# 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:

**S2492 - Vendace (*Coregonus albula*)**

ENGLAND

## 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 (England information only)** |
| 1.2 Species code | **2492** |
| 1.3 Species scientific name | **Coregonus albula** |
| 1.4 Alternative species scientific name | |
| 1.5 Common name (in national language) | Vendace |

## 2. Maps

| | |
|---|---|
| 2.1 Sensitive species | No |
| 2.2 Year or period | 2017- |
| 2.3 Distribution map | Yes |
| 2.4 Distribution map Method used | Complete survey or a statistically robust estimate |
| 2.5 Additional maps | No |

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

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

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

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

a) Unit

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

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

3.5. Additional information

## BIOGEOGRAPHICAL LEVEL

## 4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs

**Atlantic (ATL)**

4.2 Sources of information

Bohn, T. & Amundsen, P. 2001. The Competitive Edge of an Invading Specialist, Ecology, Vol. 82, No. 8 pp. 2150-2163
Burgess, A, Goldsmith, B and Goodrich, S. 2014. Interpretation of Water Framework Directive Macrophyte Data for CSM Condition Assessment. Project Reference No: 25552. Report to Natural England.
Common Standards Monitoring Guidance for Freshwater Fauna 2015
Common Standards Monitoring Guidance for Freshwater Lakes 2015
Davies, C., Shelley, J., Harding, P., McLean, I., Gardiner, Ross & Peirson, G. 2004. Freshwater Fishes in Britain. The species and their distribution. Harley Books.
Elliott, J. A. & Bell, V. A. 2011. Predicting the potential long-term influence of climate change on vendace (Coregonus albula) habitat in Bassenthwaite Lake, U.K. Freshwater Biology 56: 395 - 405.
Etheridge, E.C., Adams, C.E., Bean, C.W., Durie, N.C., Gowans, A.R.D., Harrod, C., Lyle, A.A., Maitland, P.S. & Winfield, I.J. 2012. Are phenotypic traits useful for differentiating among a priori Coregonus taxa?
Kottelat, M. & Freyhof, J. 2007. Handbook of European Freshwater Fishes
Mainstone, C., Hall, R. & Diak, I. 2016. A narrative for conserving freshwater and wetland habitats in England. Natural England Research Reports, Number 064.
Mainstone, C.P. 2016. Developing a coherent narrative for conserving freshwater and wetland habitats: experiences in the UK. WIRES Water, published Online: Nov 07 2016. DOI: 10.1002/wat2.1189.
Maitland, P. S. 1966. The present status of known populations of the Vendace, Coregonus vandesius in Great Britain. Nature 210, 216-217.
Maitland, P.S. & Campbell, R.N. 1992. Freshwater Fishes of the British Isles. HarperCollins.

Rosch, R. & Schmid, W. 1996. Ruffe (Gymnocephalus cernuus), newly introduced into Lake Constance: preliminary data on population biology and possible effects on whitefish (Coregonous lavaretus). Ann. Zool. Fennici 33 467-471
Winfield, I.J., Adams, C.E., Bean, C.W., Durie, N.C., Fletcher, J.M, Gowans, A.R., Harrod, C., James, J.B., Lyle, A.A., Maitland, P.S., Thompson, C., & Verspoor, E. 2011. Conservation of the vendace (Coregonus albula), the U.K.'s rarest freshwater fish.
Winfield, I.J., Fletcher, J.M & James, J.B. 2004. Conservation ecology of the vendace (Coregonus albula) in Bassenthwaite Lake and Derwent Water, UK. Ann. Zool. Fennici 41. 155-164.
Winfield, I.J., Fletcher, J.M & James, J.B. 2016. Monitoring the Fish populations of Bassenthwaite Lake and Derwent Water, 2015. Report to Natural England and United Utilities (Unpublished).
Winfield, I.J., Fletcher, J.M & James, J.B. 2016. The 'reappearance' of vendace (Coregonus albula) in the face of multiple stressors in Bassenthwaite Lake, U.K. Fundam. Appl. Limnol.
Winfield, I.J. & James, J.B. 2018. Monitoring the Fish populations of Bassenthwaite Lake and Derwent Water, 2017. Report to Natural England and United Utilities (Unpublished).

