



Twaite and Allis Shad

Alosa fallax and *Alosa alosa*

Species Action Plan

1. Introduction

Twaite and Allis shad were both listed as priority UK BAP species and subsequently included in Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.

2. Current Status

2.1 Ecology and habitat requirements

Twaite shad (*Alosa fallax*) and Allis shad (*A. alosa*) are anadromous, meaning that they reproduce in freshwater but grow in the sea, and are members of the herring family. Adult Twaite shad from the Severn estuary grow to around 40cm in length whilst Allis shad can be larger, up to 50cm. Both species are also characterised by a membrane partially covering each eye and large, circular, weakly attached scales that appear serrated under the belly. Although little is known about the preferred habitat of shad whilst at sea, both are recorded in coastal waters and estuaries around the UK throughout the year.

Prior to moving into freshwater to begin breeding they congregate in large schools in or near estuaries. They enter large rivers to spawn, travelling up to 150 km upstream in the UK (much further in some larger European rivers), and there is some evidence to suggest they return to their natal river by detecting the 'odour'. The Severn is one of only four rivers in the UK known to support spawning Twaite shad. Spawning is believed to be limited to as far as Powick Weir on the River Teme and Diglis Weir on the River Severn. The Allis shad is sometimes caught in the Severn but the only persistent spawning population is currently found in the River Tamar in SW England. Historically it was known to breed in large numbers in the Severn and there is a possibility that it shared spawning grounds with the Twaite shad. Genetic analysis has shown a high level of hybridisation between the two species in the Severn.

At maturity, adult Twaite shad stop feeding and gather in the estuaries of suitable rivers in early summer (April and May), moving upstream to spawn from late-April to mid-July. The males usually move upstream first, followed by the females. Spawning is a noisy affair and takes place near the surface in flowing water above appropriate areas of clean stones and gravel, amongst which the eggs sink. The eggs, which measure 1.5–3.5 mm in diameter, take about four to six days to hatch. The young fish then drop quickly downstream in the current to the quieter waters of the upper estuary where they start to feed and grow. Relative fecundity has been reported to range from 42,540 to 302,358 eggs per kg: 139,479 in the River Severn (Aprahamian, unpublished).

Growth in the first year is fairly rapid; juveniles can reach 50 mm in six months and 100–150 mm after one year (Aprahamian, 1988). Thereafter, growth is steady and most fish reach 200–250 mm after two years and 250–300 mm after three years. The females do not start to mature until they are about five years old. The males start to mature after three years and therefore spawn with older and larger females at first. The young fish feed mainly on invertebrates,

especially estuarine zooplankton, but as they grow they take larger crustaceans of various types (for example shrimps and mysids) and also small fish (Aprahamian, 1989; Assis *et al.* 1992; Taverny, 1991). Adults feed to an appreciable extent on other fish, especially the young of other members of the Clupeidae, such as sprat (*Sprattus sprattus*) and herring (*Clupea harengus*) (Maitland & Lyle 1995). Unlike Allis shad, which normally spawn only once, Twaite shad may spawn several times in their lives (Aprahamian, 1982).

Although spawning sites are not necessarily very deep, they are always in places where the river is still tens of metres wide. In Britain, the narrowest site in which spawning has been recorded (on the River Teme) is around 20m wide (Aprahamian pers. com.) but spawning sites are typically 30–60m wide (Caswell & Aprahamian, 2001).

2.2 Population and distribution

The Twaite shad occurs along most of the west coast of Europe, from southern Norway to the eastern Mediterranean Sea, and in the lower reaches of large accessible rivers along these coasts. Spawning populations have been recorded from Estonia, Germany (especially the Elbe), Britain, Ireland, western France, Spain, Portugal, Morocco, Belgium and the Netherlands (ssp. *Alosa fallax fallax*), southern France and Italy (ssp. *Alosa fallax rhodanensis*) and much of the eastern Mediterranean.

In Britain, spawning populations of Twaite shad are still found in the rivers Severn, Wye, Usk and Tywi and appear to be reasonably stable, although considerably lower than historic levels recorded prior to the construction of the first navigation weirs in the 1840s (Aprahamian *et al.* 1998). Remnant populations may still be present in other rivers (Maitland, 1993, 1995), especially where spawning takes place in estuaries.

2.3 Legislation

Twaite and Allis shad are listed in Appendix II of the Bern Convention and Annex IVa (Twaite shad) and Annexes II and V (Allis shad) of the EC Habitats Directive. Twaite shad is protected under schedule 2 of the Conservation (Natural Habitats etc) Regulations 1994. Both species are protected under schedules 5 and 9 of the Wildlife and Countryside Act 1981 and both are listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.

The Salmon and Freshwater Fisheries Act 1975 includes shad in Section 1, prohibiting the use of certain methods for taking fish, and Section 2, which protects spawning fish, their spawn and juveniles. Shad are further protected by River Severn catchment regional angling bylaws, which prohibit the taking of fish.

The EU Water Framework Directive (WFD) is designed to protect and improve the environmental condition of all waters, including rivers, lakes, groundwater, estuaries and coastal waters to one nautical mile. The Directive is implemented through river basin planning, which involves setting environmental objectives for all groundwater and surface water bodies (including estuaries and coastal waters) within a river basin district, and then devising a programme of measures to meet those objectives. Worcestershire falls within the Severn River Basin District. While the UK is set to leave the EU in spring 2019, it is currently proposed that

the WFD directive is transposed into new UK legislation. This means a cohesive approach to catchment management is likely to continue.

