

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

2019-2024

Conservation status assessment for the species:

S1102 - Allis shad

(Alosa alosa)

England



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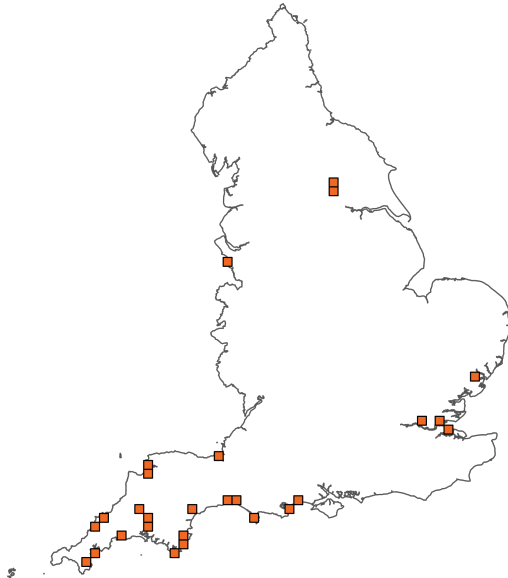
Important note - Please read

- The information in this document represents the England 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 England, 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 species 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 species (section 12 National Site Network coverage for Annex II species).

Further details on the approach to the Habitats Regulations Reporting 2019-2024 are available on the [JNCC website](#).

Assessment Summary: Allis shad

Distribution Map



Range Map

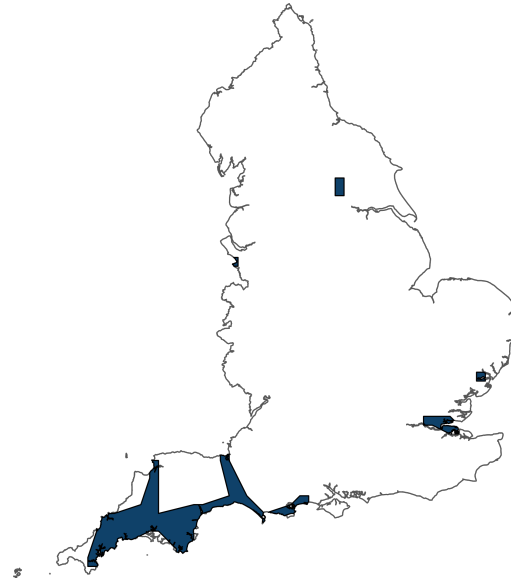


Figure 1: England distribution and range map for S1102 - Allis shad (*Alosa alosa*). Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority. The 10km grid square distribution map is based on available species records within the current reporting period.

Table 1: Table summarising the conservation status for S1102 - Allis shad (*Alosa alosa*). Overall conservation status for species is based on assessments of range, population, habitat for the species, and future prospects.

Overall Conservation Status (see section 11)

Unfavourable-inadequate (U1)

Breakdown of Overall Conservation Status

Range (see section 5)

Unfavourable-inadequate (U1)

Population (see section 6)

Unfavourable-inadequate (U1)

Habitat for the species (see section 7)

Unfavourable-inadequate (U1)

Future prospects (see section 10)

Unfavourable-inadequate (U1)

List of Sections

| | |
|--|----|
| National Level | 5 |
| 1. General information | 5 |
| 2. Maps | 5 |
| 3. Information related to Annex V Species | 5 |
| Biogeographical Level | 7 |
| 4. Biogeographical and marine regions | 7 |
| 5. Range | 7 |
| 6. Population | 9 |
| 7. Habitat for the species | 11 |
| 8. Main pressures | 13 |
| 9. Conservation measures | 14 |
| 10. Future prospects | 15 |
| 11. Conclusions | 16 |
| 12. UK National Site Network (pSCIs, SCIs, SACs) coverage for Annex II species | 17 |
| 13. Complementary information | 18 |
| 14. References | 19 |
| Biogeographical and marine regions | 19 |
| Main pressures | 23 |
| 15. Explanatory Notes | 24 |

National Level

1. General information

| | |
|---|--------------------|
| 1.1 Country | England |
| 1.2 Species code | S1102 |
| 1.3 Species scientific name | <i>Alosa alosa</i> |
| 1.4 Alternative species scientific name | |
| 1.5 Common name | Allis shad |
| Annex(es) | II, V |