## 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)<br>b) Operator<br>c) Unknown<br>d) Method | |
| 5.11 Change and reason for change in surface area of range | Genuine change<br>The change is mainly due to: Genuine change | |
| 5.12 Additional information | Whilst Derwent Water has consistently supported vendace, none were found in Bassenthwaite Lake from 2001-2013 despite specific searches. Since 2013 a small number of individuals have been found in Bassenthwaite Lake.There are three possible origins for the individuals captured after 2013 from Bassenthwaite Lake. First, it is possible that vendace have survived in Bassenthwaite Lake since 2000 at a very low abundance, below the limit of detection, and may now be increasing in abundance. Second, the fish have arrived in Bassenthwaite Lake by moving down the River Derwent from the Derwent Water population. Third, this downstream movement happened some years ago and the observed individuals are the locally-spawned offspring of colonisers. Such immigration may have occurred during the extensive flooding | |

experienced at both lakes and the connecting River Derwent in November 2009, although at least one of the two adults recorded in 2014 was too old to have resulted from this particular mechanism. DNA analysis of the single under-yearling vendace of 2013 was undertaken. The results were inconclusive but suggested a Derwent Water origin.

## 6. Population

| | | |
|---|---|---|
| 6.1 Year or period | 2017 | |
| 6.2 Population size (in reporting unit) | a) Unit | number of individuals (i) |
| | b) Minimum | |
| | c) Maximum | |
| | d) Best single value | 7677 |
| 6.3 Type of estimate | Best estimate | |
| 6.4 Additional population size (using population unit other than reporting unit) | a) Unit | |
| | b) Minimum | |
| | c) Maximum | |
| | d) Best single value | |
| 6.5 Type of estimate | | |
| 6.6 Population size Method used | Complete survey or a statistically robust estimate | |
| 6.7 Short-term trend Period | 2007-2018 | |
| 6.8 Short-term trend Direction | Increasing (+) | |
| 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 | 1994-2018 | |
| 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 | Complete survey or a statistically robust estimate | |
| 6.15 Favourable reference population (using the unit in 6.2 or 6.4) | a) Population size | |
| | b) Operator | |
| | c) Unknown | |
| | d) Method | |
| 6.16 Change and reason for change in population size | Genuine change | |
| | The change is mainly due to: | Genuine change |
| 6.17 Additional information | | |

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

## 7. Habitat for the species

| | | |
|---|---|---|
| 7.1 Sufficiency of area and quality of occupied habitat | a) Are area and quality of occupied habitat sufficient (to maintain the species at FCS)? | No |
| | b) Is there a sufficiently large area of occupied AND unoccupied habitat of suitable quality (to maintain the species at FCS)? | No |
| 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 | Stable (0) | |
| 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 | | |

## 8. Main pressures and threats

### 8.1 Characterisation of pressures/threats

| Pressure | Ranking |
|---|---|
| Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01) | H |
| Other invasive alien species (other then species of Union concern) (I02) | H |
| Problematic native species (I04) | H |
| Extraction activities generating diffuse pollution to ground or surface waters (C11) | M |
| Modification of hydrological flow (K04) | M |
| Freshwater fish and shellfish harvesting (recreational) (G06) | M |
| Other climate related changes in abiotic conditions (N09) | M |

| Threat | Ranking |
|---|---|
| Mixed source pollution to surface and ground waters (limnic and terrestrial) (J01) | H |
| Other invasive alien species (other then species of Union concern) (I02) | H |
| Problematic native species (I04) | H |
| Extraction activities generating diffuse pollution to ground or surface waters (C11) | M |
| Modification of hydrological flow (K04) | M |
| Freshwater fish and shellfish harvesting (recreational) (G06) | M |
| Other climate related changes in abiotic conditions (N09) | H |

