014c; 2016; 2019; Shilland et al. 2019; NRW unpublished data). Range has been assessed using the UK Lakes inventory as a cross check for all 10km grid squares reported in JNCC (2007). Lakes in the UK lakes inventory were first assigned a type based on survey data and map based factors such as geology and altitude. H3260 lakes were selected and georeferenced to 10km squares. This procedure has not been updated for the current reporting round as the location and extent of lake habitat is generally well known, and changes to lakes such as infilling require planning permission. Consequently, range has not changed.
4.6: Long-term trend; Period	The standard long-term period has been used.
4.7: Long-term trend; Direction	There is no evidence of a long term change in range for this habitat within Wales. See comments under short-term trend in 4.3 and 4.5 above.

4.8: Long-term trend; Magnitude	Not applicable - see 4.7.
4.9: Long-term trend; Method used	There is a reasonably consistent dataset across the long-term timescale.
4.11: Change and reason for change in surface area of range	There is no evidence to suggest a significant change in range.
5.1: Year or period	Most of the dataset is post 2007. The status of this and other Habitats Directive habitats in Wales were reviewed by Hatton-Ellis (2014, 2019). The background data for this assessment is the inventory data used by Hughes et al. (2004), updated and verified against aerial photos and recently collected data.
5.2: Surface area	Low alkalinity: 14.47 km2 (156 lakes) Moderate alkalinity: 5.36 km2 (13 lakes) Total (Best single value): 19.83 km2 As outlined in the introductory section, there are significant ecological differences between the low and moderate alkalinity subtypes of this habitat, and consequently a breakdown of their respective areas has been provided. The greatest potential source of uncertainty lies in the interpretation of large public water supply reservoirs. These were excluded from the calculation unless there is evidence to suggest that they support a macrophyte community consistent with good quality lake habitat. Inclusion of these water bodies could increase the area by an additional 6km2.
5.4: Surface area; Method used	This is based on inventory data, subject to the sources of uncertainty described in 5.2 above.
5.5: Short-term trend; Period	The standard period has been used, though for this habitat type significant changes in area are extremely unlikely over such a short period.

5.6: Short-term trend; Direction	There is no evidence for a significant change in area over this period. There is no evidence for a change in the distribution pattern within range since the previous reporting round.
5.7: Short-term trend; Magnitude	Not applicable. See 5.6.
5.8: Short-term trend; Method used	No formal assessment of trend in lake area has been carried out, because the likelihood of area changing is extremely low.
5.9: Long-term trend; Period	The standard period has been used.
5.10: Long-term trend; Direction	There is no evidence for a significant trend in area over this period.
5.11: Long-term trend; Magnitude	Not applicable. See 5.10.
5.12: Long-term trend; Method used	There is no evidence for a significant trend in area over this period.
5.14: Change and reason for change in surface area	Comment on Favourable Reference Area in 2013 report: Value: 19km2 H3130 in Wales is likely to be somewhat above the favourable reference area for this habitat due to the construction of artificial reservoirs and pools for water supply and industry in upland areas. Some of these are now disused and may constitute good habitat. However, moderate alkalinity examples are much rarer and are a seriously threatened habitat in Wales. Method used to set FRA value: See 5.1.
6.1: Condition of habitat	Low alkalinity: Good: Max 3.04 km2 Min 3.04 km2

Not Good: Max 5.40 km2 Min 5.40 km2

Not Known: Max 5.33 km2 Min 5.33 km2

Moderate alkalinity:

Good: Max 0.32 km2 Min 0.32 km2

Not Good: Max 5.64 km2 Min 5.64 km2

Not Known: Max 0.13 km2 Min 0.13 km2

Total

Good: Max 3.35 km2 Min 3.35 km2

Not Good: Max 11.04 km2 Min 11.04 km2

Not Known: Max 5.45 km2 Min 5.45 km2

The overall habitat area statistics are strongly skewed by the status of several large lakes (e.g. Llyn Tegid, 4.15 km2).

Higher altitude examples of these lakes are starting to show measurable improvements in structure and function including an increase in macrophyte species richness, reappearance of acid sensitive macrophytes, diatom floras returning towards a reference condition (or at least a new, less impacted stable state), and increases in alkalinity, acid neutralising capacity and pH. These changes are indicate recovery from acidification. Reductions in grazing animal stocking rates in upland areas are also expected to improve habitat quality, though these changes are slow and are not yet apparent in lake ecosystems.