2. Maps

| | |
|-----------------------------------|---|
| 2.1 Sensitive species | No |
| 2.2 Year or period | 2000-2024 |
| 2.3 Distribution map | Yes |
| 2.4 Distribution map; Method used | Based mainly on extrapolation from a limited amount of data |

2.5 Additional information

Data contained within the National Biodiversity Network Database has been used to produce distribution maps for allis shad. These data have been collated from both routine and ad-hoc fish surveys. Allis shad distribution is likely to be under-represented in England as they are often not recorded in routine surveys due to their migratory life history. There are uncertainties over the ability to discriminate between allis and twaite shad in the records available for the two species, and the species have the ability to hybridise. Therefore a considerable number of records are reported at genus level only. Range maps are based on the species records for *A. alosa*.

3. Information related to Annex V Species

3.1 Is the species taken in the wild / exploited? No

3.2 What measures have been taken?

| | |
|--|-----|
| a) Regulations regarding access to property | Yes |
| b) Temporary or local prohibition on the taking of specimens in the wild and exploitation | Yes |
| c) Regulation of the periods and/or methods of taking specimens | Yes |
| d) Application of hunting and fishing rules which take account of the conservation of such populations | Yes |
| e) Establishment of a system of licences for taking specimens or of quotas | Yes |
| f) Regulation of the purchase, sale, offering for sale, keeping for sale, or transport for sale of specimens | Yes |
| g) Breeding in captivity of animal species as well as artificial propagation of plant species | Yes |
| Other measures | Yes |

Other measures description

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

a) Unit No unit - not reported

Table 2: Quantity taken from the wild during the reporting period (see 3.3a for units). For species with defined hunting seasons, Season 1 refers to 2018/2019 (autumn 2018 to spring 2019), and Season 6 to 2023/2024. For species without hunting seasons, data are reported by calendar year: Year 1 is 2019, and Year 6 is 2024.

| | Season/ year 1 | Season/ year 2 | Season/ year 3 | Season/ year 4 | Season/ year 5 | Season/ year 6 |
|-----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| b) Minimum | - | - | - | - | - | - |
| c) Maximum | - | - | - | - | - | - |
| d) Unknown | - | - | - | - | - | - |

3.4: Hunting bag or quantity taken in the wild; Method used

Insufficient or no data available

3.5: Additional information

No additional information

Biogeographical Level

4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs ATL

4.2 Sources of information

See section 14 References

5. Range

5.1 Surface area (km²) 7,270.07

5.2 Short-term trend; Period 2013-2024

5.3 Short-term trend; Direction Stable

5.4 Short-term trend; Magnitude

a) Estimated minimum

b) Estimated maximum

c) Pre-defined range

d) Unknown

e) Type of estimate

f) Rate of decrease Decreasing $\leq 1\%$ (one percent or less) per year on average

5.5 Short-term trend; Method used Based mainly on extrapolation from a limited amount of data

5.6 Long-term trend; Period 2000-2024

| | |
|---------------------------------------|--------|
| 5.7 Long-term trend; Direction | Stable |
|---------------------------------------|--------|

**5.8 Long-term trend;
Magnitude**

a) Minimum

b) Maximum

c) Rate of decrease

| | |
|---|---|
| 5.9 Long-term trend; Method used | Based mainly on expert opinion with very limited data |
|---|---|

5.10 Favourable Reference Range (FRR)

a) Area (km²)

| | |
|---------------------------------|--|
| b) Pre-defined increment | Current range is between 2% and 10% smaller than the FRR |
|---------------------------------|--|

| | |
|-------------------|----|
| c) Unknown | No |
|-------------------|----|

| | |
|-----------------------|----------------|
| d) Method used | Expert opinion |
|-----------------------|----------------|

| | |
|----------------------------------|----------|
| e) Quality of information | moderate |
|----------------------------------|----------|

