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:

S1833 - Slender naiad (*Najas flexilis*)

SCOTLAND

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 (Scotland information only)**
1.2 Species code	**1833**
1.3 Species scientific name	**Najas flexilis**
1.4 Alternative species scientific name	
1.5 Common name (in national language)	Slender naiad

2. Maps

2.1 Sensitive species	No
2.2 Year or period	1999-2018
2.3 Distribution map	Yes
2.4 Distribution map Method used	Based mainly on extrapolation from a limited amount of data
2.5 Additional maps	No

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

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

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

a) Unit

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

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

3.5. Additional information

BIOGEOGRAPHICAL LEVEL

4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs

Atlantic (ATL)

4.2 Sources of information

Wingfield, R., Murphy, KJ., Hollingsworth, P. and Gaywood, M.J. (2004). The Ecology of Najas flexilis. Scottish Natural Heritage Commissioned Report No. 017.
Bennion, H., Clarke, G., Davidson, T., Morley, N., Rose, N., Turner, S. and Yang, H. (2008). Palaeoecological study of seven mesotrophic lochs. ECRC research report 121. Final report to SEPA and SNH.
McKenzie, S.W., Baxter, E., Korba, L., Stewart, N. & Birkinshaw, N. 2018. Site Condition Monitoring Report 2016 Dunkeld and Blairgowrie Lochs SAC; Lochs Clunie and Marlee SSSI; and Lochs Butterstone, Craiglush and Lowes SSSI Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report
Inger, S.D, Nisbet, C. & N. Birkinshaw, N. 2018. Site Condition Monitoring Report 2018 Loch Kindar. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report Unpublished
Baxter, E. 2017. Site Condition Monitoring Report 2016 Coll Machair SAC & Totamore Dunes and Loch Ballyhaugh SSSI: Loch Ballyhaugh. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report Unpublished
Baxter, E. 2017. Site Condition Monitoring Report 2016 North East Coll Lochs and Moors SSSI: Loch an t-Sagairt. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report
Bishop, I. J, Bennion, H, and Sayer, C. D. 2018. Understanding the habitat and decline of Najas flexilis in the UK using ecology and paleoecology. Scottish Natural Heritage Commissioned Report
McKenzie, S.W., Baxter, E., Korba, L., Stewart, N. & Birkinshaw, N. 2017. Site Condition Monitoring Report 2016 Balranald Bog and Loch nam Feithean SSSI and North Uist Machair SAC: Loch Scaraidh, Loch Grogary and Loch a Roe. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report

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Baxter, E. McKenzie, S.W., Korba, L., Stewart, N. & Birkinshaw, N. 2017. Site Condition Monitoring Report 2016 Bornish and Ormiclate Machairs SSSI: West Loch Ollay, Loch Toronish and Mid Loch Ollay. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report Unpublished
Baxter, E., McKenzie, S.W., Wallace, M. & Inger S.D. 2018. Site Condition Monitoring Report 2016 South Uist Machair SAC & South Uist Machair and Lochs Ramsar. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report Unpublished
Baxter, E. 2017. Site Condition Monitoring Report 2016 North East Coll Lochs and Moors SSSI: Loch an t-Sagairt. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report Unpublished
Baxter, E. 2017. Site Condition Monitoring Report 2016 Loch Hallan SSSI: Loch Hallan. Report by Ecus Ltd. Scottish Natural Heritage Commissioned Report Unpublished
Smith, P. BSBI (2016) pers comm.
King, U. (2011) pers comm.
Scottish Environment Protection Agency (2017) pers. Comm

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)	2505
	b) Operator	
	c) Unknown	
	d) Method	Based on 2013 report
5.11 Change and reason for change in surface area of range	Improved knowledge/more accurate data Use of different method	
	The change is mainly due to:	Improved knowledge/more accurate data
5.12 Additional information	No plants were found in The Dunkeld and Blairgowrie Lochs SAC despite snorkel surveys in 2016. The most recent record in any of the lochs is 2007.The remaining lochs where it is believed present in the area are White Loch and Fingask Loch. A snorkel survey also failed to find it in Loch Kindar in Dumfries-shire in 2017 where it was last recorded in 1996 The only record from Loch Flemington in Moray was paleo and it has not been re-found. Eight additional sites have been included due to new records reaching us from CSM, BSBI or SEPA. Loch Hallan, Loch Phurit-ruadidh and Loch an Eilein all lie within the South Uist Machair SAC. Loch a' Mhuilinn is also on South Uist. Loch Tormasad and Loch na Nighe are on North Uist. Loch nan Clach Corr and Loch Olabhat are on Benbecula	