In lowland areas, H3130 usually has a higher buffering capacity and acid impacts are consequently small. Instead, pressures associated with farming and / or sewage

	discharges are a more serious issue, especially nutrient enrichment which leads to deoxygenation of sediments and the water column, loss of isoetid flora (including Luronium natans in Wales) and dominance by atypical or invasive plant species such as Ceratophyllum demersum and Elodea spp. Typical fish species such as charr, trout and gwyniad may also be threatened in this way. Invasive species such as Crassula helmsii and Elodea nuttallii are an increasing problem for this habitat type (Baxter & Stewart 2015; Shilland et al. 2018, NRW unpublished data). Since the previous reporting round, invasive species have colonised several previously unimpacted lakes in Eryri. These species are a serious threat to the long-term structure and function of the habitat in Wales, and have resulted in a reduction in the area of habitat reported as 'Good' from 21% to 16.9% since the previous assessment (Hatton-Ellis 2019). NRW macrophyte survey data show that typical species of this habitat, including the more sensitive Lobelia dortmanna, remain widely distributed and often abundant where local conditions are suitable, suggesting that for the moment, climate change is not a limiting factor for this habitat type.
6.2: Condition of habitat; Method used	About 75% of the estimated lake area has been surveyed, although not all relevant parameters have been measured for every lake. It should be noted that survey is biased towards the larger lakes. Structure and function for these lakes has been assessed using the Common Standards Method (JNCC, 2005; IAFG 2015). CSM results for these lakes are detailed in Baxter & Stewart (2014); Burgess et al. (2006, 2009, 2013); Goldsmith et al. (2011; 2014a,b,c; 2016; 2019); Hatton-Ellis (2011, 2016).

	Typical species are included in the measures of structure and function. They are identified on a lake-specific basis but usually include three or more of Isoetes spp, Lobelia dortmanna, Littorella uniflora, Sparganium angustifolium, Utricularia sp., Nitella sp. and Luronium natans. See IAFG (2015) for a description of methods and relevant NRW management plans for site-specific targets. Other relevant information: As discussed in the notes, range and area have little relevance as measures of the conservation status of the freshwater environment (see also JNCC 2007). Future Article 17 reporting on Freshwater habitats, including H3130, should place much greater emphasis on structure and function. A variety of functional, pressure sensitive metrics have been developed for protected areas (JNCC 2005) and WFD monitoring (e.g. Kelly et al. 2008, McFarland et al. 2009, Willby et al. 2009).
6.4: Short-term trend of habitat area in good condition; Direction	There has been a marked decline in the area reported as in Good condition since 2019, predominantly due to colonisation by invasive non-native species.
6.7: Typical species; Method used	IAFG (2015) Guidance has been used. This requires presence of at least three characteristic Littorelletea species (low alkalinity) or 8 species (moderate alkalinity); no loss of characteristic species; presence of characteristic species in at least 60% of vegetated sample points; and no significant decline in frequency. For a list of relevant typical species, see IAFG (2015).
7.1: Characterisation of pressures	Pressures: Pressures have been assessed by collating evidence from a variety of sources including Common Standards Monitoring (Burgess et al. 2006, 2009, Burgess & Hatton-Ellis 2013, Baxter & Stewart 2015; Goldsmith et al. 2014a, b, 2016; Shilland et al. 2017; Goldsmith et al. 2019; NRW unpublished data) other monitoring networks (Environment

Agency, unpublished data; Kernan et al. 2010) and the scientific literature (Arts 2001; Murphy 2002; Smolders et al. 2002; Battarbee 2005; Carvalho et al. 2005; Solheim et al. 2008).

Many Welsh lakes of this type have low to very low alkalinity, and have therefore suffered severely from acidification as a consequence of human induced air pollution during the mid to late 20th century (PE05; PF19). The Acid Waters Monitoring Network site at Llyn Llagi has shown a strong recovery signal (Kernan et al. 2010) and this is backed up by NRW monitoring elsewhere indicating a widespread increase in pH, alkalinity, ANC and acid sensitive plants such as Myriophyllum spicatum and Callitriche hamulata.