### 8.2 Sources of information

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

8.3 Additional information

J01/C11 - Polluting inputs resulting in eutrophication effects such as deoxygenation of the hypolimnion and fine sediment deposition on spawning substrates
J01/C11 - Polluting inputs resulting in eutrophication effects such as deoxygenation of the hypolimnion and fine sediment deposition on spawning substrates may continue for the foreseeable future due to catchment land use.
I02 - Crassula helmsii smothering of sub-littoral spawning substrates in Bassenthwaite Lake and Derwent water
I02 - Crassula helmsii smothering of sub-littoral spawning substrates in Bassenthwaite Lake and Derwent water is likely to increase and there is currently no effective control agent/method for Crassula.
I04/G06 - Competitive pressure from locally non-native fish species, notably roach and ruffe. Ruffe is known to predate vendace eggs leading to reduced recruitment. It is suspected that locally non-native fish species have been introduced to Bassenthwaite lake and Derwent water as live bait for recreational angling (although this is unproven and the evidence disputed).
I04/G06 - Competitive pressure from locally non-native fish species, notably roach and ruffe is likely to remain at or above the current pressure as there is no suitable method of control for these species in large waterbodies. It is possible that additional locally non-native/non-native fish species may be released into these water bodies.
J01/C11 - Polluting inputs resulting in eutrophication effects such as deoxygenation of the hypolimnion and fine sediment deposition on spawning substrates
J01/C11 - Polluting inputs resulting in eutrophication effects such as deoxygenation of the hypolimnion and fine sediment deposition on spawning substrates may continue for the foreseeable future due to catchment land use.
K04 - Vendace require littoral gravels for egg deposition. Changes to the hydrological regime of inflowing rivers and streams may increase deposition rates of fine sediment on these gravels. River engineering works may increase spate flow velocities within the catchment resulting in excess sediment transport. If low flows are maintained over long periods of time, elevated water temperatures and deoxygenation of inflowing rivers and streams may become evident.
K04 - increased pressure within the catchment for flood risk management and drinking water supply may lead to increased river engineering and flow management.
I04/G06 - Competitive pressure from locally non-native fish species, notably roach and ruffe. Ruffe is known to predate vendace eggs leading to reduced recruitment. It is suspected that locally non-native fish species have been introduced to Bassenthwaite lake and Derwent water as live bait for recreational angling (although this is unproven and the evidence disputed).
I04/G06 - Competitive pressure from locally non-native fish species, notably roach and ruffe is likely to remain at or above the current pressure as there is no suitable method of control for these species in large waterbodies. It is possible that additional locally non-native/non-native fish species may be released into these water bodies.
N09 - Warming of the climate may act synergistically with nutrient increases to reduce the area of suitable aquatic habitat for vendace. Increased storm intensity leading to catastrophic high flow events may lead to increased siltation of spawning areas.
N09 - Warming of the climate is predicated to continue and may ultimately exclude vendace from Bassenthwaite Lake due to the removal of a suitable

cool, well oxygenated deep-water refuge area. In addition weather events may continue to become more intense and unpredictable leading to a degradation of spawning habitat.

## 9. Conservation measures

| | | |
|---|---|---|
| 9.1 Status of measures | a) Are measures needed? | No |
| | b) Indicate the status of measures | |
| 9.2 Main purpose of the measures taken | | |
| 9.3 Location of the measures taken | | |
| 9.4 Response to the measures | | |
| 9.5 List of main conservation measures | | |
| 9.6 Additional information | | |

## 10. Future prospects

| | |
|---|---|
| 10.1 Future prospects of parameters | a) Range<br>b) Population<br>c) Habitat of the species |
| 10.2 Additional information | Following the recording of vendace in Bassenthwaite Lake in 2013 to present and the relative stability of the Derwent Water population, it may reasonably be assumed that if continued work is undertaken to address water quality and sedimentation issues within the catchment, vendace populations in both lakes may remain stable (and possibly increase) over the next 12 year period. However, in the longer term, climate change impacts may remove the required cold water refuge areas in Bassenthwaite Lake rendering the habitat unsuitable for vendace. In addition, there are no effective management techniques to address the impact of non-native and locally non-native species at the present time. It is considered unlikely that new techniques will become available in the near future, therefore, the impact on vendace will continue and may increase. |