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6. Population

6.1 Year or period	1999-2018	
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	112
6.3 Type of estimate	Best estimate	
6.4 Additional population size (using population unit other than reporting unit)	a) Unit	number of localities (localities)
	b) Minimum	
	c) Maximum	
	d) Best single value	44
6.5 Type of estimate	Best 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	Decreasing (-)	
6.9 Short-term trend Magnitude	a) Minimum	
	b) Maximum	
	c) Confidence interval	
6.10 Short-term trend Method used	Based mainly on extrapolation from a limited amount of data	
6.11 Long-term trend Period	1995-2018	
6.12 Long-term trend Direction	Decreasing (-)	
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	46 with unit number of localities (localities)
	b) Operator	
	c) Unknown	
	d) Method	Based upon the 2013 report.
6.16 Change and reason for change in population size	Genuine change Improved knowledge/more accurate data Use of different method	
	The change is mainly due to:	Genuine change
6.17 Additional information	The number of localities has dropped from a best estimate of 46 to 44 This is based on it being considered absent in 10 localities with new records for 8 out of a current total number of 54 locations for which we have post 1999 records. The population is therfore slightly declining and definately under pressure, particularly outwith its stronghold in the North-west. However because it is a	

relatively rare plant and as a submerged macrophyte which is under-represented on rake samples casual records are unusual. It is an annual and abundance may fluctuate from year to year. Paleo records suggest that it may even be absent, at least in measurable quantities, for periods as long as a decade and return. Recent increased survey effort has made it possible to more reliably conclude that it is not currently present in 7 localities although it may recover from seed. It has never been recorded growing in the final locality and was not found during CSM in 2010.

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)?	Yes
	b) Is there a sufficiently large area of occupied AND unoccupied habitat of suitable quality (to maintain the species at FCS)?	
7.2 Sufficiency of area and quality of occupied habitat Method used	Based mainly on extrapolation from a limited amount of data	
7.3 Short-term trend Period	2007-2018	
7.4 Short-term trend Direction	Decreasing (-)	
7.5 Short-term trend Method used	Based mainly on extrapolation from a limited amount of data	
7.6 Long-term trend Period		
7.7 Long-term trend Direction		
7.8 Long-term trend Method used		
7.9 Additional information	Two PhDs have been carried out looking at the habitat requirements of the species based upon its current and previous habitat. They both agree that the main pressures are acidification, nutrient enrichment and competition from non-native species. Consideration has also been given to the preference for a particular substrate. There is a significant overlap between current and former sites. Sites that contain the species today are typically circumneutral and mesotrophic. Within this it is found within a variety of different plant associations. It grows best where the pH is not too low to inhibit the plants ability to reproduce but is not so hight that the availability of CO2 is reduced. Because of its dependance on CO2 it is more susceptible to competition where bicarbonate is the predominant form of available carbon. The sites some of the sites on the Western Isles may be more buffered and the mainland sites where it seems to be under more pressure may have more intensively farmed catchments.	

8. Main pressures and threats

8.1 Characterisation of pressures/threats

Pressure	Ranking
Intensive grazing or overgrazing by livestock (A09)	H
Application of synthetic (mineral) fertilisers on agricultural land (A20)	H
Construction or development of reservoirs and dams for residential or recreational development (F29)	M

Other invasive alien species (other then species of Union concern) (I02)	H
Problematic native species (I04)	M
Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01)	H
Invasive alien species of Union concern (I01)	H

Threat	Ranking
Tillage practices in forestry and other soil management practices in forestry (B17)	M
Application of synthetic fertilisers in forestry, including liming of forest soils (B19)	M
Temperature changes (e.g. rise of temperature & extremes) due to climate change (N01)	M
Droughts and decreases in precipitation due to climate change (N02)	M
Sea-level and wave exposure changes due to climate change (N04)	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/eliminate point pollution to surface or ground waters from agricultural activities (CA10)
Reduce diffuse pollution to surface or ground waters from agricultural activities (CA11)
Manage the use of chemicals for fertilisation, liming and pest control in forestry (CB09)
Reduce diffuse pollution to surface or ground waters from forestry activities (CB10)
Manage changes in hydrological and coastal systems and regimes for construction and development (CF10)
Reduce impact of mixed source pollution (CJ01)
Manage water abstraction for public supply and for industrial and commercial use (CF11)
Management, control or eradication of other invasive alien species (CI03)
Implement climate change adaptation measures (CN02)
Adapt mowing, grazing and other equivalent agricultural activities (CA05)