Historically, many Welsh upland lakes were dammed and regulated for diverse uses such as mining, hydropower or water supply (PD02, PF17, PL04, PL06) (Roberts 1995). The severity of these impacts is very variable, from sites that maintain a largely natural flora and fauna and are considered favourable (e.g. Llyn Cwellyn - see Hatton-Ellis 2011) to sites where the functioning habitat is no longer found (e.g. Llyn Peris). However, the largest public water supply reservoirs that experience significant drawdown have either a depauperate flora or lack submerged plants altogether (NRW, unpublished data).

Hydropower (PD02) is usually most destructive in its impacts, but few H3130 lakes have associated hydro schemes, so its overall current impact is relatively low. Increasing demand for renewable energy sources could include demand for more hydropower on lakes of this type.

In more lowland settings, some of these lakes show evidence of eutrophication caused mainly by agricultural pollution (PA17) (Carvalho et al. 2005, Burgess et al. 2006, 2009; Hatton-Ellis 2016). These moderate alkalinity

examples are both rarer (Fig. 3; Duigan et al. 2006; Hatton-Ellis 2014) and under much more pressure in Wales due to nutrient enrichment.

Invasive species (PI01, PI02) are becoming an increasingly serious risk to the habitat in Wales with the spread of species such as Crassula helmsii, Elodea nuttallii and Lagarosiphon major to new sites including Llyn Padarn and Llyn Tegid. See Burgess et al. 2006, 2009, Goldsmith et al. 2019, NRW unpublished data). Sites that are also used as reservoirs or for recreation are most at risk.

Fishery management (PG09) is a moderate pressure on these habitats, but some examples (especially in the moderate alkalinity category) are affected by past stocking of non-characteristic coarse fish species. Illegal or accidental introductions of coarse fish, such as the recent appearance of perch in Llyn Padarn, are an increasing problem.

Climate change is likely to affect habitat structure and function negatively in various ways (PJ10), including promoting algal blooms, facilitating spread of invasive species, delaying recovery from acidification, altering temperature and oxygen profiles, and increasing the reproduction of undesirable species such as coarse fish. In particular, climate change acts as an enabler for other pressures by worsening the impact of nutrient and invasive species. Due to the many potential mechanisms to affect the ecosystem, the exact effects of climate change on H3130 in Wales is likely to be site-specific and difficult to predict.

Threats:

There is an ongoing strategic need for water in southern Britain and Welsh upland lakes are seen as a significant resource for drinking water supply. Welsh lakes are therefore at risk of being modified for use as public water

	supply reservoirs, especially where there is an existing but disused dam. The demand for hydropower schemes has been increasing recently and is likely to continue to do so as the need for renewable energy increases. There is a widespread perception that hydropower schemes have little environmental impact, even though they can be very destructive to lake ecosystems by destroying macrophyte communities and fish spawning grounds. Although this habitat continues to recover from the acidification caused by air pollution during the 20th century, this is predicted to remain a low level threat for the foreseeable future. Invasive non-native species, especially Elodea spp. and Crassula helmsii, will remain a threat to this habitat and are predicted to continue to spread through accidental introductions. Other INNS are likely to arrive via mainland Europe and may colonise this habitat especially where recreational activity occurs. Climate change (N05) is thought to be especially significant in upland lakes (Battarbee 2005; Jeppesen et al. 2005) with warmer temperatures, reduced ice cover, and increased nutrient availability having ecosystem level effects on both alkalinity and productivity. Other threats are expected to continue as discussed under pressures.
8.5: List of main conservation measures	The improving water quality seen in low alkalinity H3130 lakes is due to ongoing actions under the Convention on Long Range Transboundary Air Pollution, originally signed in the late 1970s, and also due to the decline in heavy industry in western Europe between 1960 and 2000. Improved forestry management practices are helping to reduce the impacts of conifer plantations on acidity,

	drainage and light penetration. Water abstraction and discharge impacts, have been reduced and / or constrained via the Review of Consents process.Where lakes are designated as protected sites, management agreements are used to control agricultural inputs. Invasive species are a significant concern, and whilst relatively easy to detect using available monitoring, so far measures to control them have limited effectiveness in this environment. Further work is needed to develop and implement effective control measures for invasive plants such as Crassula helmsii, Elodea spp. and Lagarosiphon major. Designation of new SSSIs and / or SAC extensions are needed to help to safeguard key moderate alkalinity lakes. Identification of suitable climate change adaptation measures is highly site-specific, but climate effects have been shown to follow the same pathways as nutrient enrichment. Consequently, reductions to nutrient loadings should be effective at mitigating the effects of climate change (Nõges et al. 2014). Management of undesirable species such as coarse fish and possibly increases to woodland cover thereby reducing the temperature of inflowing water during droughts and sediment erosion during floods may also be effective. Other measures currently being implemented are considered of low significance.
9.1:Future trends and prospects of parameters	9.1a Future prospects of - range. There are no reasons to expect a decline in range of this habitat in Wales in the foreseeable future. 9.1b Future prospects of - area. The area of this habitat is not expected to decline significantly in the near future.