## 11. Conclusions

| | | |
|---|---|---|
| 11.1. Range | | |
| 11.2. Population | | |
| 11.3. Habitat for the species | | |
| 11.4. Future prospects | | |
| 11.5 Overall assessment of Conservation Status | | |
| 11.6 Overall trend in Conservation Status | | |
| 11.7 Change and reasons for change in conservation status and conservation status trend | a) Overall assessment of conservation status | No change |

The change is mainly due to:

b) Overall trend in conservation status

No change

The change is mainly due to:

11.8 Additional information

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

12.1 Population size inside the pSCIs, SCIs and SACs network (on the biogeographical/marine level including all sites where the species is present)

a) Unit

b) Minimum

c) Maximum

d) Best single value

12.2 Type of estimate

12.3 Population size inside the network Method used

12.4 Short-term trend of population size within the network Direction

12.5 Short-term trend of population size within the network Method used

12.6 Additional information

## 13. Complementary information

13.1 Justification of % thresholds for trends

13.2 Trans-boundary assessment

13.3 Other relevant Information

# Distribution Map

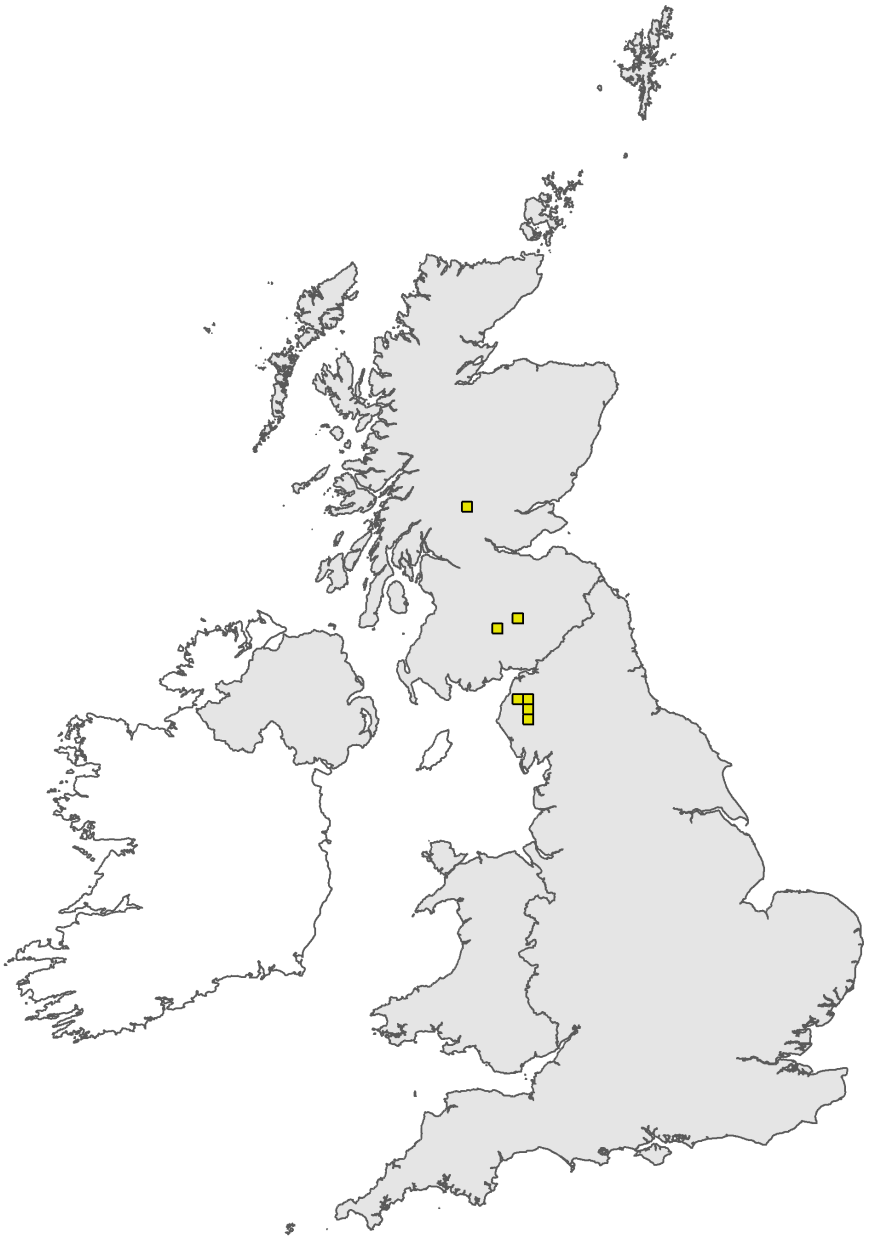

Figure 1: UK distribution map for S2492 - Vendace (*Coregonus albula*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

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 S2492 - Vendace (*Coregonus albula*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

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

# Explanatory Notes

**Species name: Coregonus albula (2492)**

| Field label | Note |
|---|---|
| 3.1 Is the species take in the wild/ exploited | Vendace are not directly exploited as a quarry species for recreational angling in England. It is possible that they could be captured as bycatch when fishing for other freshwater fish species, however, this is unlikely due to the habitat occupied and foraging behaviour of vendace. They have specific protection under Schedule 5 of the wildlife and Countryside Act 1981 and general protections from fishery activity under the Salmon and Freshwater Fisheries Act 1975. |
| 3.2 Which of the measures in Art. 14 have been taken? | Specific protection afforded to vendace in England by Schedule 5 of the Wildlife and Countryside Act 1981: (1) Subject to the provisions of this Part, if any person intentionally kills, injures or takes any wild animal included in Schedule 5, he shall be guilty of an offence. (2) Subject to the provisions of this Part, if any person has in his possession or control any live or dead wild animal