9.6 Additional information

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10. Future prospects

10.1 Future prospects of parameters	a) Range	Poor
	b) Population	Unknown
	c) Habitat of the species	Good
10.2 Additional information	There is a strong possibility that the range will continue to shrink. Of the remaining 7 Mainland Sites it has only been recorded from Loch Tangy and Loch Nan Gad in Kintyre in the last 10 years. However the population seems roughly stable, with new localities being discovered, and e-DNA techniques may lead to the discovery of further localities. Water quality is generally improving and work already undertaken has started to improve matters on the Dunkeld-Blairgowrie Lochs where it is considered absent. However, complete recovery may be slow due to internal loading. Elodea remains a threat and there is currently no method of addressing this. However it is largely seen as a compounding factor.	

11. Conclusions

11.1. Range	Favourable (FV)
11.2. Population	Unfavourable - Inadequate (U1)
11.3. Habitat for the species	Unfavourable - Inadequate (U1)
11.4. Future prospects	Unknown (XX)
11.5 Overall assessment of Conservation Status	Unfavourable - Inadequate (U1)
11.6 Overall trend in Conservation Status	Deteriorating (-)
11.7 Change and reasons for change in conservation status and conservation status trend	a) Overall assessment of conservation status Genuine change Improved knowledge/more accurate data Use of different method The change is mainly due to: Genuine change b) Overall trend in conservation status Genuine change Improved knowledge/more accurate data Use of different method The change is mainly due to: Genuine change
11.8 Additional information	It is difficult to determine when the species is absent from a site. Even when there is evidence it is absent it may not be lost. It may be either at below detectable levels or able to recover from the seedbank. However the failure of targeted surveys using the best methods currently available ,snorkling, indicate that it is likely that it is absent from a number of sites and its range has contracted. New survey techniques using e-DNA may change this assessment and paleoecology work has identified that it can return after a significant period where it absent from the sediment record. Measures to improve the conditions within previously occupied lochs are therfore very worthwhile.

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

12.1 Population size inside the pSCIs, SCIs and SACs network (on the biogeographical/marine level including all sites where the species is present)	a) Unit	number of map 1x1 km grid cells (grids1x1)
	b) Minimum	
	c) Maximum	
	d) Best single value	40
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		Stable (0)
12.5 Short-term trend of population size within the network Method used		Complete survey or a statistically robust estimate
12.6 Additional information		Slender Naiad has been recorded from 25 loclaities within the SAC network. It is currently considered absent from 8 of these following recent survey. Only 2 of the 8 have records from within the short term period 2007 -2018. Loch of the Lowes and Loch Marlee from 2007.