2.4 Summary of important sites

After returning from the sea, the critical habitat requirements for shad are:

- March–June: a clear migration route to the spawning grounds, with suitable river flows and no barriers.
- Late May–late June: suitable resting pools and clean gravels at the spawning areas.
- Mid June–late September: slow-flowing nursery areas for juveniles after hatching, in fresh water above the estuary (Menneson-Boisneau *et al.* 1986; Belaud *et al.* 1991; Prouzet *et al.* 1994).

The most important Twaite shad spawning sites are on the River Teme from Powick Weir downstream to its confluence with the River Severn. The gravel substrate below Diglis Weir on the River Severn is currently the upstream limit for this species. Spawning has also been recorded as part of the Unlocking the Severn Project at several locations in 2018 between Maisemore Weir, Gloucester, and Diglis Weir, Worcester, particularly around Haw Bridge below Tewkesbury. It is likely that currently few if any Allis shad successfully spawn in the Severn as this species favours longer migrations into fresh water and navigation weirs currently restrict this.

3. Current factors affecting the species

- Shad migrate in shoals and successful migration over obstructions is dependent on exacting conditions being met. Shad will only migrate over an obstruction if laminar flows are present and there is sufficient depth of water. This means that unless a weir is flooded out by tide only fish pass designs that can present a non-turbulent 'wall' of water for shad to move through at a range of water heights are effective, particularly deep vertical slot or rock ramp passes. These types of fish pass are generally expensive to construct. Existing tidally influenced weirs (e.g. Maisemore, Llanthony and Upper Lode) must not be modified at the risk of making this tidal transport more difficult.
- Shad are more sensitive than other estuarine species to water quality, with research suggesting a minimum requirement of 'Good' Water Framework Directive classification in natal rivers. In low flow summer conditions water quality may deteriorate. More research is required into shad tolerance to nitrate / nitrite and total phosphorus levels, which are relatively higher on the Severn than in some continental rivers that hold good shad populations (such as the Loire & Garonne). The impact of dredging needs to be continually assessed in relation to timing of works and localised water quality issues.
- Shad have been shown to be sensitive to acoustic noise. High frequency noise (70 – 300kHz) can prove a complete barrier to migration, with shad adopting a flee response. Acoustic noise at low frequency (below 2kHz), often associated with in-river construction (e.g. piling), can cause avoidance but shad are not believed to be any more sensitive than many

other fish species. Acoustic noise sources need to be assessed at the planning and consent stage and their potential impacts mitigated for, particularly during the key upstream migration phase.

- Physical modification of the river has removed important habitat needed by shad. Navigation considerations have removed the 'pool/riffle' sections from the accessible river, while farming practices have removed much of the valuable riparian habitat needed by juvenile shad on their drift downstream. Canalisation caused by the Severn Navigation and historic modifications for Flood Risk Management purposes also removes many of the slack water areas important for providing food for juvenile shad. Abstraction points should provide the necessary screening to prevent the entrainment of juveniles on their downstream migration to the estuary.

4. Current Action

4.1 Local protection

The River Teme is a Site of Special Scientific Interest (SSSI) over its whole length, with Twaite shad listed in the citation, and the designation includes the important spawning area downstream of Powick Weir.

The Twaite shad is listed within the Severn Estuary Special Area of Conservation (SAC) designation.

4.2 Site management and programmes of action

Funding of £22 million was secured in 2016 for the Unlocking the Severn Project, a partnership between the Canal & River Trust, Environment Agency, Severn Rivers Trust and Natural England. The project will re-open the Severn to fish migration and reconnect local communities with the lost natural, cultural and industrial heritage of the river. The project will benefit the Twaite and Allis shad by substantially increasing access to 253 kilometres of historic spawning grounds, as well as other critically declining species such as salmon (*Salmo salar*) and the European eel (*Anguilla anguilla*). Several major barriers on the River Severn and River Teme in Worcestershire will have fish passes added that are specifically designed for shad, allowing all fish free movement across these barriers. On the Severn work will take place at Diglis, Holt, Bevere and Lincomb weirs and at Powick and Knightwick weirs on the River Teme. Works are due to be completed by 2022.

4.3 Survey, research and monitoring

Extensive monitoring has begun as part of the Unlocking the Severn Project. Baseline data was collected in 2013 on ecological parameters and habitat potential. In 2017 and 2018 fixed fish counting methods have been used by the Environment Agency at Upper Lode Weir, Tewkesbury, to count migrating shad and estimate the run size with the aim of repeating the count in subsequent years.

Bournemouth University and Hull International Fisheries Institute began research and a PhD in 2017 into shad movements in the Severn, spawning extents and DNA analysis of the shad species.

5. Associated Plans

Rivers and Streams.

6. Conservation Aim

The historic spawning range of the Twaite shad on the River Teme and the River Severn has been restored by creating passage for the fish around key major barriers to their migration, leading to an increased run size and ultimately the favourable status of shad in the Severn Estuary SAC being achieved.

7. Conservation Objectives

- Prepare written guidelines and deliver educational events for landowners, land managers, conservation staff and local authorities on the ecology, distribution and known requirements of shad and how to incorporate the needs of shad into river management works
- Deliver publicity and events to engage communities and increase public awareness and understanding of the River Severn and the biology, ecology and distribution of shad
- Remove all major barriers to shad along the Severn in Worcestershire by creation of fish passage solutions
- Highlight the migration of fish species at navigation weirs as a significant concern during consultations on the future of WFD legislation
- Undertake further research into behavioural avoidance of acoustic noise sources by shad
- Continue assessment of the impact of entrainment mortality on juvenile shad populations at intake screens
- Carry out active monitoring of the distribution and status of adult and juvenile shad on the River Severn
- Encourage anglers to submit catch return information to the Environment Agency when shad are accidentally caught

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