included in Schedule 5 or any part of, or anything derived from, such an animal, he shall be guilty of an offence. (4) Subject to the provisions of this Part, if any person intentionally- (a) damages or destroys, or obstructs access to, any structure or place which any wild animal included in Schedule 5 uses for shelter or protection ; or (b) disturbs any such animal while it is occupying a structure or place which it uses for that purpose, he shall be guilty of an offence. |
| 3.3 Hunting bag or quantity taken in the wild for Mammals and Acipenseridae (Fish) | Number of adults would be used, however, no recording unit available due to no national requirement for catch returns to be submitted and specific targeting of vendace being illegal. |

**Species name: Coregonus albula (2492) Region code: ATL**

| Field label | Note |
|---|---|
| 5.11 Change and reason for change in surface area of range | Whilst Derwent Water has consistently supported vendace, none were found in Bassenthwaite Lake from 2001-2013 despite specific searches. Since 2013 a small number of individuals have been found in Bassenthwaite Lake. There are three possible origins for the individuals captured after 2013 from Bassenthwaite Lake. First, it is possible that vendace have survived in Bassenthwaite Lake since 2000 at a very low abundance, below the limit of detection, and may now be increasing in abundance. Second, the fish have arrived in Bassenthwaite Lake by moving down the River Derwent from the Derwent Water population. Third, this downstream movement happened some years ago and the observed individuals are the locally-spawned offspring of colonisers. Such immigration may have occurred during the extensive flooding experienced at both lakes and the connecting River Derwent in November 2009, although at least one of the two adults recorded in 2014 was too old to have resulted from this particular mechanism. DNA analysis of the single under-yearling vendace of 2013 was undertaken. The results were inconclusive but suggested a Derwent Water origin. |
| 6.2 Population size | When considering the figures above, caution should be exercised if attempting to use estimated population sizes to determine the conservation status of vendace. The population numbers are extrapolated from hydroacoustic data associated with very low numbers of gill net captured vendace. To highlight this point, in 2017 a total of 171 fish was sampled by gill net from Bassenthwaite Lake, comprising 59 perch, 3 pike, 29 roach, 79 ruffe and 1 vendace. If a minimum figure was used to express the vendace population in Bassenthwaite Lake the population size would = 1 individual. |