13. Complementary information

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

Distribution Map

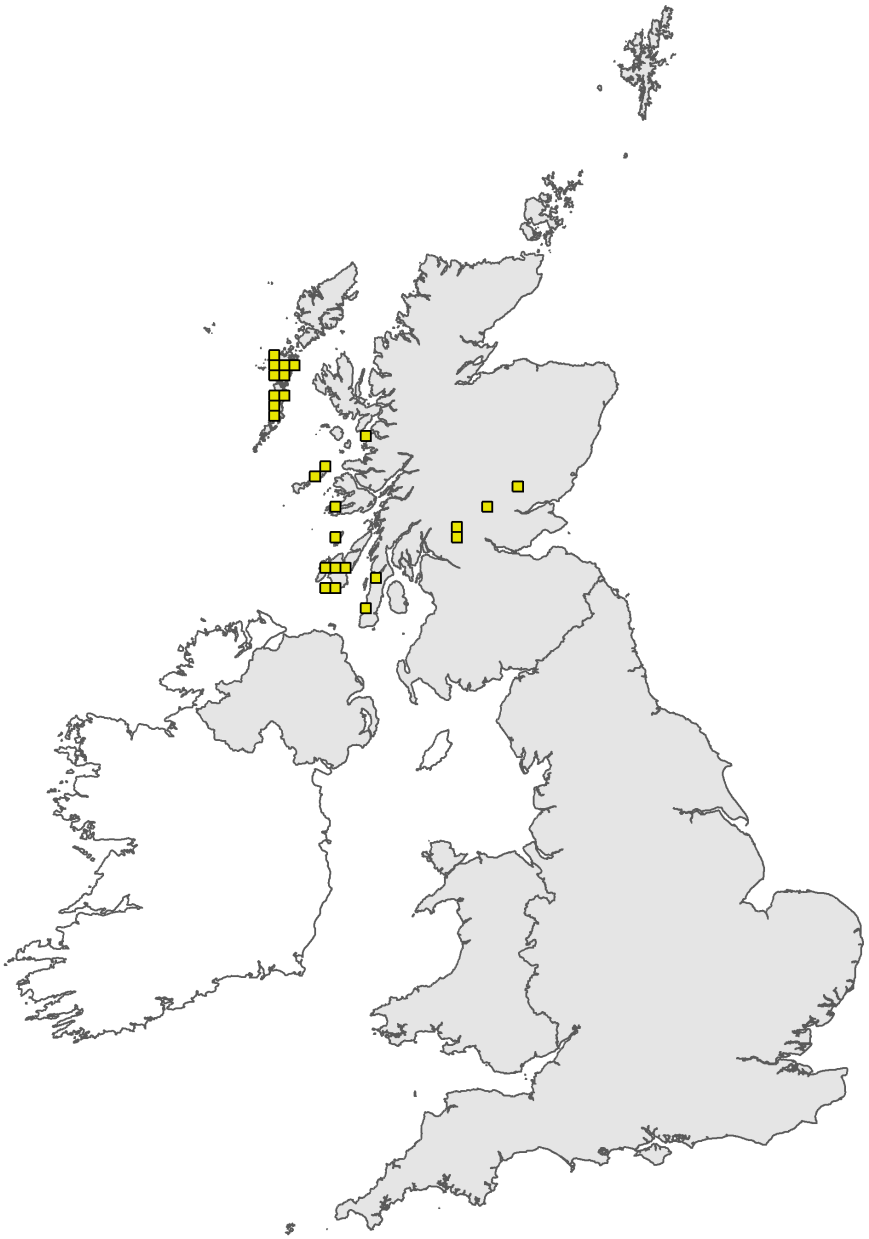

Figure 1: UK distribution map for S1833 - Slender naiad (*Najas flexilis*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