5.11 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

5.12 Additional information

No additional information

6. Population

6.1 Year or period 2000-2024

6.2 Population size (in reporting unit)

a) Unit number of map 1x1 km grid cells

b) Minimum

c) Maximum

d) Best single value 48

6.3 Type of estimate Best estimate

6.4 Quality of extrapolation to reporting unit low

6.5 Additional population size (using population unit other than reporting unit)

a) Unit

b) Minimum

c) Maximum

d) Best single value

e) Type of estimate

6.6 Population size; Method used Based mainly on expert opinion with very limited data

6.7 Short-term trend; Period 2013-2024

6.8 Short-term trend; Direction Uncertain

6.9 Short-term trend; Magnitude

a) Estimated minimum

b) Estimated maximum

c) Pre-defined range

d) Unknown Yes

e) Type of estimate Best estimate

f) Rate of decrease

6.10 Short-term trend; Method used Insufficient or no data available

6.11 Long-term trend; Period 2000-2024

6.12 Long-term trend; Direction Decreasing

6.13 Long-term trend; Magnitude

a) Minimum

b) Maximum

c) Confidence interval

d) Rate of decrease

6.14 Long-term trend; Method used Insufficient or no data available

6.15 Favourable Reference Population (FRP)

ai) Population size

aii) Unit

b) Pre-defined increment Current population is between 5% and 25% smaller than the FRP

c) Unknown No

d) Method used Expert opinion

e) Quality of information

6.16 Change and reason for change in population size

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

6.17 Additional information

The lack of a coordinated monitoring programme which encompasses all lifestages of allis shad makes it impossible to accurately assess whether the population is recruiting efficiently, however, 106 allis shad have had successful scale readings which indicated that fish were found to spawn across a variety of age classes (4-7) with the highest numbers of fish spawning at year 5. Nine fish were thought to have spawned on at least one previous occasion. Of 16 dead allis shad examined, 7 were females and 9 were males. However, no females were found upstream of Gunnislake trap, opposed to 5 dead and 2 migrating males found in the freshwater Tamar. This may indicate that males are more likely to migrate successfully into freshwater at this site. As spawning has been documented and observed in English rivers throughout the study period, it may be broadly assumed that allis shad are recruiting successfully at at least one location within England.

6.18 Age structure, mortality and reproduction deviation Unknown

7. Habitat for the species

7.1 Sufficiency of area and quality of occupied habitat (for long-term survival)

a) Is area of occupied habitat sufficient? Yes

b) Is quality of occupied habitat sufficient? No

c) If No or Unknown, is there a sufficiently large area of unoccupied habitat of suitable quality? No

7.2 Sufficiency of area and quality of occupied habitat; Method used

a) Sufficiency of area of occupied habitat; Method used Based mainly on extrapolation from a limited amount of data

| | |
|---|--|
| b) Sufficiency of quality of occupied habitat; Method used | Complete survey or a statistically robust estimate |
| 7.3 Short-term trend; Period | 2012-2024 |
| 7.4 Short-term trend; Direction | Increasing |
| 7.5 Short-term trend; Method used | Complete survey or a statistically robust estimate |
| 7.6 Long-term trend; Period | 2000-2024 |
| 7.7 Long-term trend; Direction | Increasing |
| 7.8 Long-term trend; Method used | Complete survey or a statistically robust estimate |

7.9 Additional information

Allis shad populations have declined across Europe and are reduced across England when compared with their natural/unimpacted reference condition. The only known spawning location in England is located in the reach below Gunnislake weir on the upper Tamar estuary. Access restrictions (due to physical barriers) to historical river habitat is the primary issue for the species. However, water quality is thought to have been responsible for the loss of shad species from the River Thames, although it is likely that there would be an interaction between polluting inputs to the river and the presence of barriers, such as weirs, which may have compounded the impacts of individual stressors on the species. An example of this would be impoundments behind in-channel structures leading to increased deposition of fine sediment. This reduces the mosaic of habitats which characterise a naturally functioning riverine environment and provide the range of microhabitats utilised by allis shad at different stages of their lifecycle. The extent to which poor water quality has effected shad populations is uncertain, however, excessive fine sediment may smother spawning gravels and nutrient enrichment may stimulate increased algal growth in these areas. Allis shad release their eggs into the water column, unlike salmon which bury their eggs in redds deep within the gravel, therefore, Allis shad eggs may be less susceptible to deoxygenation effects related to gravel clogging than those of salmonid species. It is likely that the effects of water quality and physical habitat degradation are highly variable across the range of allis shad. The current barriers to migration are likely to limit access to some areas of habitat which would be of suitable quality to maintain a viable allis shad population, however, without further improvements in both water quality and habitat quality, there is unlikely to be a

sufficient area of currently unoccupied high quality habitat to maintain the species at FCS.