	9.1c Future prospects of - structure and function. Low alkalinity subtype: Negative. Future prospects for the low alkalinity subtype of this habitat in Wales are seen as poor. Although here is measurable chemical and biological recovery from acidification, this is negated by the recent and very concerning spread of invasive non-native species. Moderate Alkalinity Subtype: Very negative. The moderate alkalinity subtype remains highly threatened and continues to decline. It is much more vulnerable to invasive species and agricultural pressures, and less well protected by the Natura 2000 series. Overall the future prospects of structure and function are considered to be Poor.
10.1: Range	Range is assessed as Favourable because the current range is stable and approximately equal to the Favourable Reference Range.
10.2: Area	Conclusion on Area reached because: (i) the short-term trend direction in Area is stable; (ii) the current Area is approximately equal to the Favourable Reference Area; and iii) there has been no significant change in distribution pattern within range.
10.3: Specific structure and functions	Structure and Function is assessed as Unfavourable – Bad because more than 25% (56%) of the habitat is in Unfavourable condition and the short-term trend of the habitat area in Good condition is strongly negative and expert opinion determines that there are significant issues for this habitat.
10.4: Future prospects	Future prospects is assessed as Unfavourable – bad because the Future prospects for Structure and function are bad.
10.5: Overall assessment of Conservation Status	The overall assessment is Unfavourable – Bad because Structure and Function and Future Prospects are assessed as Unfavourable – bad.

11.1: Surface area of the habitat type inside the pSCIs, SCIs and SACs network	Estimation of habitat type surface area included in the SAC network: Best Estimate: Low Alkalinity: 5.26 km2 Moderate Alkalinity: 4.21 km2 Total: 9.47 km2 This total was recalculated in NRW (2019). It does not include SSSI only lakes.
11.3: Surface area of the habitat type inside the network; Method used	Based on CSM method (JNCC, 2005), with targets adapted at a site-specific level to take into account site-specific factors that may influence the results, such as the natural flora and extent of rocky substrate. Data derived from the updated Welsh lakes inventory (Hatton-Ellis 2014).
11.5: Short-term trend of habitat area within the network; Method used	Due to the widespread occurrence of this habitat type, it is not feasible to monitor every lake.
11.6: Short-term trend of habitat area in good condition within the network; Direction	Low alkalinity: Good: Max 2.11 Km2 Min 2.46 Km2 (-0.34 km2) Not Good: Max 2.17 Km2 Min 2.17 Km2 (+0.21 km2) Not Known: Max 0.77 Km2 Min 0.67 Km2 (+0.13 km2) Moderate alkalinity: Good: Max 0 Km2 Min 0 Km2 (unchanged) Not Good: Max 4.19 Km2 Min 4.19 Km2 (unchanged) Not Known: Max 0.02 Km2 Min 0.02 Km2 (unchanged)

	Overall: -0.35 km2 (3.9% net deterioration). The colonization of Llyn Ogwen (39ha) by Elodea nuttallii has resulted in a deterioration within the site network since 2019, in spite of some improvements in smaller lakes.
5.13: Favourable Reference Area (FRA)	The UK-level FRV for surface area was developed by JNCC using an audit trail based on the year the FRV was first established and any changes made in subsequent reporting rounds. The audit may draw from any combination of the 2007, 2013, or 2019 Habitats Directive reports and reflects the full rationale used for the 2019 Article 17 reporting. This FRV was reviewed by Welsh experts and considered appropriate for use in Wales based on current habitat extent and trends.
4.10: Favourable Reference Range (FRR)	The UK-level FRV for range was developed by JNCC using an audit trail based on the year the FRV was first established and any changes made in subsequent reporting rounds. The audit may draw from any combination of the 2007, 2013, or 2019 Habitats Directive reports and reflects the full rationale used for the 2019 Article 17 reporting. This FRV was reviewed by Welsh experts and considered appropriate for use in Wales based on current distribution and trends.