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

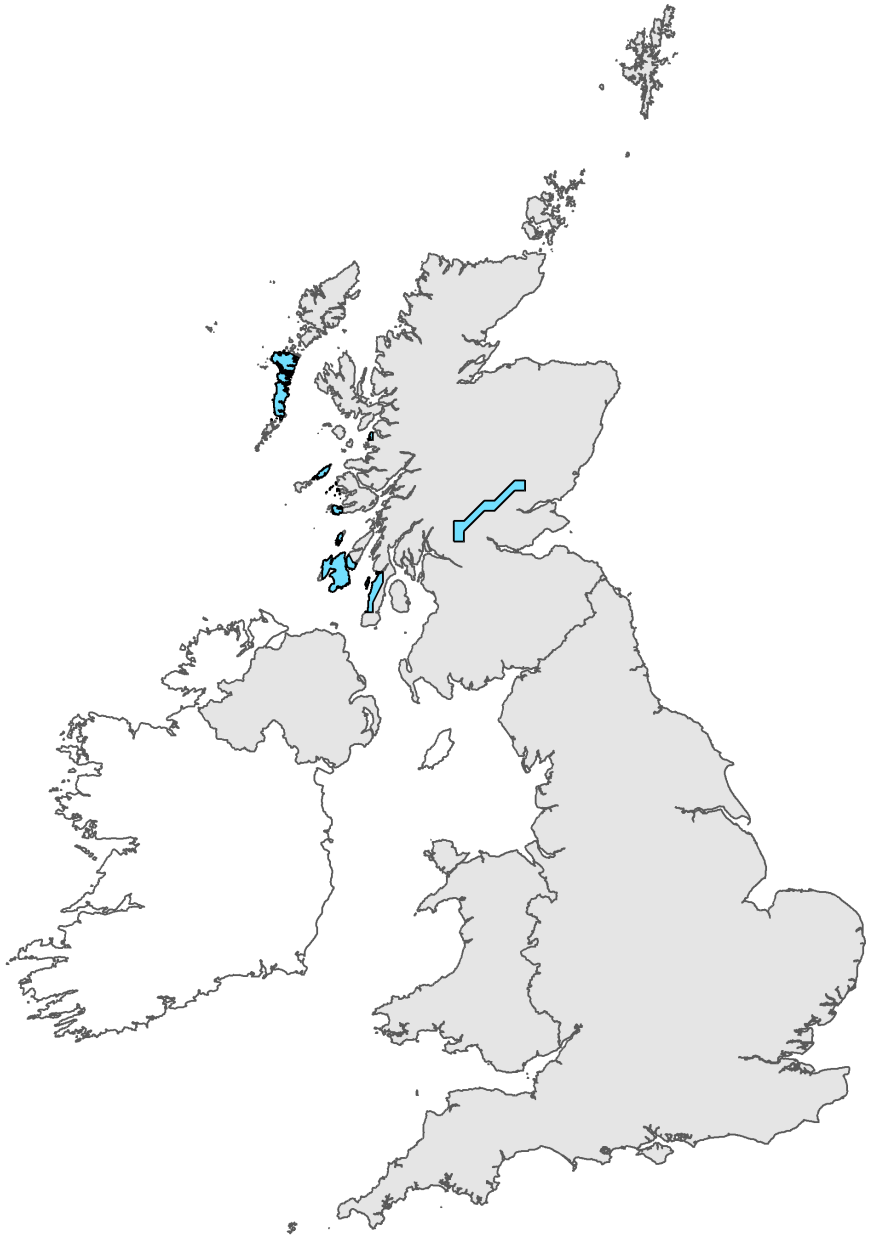

Figure 2: UK range map for S1833 - Slender naiad (*Najas flexilis*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

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 20km. For further details see the 2019 Article 17 UK Approach document.

Explanatory Notes

Species name: Najas flexilis (1833) Region code: ATL

Field label	Note
5.3 Short term trend; Direction	From the area calculation the species range seems to be roughly stable in the short term with a 2.4% increase from 2013. However there has been an expansion of its range in the North-west islands due to eight new records being included. Five of these records predate 2013. Ten sites have been removed from the previous round. Seven on the mainland. There is therefore a concern that the healthy range in the North-west is masking a decline on the mainland where it is considered absent from an SAC and some of the records are also getting older. This is an annual species, however, paleo information suggests that it can return a decade after it last set seed in significant numbers. Return is likely to be from small, hard to find, populations or seed rather than recolonisation. As a submerged species which is not well sampled by grapple it is hard to record. Most locations with records have therefore been retained. It has been classified as absent in lochs where it has not been recorded for over 10 years and there has been survey activity, usually snorkel based, which would expect to have found it if it was present. The main effect of removing these sites is a contraction in its mainland range. Two of these lochs were outliers. It has not been recorded from Loch Kindar near Dumfries in South Scotland since 1996 and a snorkel survey in 2017 failed to find it. Loch Flemington near Nairn in North Scotland was a paleo record and SCM has not recorded it. The other sites where it is considered absent are in the Dunkeld-Blairgowrie area and were subject to a snorkel search in 2016. The remaining two adjacent lochs in Perthshire have not been surveyed recently but there is no strong evidence that it is not present and these have been retained. This is consistent with the approach to previous rounds.
5.10 Favourable reference range	The favourable reference range is based upon previous reporting.
5.11 Change and reason for change in surface area of range	Although calculated as stable the range appears to have shifted with roughly matching contractions and expansions on the mainland and in the Western Isles respectively. This regional contraction is a concern. There has been a small (2.6% of FRV) increase this is largely due to new records being added and improved knowledge more accurate data has been selected as the main reason. However the additional records are in areas close to existing locations. The adoption of 1km squares rather than locations also have resulted in an expansion in these areas so different method has been selected as a reason for change. This expansion in range is also likely to be masking a contraction on the mainland. 2017 monitoring found no specimens in Loch Kindar in Dumfries and Galloway and the species was absent from all 5 Dunkeld Blairgowrie Lochs in 2016. It has also not been refound in Loch Flemington as discussed under 5.3 above. Time has gone on and the period since it was last recorded has increased for some sites. An intensive survey of sites using snorkeling, the best available survey method, has also informed the decision about distribution. Seven of the ten sites where it has been found absent are on the mainland; the five Dunkeld Blairgowrie SAC lochs and Loch Kindar in Dumfries-shire. Loch Flemington where the only record is paleo from pre-2006 and it was not found growing by CSM.