8. Main pressures

8.1 Characterisation of pressures

Table 3: Pressures affecting the species, 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 |
|---|---|------------|
| PK01: Mixed source pollution to surface and ground waters (limnic and terrestrial) | Ongoing and likely to be in the future | High (H) |
| PG13: Bycatch and incidental killing (due to fishing and hunting activities) | Ongoing | Medium (M) |
| PL01: Abstraction from groundwater, surface water or mixed water (mixed or unknown drivers) | Ongoing and likely to be in the future | Medium (M) |
| PA17: Agricultural activities generating pollution to surface or ground waters (including marine) | Ongoing and likely to be in the future | High (H) |
| PL05: Modification of hydrological flow (mixed or unknown drivers) | Ongoing and likely to be in the future | High (H) |
| PJ14: Other climate related changes in abiotic conditions | Ongoing and likely to be in the future | High (H) |
| PL03: Old barriers or other obsolete infrastructures (mixed or unknown drivers) | Ongoing and likely to be in the future | High (H) |
| PJ03: Changes in precipitation regimes due to climate change | Ongoing and likely to be in the future | High (H) |
| PL06: Physical alteration of water bodies (mixed or unknown drivers) | Ongoing and likely to be in the future | High (H) |
| PD02: Hydropower (dams, weirs, run-off-the-river and respective infrastructure) | Ongoing and likely to be in the future | Medium (M) |
| PG06: Freshwater fish and shellfish harvesting (professional) | In the past but now suspended due to measures | Medium (M) |

| | | |
|--|--|------------|
| PD01: Wind, wave and tidal power (including infrastructure) | Only in future | High (H) |
| PI02: Other invasive alien species (other than species of Union concern) | Ongoing and likely to be in the future | Medium (M) |

8.2 Sources of information

See section 14 References

8.3 Additional information

No 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 National Site Network

9.4 Response to measures

Medium-term results (within the next two reporting periods, 2025–2036)

9.5 List of main conservation measures

Table 4: 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 |
|---|----------|
| MK01: Reduce impact of mixed source pollution | High (H) |
| MA10: Reduce/eliminate point or diffuse source pollution to surface or ground waters (including marine) from agricultural activities | High (H) |
| MF02: Habitat restoration of areas impacted by residential, commercial, industrial and recreational infrastructure, operations and activities | High (H) |

| | |
|--|------------|
| MK03: Restoration of habitats impacted by multi-purpose hydrological changes | High (H) |
| MF09: Adapt the management of water abstraction for public supply and for industrial and commercial use to reduce negative impacts on habitats and species (incl. restoration of habitats) | High (H) |
| MJ01: Implement climate change mitigation measures | High (H) |
| MG02: Management of hunting, recreational fishing, and the recreational or commercial harvesting or collection of plants and fungi (incl. restoration of habitats) | Medium (M) |

9.6 Additional information

No additional information

10. Future prospects

10.1a Future trends of parameters

| | |
|------------------------------------|----------------|
| ai) Range | Overall stable |
| bi) Population | Overall stable |
| ci) Habitat for the species | Overall stable |

10.1b Future prospects of parameters

| | |
|-------------------------------------|---------|
| aii) Range | Good |
| bii) Population | Unknown |
| cii) Habitat for the species | Unknown |

10.2 Additional information

River habitat restoration may be expected to continue, including works specifically targeting allis shad, therefore the species may have increasing access to areas of good quality habitat within its natural range. However, the potential impact from estuarine infrastructure related to power generation is currently unknown as much of the work is currently at the planning stage and the level to which impacts may be mitigated has not been determined. As improvements continue to be made regarding water quality and re-establishment of natural riverine processes in England and plans are developed and implemented to improve fish passage for shad at key sites such as the River Severn and

River Tamar, together with other estuaries and rivers around England, the area of freshwater habitat suitable for shad spawning and juvenile development may be expected to increase. Set in opposition to this generally positive outlook are the unknowns of climate change effects which may lead to more extreme flow variations, the potential for continued diffuse agricultural pollution resulting in inputs of nutrients and fine sediment and the possibility of increases in energy production infrastructure associated with run of river hydropower, tidal barrages, lagoons and nuclear power. It is perhaps this final threat that, if implemented, may present the most serious long-term threat to the continuation of allis shad populations in English coastal, estuarine and freshwater habitats.