| | |
|---|---|
| 6.8 Short term trend; Direction | The population density and population size of post-juvenile vendace at Bassenthwaite Lake were zero between 2001 and 2013. This decline to, and persistence at, zero resulted from the absence of vendace from the gill-net samples between 2001 and 2013, but between 2014 and 2017 vendace were recorded. This continued appearance of vendace in gill-net samples resulted in the estimate for the population density of vendace in 2017 being above that recorded in 2016 and comparable with those recorded in 2015 and 2014. Nevertheless, it is stressed that these estimates of post-juvenile vendace population density and population size are based on only small gill-net sample sizes and so must be viewed with caution. The vendace population density and size has remained reletively consistent throught the period in Derwent Water. |
| 6.12 Long term trend; Direction | The population density and population size of post-juvenile vendace at Bassenthwaite Lake within the long term trend period between 1995 and 2018 reduced to zero between 2001 and 2013. This decline to, and persistence at zero resulted from the absence of vendace from the gill-net samples between 2001 and 2013, but between 2014 and 2017 vendace were recorded. This continued appearance of vendace in gill-net samples resulted in the estimate for the population density of vendace in 2017 being approximately 50% lower than those recorded in the mid to late 1990s. Nevertheless, it is stressed that these estimates of post-juvenile vendace population density and population size are based on only small gill-net sample sizes and so must be viewed with considerable caution. The vendace population density and size has remained reletively consistent throughout the period in Derwent Water |
| 6.16 Change and reason for change in population size | Vendace were considered extinct in Bassenthwaite Lake between 2001 - 2013. Since 2013 vendace individuals have been recoreded in annual surveys up to and including 2017. Survey methodologies have remained comparable. |

| | |
|---|---|
| 7.1 Sufficiency of area and quality of occupied habitat | Both Derwent Water and Bassenthwaite Lake populations are impacted by non-native and locally non-native species including competition from fish species such as roach and ruffe and the smothering of vendace spawning areas in the sub-littoral zone by Crassula helmsii. In addition, the vendace spawning areas within Bassenthwaite are impacted by excessive siltation which was noted to be continuing in 2017 habitat surveys. Water quality data outlined in the 2014 lake SSSI CSM report indicated that Bassenthwaite Lake had elevated levels of total phosphorus, the average exceeding the CSM mesotrophic (deep lake) target limit of 15 microgl-1. Mean TP values for the periods 2010-12 (16.5 microgl-1) and 2007-09 (17.5 microgl-1) were comparable, indicating no change in nutrient status. Chlorophyll a data showed the site to have a moderate phytoplankton biomass and dissolved oxygen concentrations were unfavourable. The reported noted that the lake has suffered increased sediment loads and the macrophyte community was recorded as unfavourable, with C. helmsii present. The 2014 CSM report recorded the 2010-12 water quality in Derwent Water as good with low TP concentrations (7.5 microgl-1),falling within the CSM target limits for oligotrophic lakes . Mean TP was similar over the period 2007-09 (6.6 microgl-1). Chlorophyll a data showed the site to have consistently low phytoplankton biomass and dissolved oxygen concentrations were high throughout the water column (~9 mgl-1). C. helmsii was also recorded growing extensively above the water line. The presence of C. helmsii placed the site in unfavourable condition, despite an otherwise favourable macrophyte community structure. The Bassenthwaite vendace population may become extirpated from the water body in the future due to climate change effects, particularly increases in water temperature. Warming effects are likely to be more severe in Bassenthwaite, when compared with Derwent Water, due to its shallower depth. This assessment is solely based on vendace populations only being present in Derwent Water and Bassenthwaite Lake since the last glacial retreat from the lake district. At the present time, there is no evidence for vendace having been present within England at any other location. However, in the geographical area described by the Lake District, it is likley that waterbodies with a similar water chemistry, thermal regime, morphology and speicies assemblage may have been/are available for colonisation by vendace, should suitable conditions allowing their colonisation of these water bodies have become or will become available. If this principle is taken to its conclusion, suitable transloction sites (e.g. free from non-native species and with low future risks) in a similar geographic area (Lake District) are likely to exist. These sites may be capapble of mitigating for uncontrollable climate change effects (i.e. sites at higher altitude) acting on Bassenthwaite Lake and rendering it unsuitable / unsustainable for future vendace populations . |
| 7.2 Sufficiency of area and quality of occupied habitat; Method used | 2014 CSM assessment for Derwent Water and Bassenthwaite Lake |
| 7.4 Short term trend; Direction | The species is resident in Bassenthwaite Lake and Derwent Water |
| 7.5 Short term trend; Method used | 2014 CSM assessment for Derwent Water and Bassenthwaite Lake |