6.3 Type of estimate	The population estimate is extrapolated from the number of lochs where the species is found. It is a submerged macrophyte with a preference for deep water and is under represented on rake samples. As a rarity most people are unfamiliar with it. Casual records are few restricted to some edge specimens.The most reliable method of survey is snorkling. However this is not completely reliable on large or deep sites and can be difficult in poor visibility or where there is significant epiphytic algae. Populations in each loch vary from year to year and the size of the loch does not necessarily relate well to the size of the population. Some large lochs have small populations and vice-versa. E-DNA techniques are likely to increase the number of localities where it is recorded. Follow up surveys will be required to quantify the abundance and condition of the population which is important in determining how well the plant is doing in a locality.
6.4 Additional population size	The total number of sites where it has been found continues to climb as it is recorded from new sites. However a recent survey of designated sites using a more reliable snorkel method has added confidence to believe that it is absent from a number of sites. Paleo work suggests that it can be absent for a number of years then return. However an increase in the time since it has been been found also increases confidence. A total of 54 sites have now been identified with records since 1999 however it appears to be absent from 10 of these mainly on the basis of recent targeted surveys .
6.8 Short term trend; Direction	The short term trend population has been classified as decreasing . Because of the sporadic nature of the records it is difficult to disambiguate a short term trend. However The probable absence from all of the Dunkeld - Blairgowrie SAC lochs and the decline from the FRP which was set at the last round as 46 to be currently believed present in 44 localities indicates a decline at least part of which was in the 2007-2018 period.
6.12 Long term trend; Direction	The additional sites lie within the existing range typically in the Western Isles. This may be due to short range dispersal. However due to the annual nature and submerged nature of the species it may also be due to new observations rather than new sites. The recent failure to find it in 6 of its 14 mainland sites, the 5 Dunkeld Blairgowrie lochs and Loch Kindar suggests that it is under pressure. Although still considered present, we are also not aware of any records in the last 10 years from four mainland sites: Loch a' Bhada Dharaich in Lochaber, White Loch and Fingask in Perthshire and Loch Monzievard ner Aberfoyle which has a single paleo record from pre-2006.
6.15 Favourable reference population	This is based upon the FRP in the last report
6.16 Change and reason for change in population size	The population size is difficult to determine .The estimate of population in 2005 was 39 and the FRP in the last round was estimated at 46. The total number of sites where it has been recorded continues to rise due to new records and the total number of sites is 54. However more detailed survey mainly using snorkel has indicated that it is absent from 10 sites. Given that these sites now have a longer period without a record and the more detailed method used it is likely that this reflects a genuine decline on the mainland at least.

7.1 Sufficiency of area and quality of occupied habitat	Two PhDs have identified the main issues likely to cause the loss of the species from a loch; these are changes to water chemistry notably pH and nutrient status and competition effects. Loss of the species from a site is therfore closely associated with the quality of the habitat. While stable and possibly even expanding in its stronghold areas the probable loss of colonies on the mainland,including Dunkeld and Blairgowrie Lochs SAC are affecting its ability to achieve favourable conservation status. Slender Naiad is particularly specific in its habitat requirements. The high pH , which it prefers is often assosciated with naturally nutrient rich lochs however it also prefers low nutrient status lochs. While the extent of sites for expansion is unknown it is limited and may be relatively small in comparison to the resource of all standing waters. However, it remains stable, possibly expanding, in its western stronghold and the area and quality of habitat is large enough for the long-term survival of the species.
7.4 Short term trend; Direction	The direction of the habitat trend over the standard short term of 2007-2018 is decreasing due to quality rather than extent . The area is stable as no lochs have been lost, even though the species may not be currently present, and may even be increasing as Slender Naiad has been recorded for the first time from some sites during the 2007-2018 period . The quality is uncertain. We do not have systematic waterquality information for the the lochs. In general water quality is improving due to WFD there is also targeted action such as the Lunan Lochs Natural Care Scheme in the Dunkeld-Blairgowrie area which is improving the water quality even on sites where it is currently believed absent. Use of how well the plant is doing as an indicator is difficult as it is not possible to define when it was last present with any certainty. For the lochs where it was not found by the recent 2016 snorkel survey of 16 localities the last record was 2007 or earlier making it difficult to assign this to a short term trend or part of a longer term change that has not been been clear.
8.1 Characterisation of pressures/ threats	The list of pressures is derived from the SCM database and link closely with the pressures identified in the two PhD studies notably nutrient enrichment and invasive non-natives such as Elodea canadensis and E.nutallii. Grazing has been included as poaching, feeding and grassland management may also give rise to nutrient enrichment. Forestry operations have also been listed as a threat as the catchment of Loch Tangy is heavily afforested and we have been involved in casework advice on forest operations within part of this. Climate change has been identified as a risk with increased mixed source pollution identified as high due to the potential increase in sediment and nutrient transport associated with predicted increased number and intensity of storm events. It is difficult to seperate temperature related effects however both in the UK and the rest of Europe it has been lost from its more southerly sites. in Ohio it has also been abserved to have shifted its observed range North. Water abstraction has previously been identified as a pressure on one of the the Dunkeld-Blairgowrie Lochs but this seems to have been resolved.
9.1 Status of measures	The species has been lost from a number of sites particularly on the mainland and within an SAC measures are therefore required. In addition to general measures addressing water quality issues such as SEPAs priority catchment work, work under AECS and work on raising awareness about the spread of non-native invasive species an SNH Natural Care Scheme has been addressing water quality issues in the Dunkeld-Blairgowrie SAC Lochs. Impacts from Fish Cages have been removed from Butterstone and inputs from the visitor centre at Loch of the Lowes have also been undertaken on two of the SAC lochs. A PhD has been carried out to identify issues surrounding the decline of the species using paleo-ecology and further work is under discussion. Publicity and awareness raising is being undertaken to control the spread of invasive non-native species including Elodea.