11. Conclusions

11.1 Range Unfavourable-inadequate (U1)

11.2 Population Unfavourable-inadequate (U1)

11.3 Habitat for the species Unfavourable-inadequate (U1)

11.4 Future prospects Unfavourable-inadequate (U1)

11.5 Overall assessment of Conservation Status Unfavourable-inadequate (U1)

11.6 Overall trend in Conservation Status Stable

11.7 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.

11.7 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.

11.8 Additional information

No additional information

12. UK National Site Network (pSCIs, SCIs, SACs) coverage for Annex II species

12.1 Population size inside the pSCIs, SCIs and SACs network

| | |
|---|---|
| a) Unit | number of map 1x1 km grid cells |
| b) Minimum | |
| c) Maximum | |
| d) Best single value | 18 |
| 12.2 Type of estimate | Best estimate |
| 12.3 Population size inside the network; Method used | Based mainly on extrapolation from a limited amount of data |
| 12.4 Short-term trend of population size within the network; Direction | Uncertain |
| 12.5 Short-term trend of population size within the network; Method used | Insufficient or no data available |
| 12.6 Short-term trend of habitat for the species inside the pSCIs, SCIs and SACs network; Direction | Increasing |
| 12.7 Short-term trend of habitat for the species inside the pSCIs, SCIs and SACs network; Method used | Complete survey or a statistically robust estimate |

12.8 Additional information

The situation within the SAC network broadly reflects the general situation within higher quality areas of the river resource outside of the network. As improvements continue to be made regarding water quality and re-establishment of natural riverine processes in England and plans are developed and implemented to improve fish passage for allis shad in rivers throughout England, the area of freshwater habitat suitable for shad spawning and juvenile development may be expected to increase. The rate of improvement may be expected to be greater within the SAC network than outside of it.

Set in opposition to this generally positive outlook are the unknowns of climate change effects which may lead to more extreme flow variations and the potential for continued diffuse agricultural pollution resulting in inputs of nutrients and fine sediment. In addition major infrastructure projects are planned within the SAC series, however, they may not be permitted within the SAC site series without suitable mitigations being in place.

13. Complementary information

13.1 Justification of percentage thresholds for trends

No justification information

13.2 Trans-boundary assessment

No trans-boundary assessment information

13.2 Other relevant information

No other relevant information

14. References

Biogeographical and marine regions

4.2 Sources of information

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Main pressures

8.2 Sources of information

No sources of information

15. Explanatory Notes

| Field label | Note |
|----------------------------------|---|
| 2.5: Additional information | <p>Allis shad (<i>Alosa alosa</i>) are clupeid fish and one of two shad species that live in England, the other species being twaite shad (<i>Alosa fallax</i>). The two species have a similar general appearance and biology. Allis shad are anadromous, living in coastal habitats and migrating to freshwater to spawn. Allis shad occur throughout Europe, however, the upper River Tamar estuary in England represents the only currently known spawning location in the UK, although there is growing evidence for other locations within south west rivers. Most allis shad only spawn once, although approximately 5% may spawn again. They spawn between May and July when water temperatures reach 10 – 12 0C, in fast flowing, shallow areas of unconsolidated gravels. Spawning takes place at night with eggs being broadcast into the water and sinking to the river bed. 0+ fish then migrate seaward in the autumn. The marine habitat requirements are poorly understood, however, they are thought to remain in coastal areas at depths between 10-150m. Genetic studies have also indicated high levels of introgressive hybridization between twaite and allis shad in some populations.</p> |
| 7.4: Short-term trend; Direction | <p>Allis shad are widely distributed and have complex habitat requirements as they are anadromous and require migratory passage, with relatively low flow velocities and turbulence. In addition, the habitat required during the marine/estuarine phase of their lifecycle is poorly understood. These factors, combined with sporadic survey effort make a detailed assessment of habitat quality trends impossible at the present time. However, progress has been made with reducing nutrient and organic pollution levels in many rivers across England within the short-term trend period, which may have a beneficial effect on the quality of shad habitat. Water quality improvements in a few rivers and estuaries are also likely to facilitate passage to spawning grounds. There has been a significant change in</p> |