| | |
|---|---|
| 8.1 Characterisation of pressures/ threats | Pressures: J01/C11 - Polluting inputs resulting in eutrophication effects such as deoxygenation of the hypolimnion and fine sediment deposition on spawning substrates I02 - Crassula helmsii smothering of sub-littoral spawning substrates in Bassenthwaite Lake and Derwent water I04/G06 - Competitive pressure from locally non-native fish species, notably roach and ruffe. Ruffe is known to predate vendace eggs leading to reduced recruitment. It is suspected that locally non-native fish species have been introduced to Bassenthwaite lake and Derwent water as live bait for recreational angling (although this is unproven and the evidence disputed). K04 - Vendace require littoral gravels for egg deposition. Changes to the hydrological regime of inflowing rivers and streams may increase deposition rates of fine sediment on these gravels. River engineering works may increase spate flow velocities within the catchment resulting in excess sediment transport. If low flows are maintained over long periods of time, elevated water temperatures and deoxygenation of inflowing rivers and streams may become evident. N09 - Warming of the climate may act synergistically with nutrient increases to reduce the area of suitable aquatic habitat for vendace. Increased storm intensity leading to catastrophic high flow events may lead to increased siltation of spawning areas. Threats: J01/C11 - Polluting inputs resulting in eutrophication effects such as deoxygenation of the hypolimnion and fine sediment deposition on spawning substrates may continue for the foreseeable future due to catchment land use. I02 - Crassula helmsii smothering of sub-littoral spawning substrates in Bassenthwaite Lake and Derwent water is likely to increase and there is currently no effective control agent/method for Crassula. I04/G06 - Competitive pressure from locally non-native fish species, notably roach and ruffe is likely to remain at or above the current pressure as there is no suitable method of control for these species in large waterbodies. It is possible that additional locally non-native/non-native fish species may be released into these water bodies. K04 - increased pressure within the catchment for flood risk management and drinking water supply may lead to increased river engineering and flow management. N09 - Warming of the climate is predicated to continue and may ultimately exclude vendace from Bassenthwaite Lake due to the removal of a suitable cool, well oxygenated deep-water refuge area. In addition weather events may continue to become more intense and unpredictable leading to a degradation of spawning habitat. |
| 10.2 Additional information | Following the recording of vendace in Bassenthwaite Lake in 2013 to present and the relative stability of the Derwent Water population, it may reasonably be assumed that if continued work is undertaken to address water quality and sedimentation issues within the catchment, vendace populations in both lakes may remain stable (and possibly increase) over the next 12 year period. However, in the longer term, climate change impacts may remove the required cold water refuge areas in Bassenthwaite Lake rendering the habitat unsuitable for vendace. In addition, there are no effective management techniques to address the impact of non-native and locally non-native species at the present time. It is considered unlikely that new techniques will become available in the near future, therefore, the impact on vendace will continue and may increase. |