9.3 Location of the measures taken	Specific measures have been taken within designated sites and more general measures to deal with water quality and INNS have been taken outwith. Because most of the pressures and threats relate to offsite issues either in the catchment or in the case of INNS general awareness raising beyond the catchment the location of many of the conservation measures are offsite.
9.4 Response to the measures	Measures to deal with nutrient enrichment tend to be relatively long term. Even where the nutrient inputs are significantly reduced internal cycling of nutients, particularly phosphorus, may mean that improvements are decadal in scope. There is currently no method for intervention to deal with Elodea in lochs. However improvements in water quality are likely to increase resiliance and there is some evidence that impacts may reduce following an early establishment phase.
10.1 Future prospects of parameters	The absence from a number of mainland lochs has resulted in a reduction in the range in mainland Scotland. It has been reported in only two remaining mainland localities within the last ten years; both sites in Kintyre. While this lack of records is not considered evidence to assume that it is absent, given the decline elsewhere on the mainland there is evidence it is under pressure and may be or become absent leading to further reduction in range. However the population seems to be roughly stable with additional sites identified in the species strongholds of the western isles. The main threat in this area is through spread of Elodea. However this has only previously been identified as as a compounding factor. Water quality and therfore the habitat is generally improving. Studies at Esthwaite and elsewhere have shown that it can take a considerable time to return a waterbody to a conditon where the plant is able to thrive.
11.1 Range	Classified as favourable with a roughly stable area calculated as an increase of 64.46km2 between 2013 and 2019 equivalent to 2.6% of FRV. However there are concerns regarding losses from mainland areas being masked by expansion elsewhere and potential further future losses on mainland sites where it has not been recorded for some time.
11.2 Population	The species is believed to be present in 44 lochs which is lower than the 46 adopted as the favourable reference . However comentary in the 2013 report suggests that some of those 46 sites included ones where the species had not been found for some time and for which it is now been considered as absent
11.3 Habitat for the species	The habitat has been classified as inadequate as loss of the species from localities is strongly linked to habitat quality. It is likely that the habitat has been sub-optimal in some localities for some time and measures which have been introduced to address this are slow to take effect.
11.5 Overall assessment of Conservation Status	The conservation status has been classified as unfavourable using Annex C because of Unfavourable assessment for population and associated Unfavourable habitat quality assessment. Part of this loss may have occurred prior to this reporting period but use of more extensive snorkel survey has helped confirm this. Range has been classified as favourable based on generally stable total area albeit with concerns regarding the mainland distribution.
11.7 Change and reasons for change in conservation status and conservation status trend	The conservation status has been classified as unfavourable using Annex C because of the provisional loss of Range. Part of this loss may have occurred prior to this reporting period but use of more extensive snorkel survey has helped confirm this