accessibility / passage efficiency within the trend period for the River Severn (Unlocking the Severn Project) and other potential aalis shad sites in England. There have been no new in-channel structures in the recent past and measures to address existing key artificial barriers to shad migration are in the planning phase, therefore, the likely trend may be inferred as increasing. However, physical barriers to migration and physical habitat degradation are still significant stressors for shad populations within England. In addition, the increased focus on run of river hydropower schemes, nuclear new-build and the potential for tidal barrage systems may result in man-made barriers to shad migration being perpetuated for the foreseeable future

7.8: Long-term trend;
Method used

Water quality improvements across a range of estuarine and freshwater sites, combined with an increase in multi-species fish passage solutions and river habitat restoration projects over the trend period have improved access for shad to previously inaccessible areas within their natural range.

8.3: Additional
information

Physical barriers which prevent allis shad reaching their spawning grounds have been a pressure on many populations throughout their range. These barriers may also act synergistically with water quality problems such as increased sediment and nutrient load. Impoundments behind structures may lead to increased deposition of fine sediment on gravels and dissolved oxygen sags due to a lack of turbulent flow. In some areas fish passes have been added to barrier structures, however, these may not be suited to the passage of shad which generally require lower flow velocities.

Allis shad require clean, well oxygenated gravels for spawning and slackwater refuge areas for juveniles. Changes to the hydrological regime may increase deposition rates of fine sediment on gravels and increase the resistance of structures to passage by allis shad. In addition river engineering works may increase spate flows within the catchment which may result in both adult and

juvenile shad being washed out of areas of favourable habitat within the river system. If low flows are maintained over long periods of time, elevated water temperatures, deoxygenation, siltation and bed armouring may become evident. Low flows may hinder the passage of in-channel structures. Conversely very high flows may scour gravel spawning beds and deposited eggs. Increased pressure on water supplies for drinking water and agricultural irrigation may lead to increased abstraction and lower flows within the channel. Increased channel engineering and flow modification for flood risk management may continue to degrade the complex habitat mosaic required for shad to complete their lifecycle.

Diffuse agricultural pollution has increased the input of fine sediment, phosphate and nitrate to rivers leading to eutrophication issues such as increased algal production in spawning areas and smothering of gravels. Urbanization and industrialization have resulted in discharges of both raw and treated sewage, industrial effluents and diffuse urban pollution. These discharges may prove acutely toxic to shad or produce lethal effects due to deoxygenation of the water column. A wide variety of other chemicals, including pesticides and endocrine disrupters, have been released into the aquatic environment. These may result in obvious lethal effects, however, a wide variety of sub-lethal effects, such as reduced fertility may affect the overall fitness of shad. Due to the diverse array of sources and impacts, the severity and contribution of each individual stressor on the population as a whole is unknown. While great improvements have been made in water quality across England, particularly relating to point source inputs of gross organic pollution, diffuse rural sources of nutrients and sediment emanating from agricultural land use are likely to continue to be a stress on the aquatic environment.

Invasive non-native fish species such as zander and wels catfish have the potential to increase predation pressure on shad. Zander are now well established within the R. Severn

system and may have a competitive advantage over pike within modified and turbid river reaches. INNS species, continue to increase their range and populations in many English river and lake catchments. There are no effective control measures for many INNS and their range is expected to continue to expand in river and lake networks for the foreseeable future.

English populations of shad may be captured as bycatch during commercial fishing on their marine feeding grounds, in coastal areas during spawning migration, and in their up-river migrations. Fishing pressure includes both commercial net and recreational rod fisheries. However, shad cannot be legally targeted and are therefore only impacted as bycatch. Shad are not considered to be a particularly robust species, therefore, stress related to capture and handling may either kill them or render them less likely to spawn successfully.

Increases in temperature may produce synergistic effects with other environmental stresses such as increased toxicity of pollutants and more rapid deoxygenation. Low flows may reduce the ability of shad to pass barriers and high spate flows may lead to adults, juveniles and eggs being washed out of areas of suitable habitat. The potential for climate change to impact on future allis shad populations is poorly understood. Future climate change scenarios indicate a shift to a pattern of increasingly extreme events such as more prolonged low flows and higher, more energetic spate flows. This is likely to add further stress to shad populations by making migratory barriers harder to pass and the ability to utilise high quality in-river habitats more difficult. Conversely, warmer waters may favour shad populations and allow a northerly range expansion.

Hydro-electric schemes may form major obstructions as allis shad populations are denied passage over spillways, through turbines and impoundments. Impounding

structures may disrupt sediment movement down river, deepen and stabilise water levels, reduce hydraulic scour and increase siltation behind the structure. They may restrict the free movement of shad up and down the river. Designs may require the abstraction of water out of the channel through an off-line turbine, leaving a depleted reach. Other designs divert water within the channel through the turbine which may create current velocities that attract migrating shad. Bank reinforcements affect riparian habitats, while turbine arrangements without suitable screening can entrain shad, generating injuries and mortalities. Turbine offtakes may attract migratory fish resulting in delays to migration and increased predation.

The future development of tidal barrages and infrastructure associated with nuclear new build has the potential to represent a threat to future allis shad populations, unless suitably mitigated.

9.5: List of main conservation measures

Work has continued to reduce point and diffuse discharges to both the national site network and wider river network. Major infrastructure projects to improve sewerage, such as removal or upgrade of combined sewer overflows and improved phosphorus removal from treated sewage effluent has been funded via the water industry's programme of strategic improvements such as AMP and PR rounds. However, further investigations are needed into the application of new best available technology for phosphorus removal and the increased availability of mains sewerage for rural populations. The England Catchment Sensitive Farming Initiative is continuing to promote a range of best agricultural practices to reduce pollution loads to priority aquatic sites. A combination of Habitats Site,

SSSI and Water Framework objectives continues to drive improvements in water quality with diffuse water pollution prevention plans developed for many sites. New Countryside Stewardship payments are being developed to incentivise good agricultural practices.

A major programme of physical restoration has been implemented on the designated river network, involving the development of a long-term strategic plan for each river and its programmed implementation. These plans address key issues such as dams and weirs, floodplain reconnection, channel modifications, lack of riparian habitat, lack of riparian trees and lack of woody debris in the channel. Outside of the designated site network, river restoration schemes have focused on addressing channel modifications and the many weirs and dams on the river network in England. A further driver for river restoration has been the increased prominence of natural flood management. If properly implemented, NFM has the potential to enable widespread improvements in many previously degraded riverine habitats.

The rationale behind restoring river habitat in England is the restoration of natural riverine processes, which creates characteristic habitats and provides for individual species to an extent dependent on the natural character of the river. This rationale is also the main adaptation response for combatting climate change. Some aspects of restoring natural function are also seen as climate change mitigation measures, such as the re-establishment of natural tree cover and riparian vegetation which is being implemented as part of many river restoration schemes and agri-environment schemes. These interventions may result in moderated extremes of flow, reductions in water temperature and increased water quality.

Improvements have been achieved with limiting abstraction volumes and improving flow regimes by altering compensation flows from water company assets via AMP

and PR rounds. However, further improvements are required to naturalise flows at many sites. As part of the ongoing abstraction reform process, abstraction licences will become environmental permits and a greater emphasis will be given to environmental considerations. Since 2022 many previously exempt abstractions require a permit.

Detailed assessments are being made of potential risks to shad due to abstractions from existing and new water supply infrastructure. Where problems are highlighted mitigation measures such as improved screening or modified operating procedures are being implemented.

Fisheries in all rivers are subject to exploitation controls. Allis shad are listed in Annexes II and V of the Habitats Directive. Annex II requires that Special Areas of Conservation are designated for allis shad, with the appropriate management of these and other sites where they are known to occur so that the favourable conservation status of the species can be secured. Additional fishery specific issues are addressed by the 'Salmon and freshwater fisheries act 1975' and the Marine and Coastal Access Act. Under these legislations the Environment Agency has powers to licence fisheries that may interact with shad. Fishery byelaws regulate when, where and how fishing can take place. The licencing approach limits exploitation pressure on shad populations.