Cyfoeth Naturiol Cymru
Natural Resources Wales

NRW Response to the Consultation on Revisions to Schedule 9 of the Wildlife & Countryside Act.

McCabe M, Ellis M, Hatton-Ellis MA, Hatton-Ellis TW, Howe EA, Thorpe D, Tucker C, Wray B

NRW Evidence Report Number 86

About Natural Resources Wales

Natural Resources Wales is the organisation responsible for the work carried out by the three former organisations, the Countryside Council for Wales, Environment Agency Wales and Forestry Commission Wales. It is also responsible for some functions previously undertaken by Welsh Government.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, used and enhanced, now and in the future.

We work for the communities of Wales to protect people and their homes as much as possible from environmental incidents like flooding and pollution. We provide opportunities for people to learn, use and benefit from Wales' natural resources.

We work to support Wales' economy by enabling the sustainable use of natural resources to support jobs and enterprise. We help businesses and developers to understand and consider environmental limits when they make important decisions.

We work to maintain and improve the quality of the environment for everyone and we work towards making the environment and our natural resources more resilient to climate change and other pressures.

Evidence at Natural Resources Wales

Natural Resources Wales is an evidence based organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

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2. Executive Summary

This report is a response from Natural Resources Wales to the consultation from Defra and Welsh Government, co-ordinated by JNCC, to revise the species listed on Schedule 9 of the Wildlife and Countryside Act 1981. Under section 14 of the Act it is an offence to release animals or plants listed in Schedule 9 into the wild. Schedule 9 lists species which are non-native, or native species of conservation concern. This review of Schedule 9 relates only to non-native species, both additions to the list and removals from it were requested.

To facilitate the compilation of the response it was divided into three broad groupings, freshwater, marine and terrestrial, with relevant technical specialists contributing in their respective areas of expertise. Species were recommended for addition to the Schedule 9 list where they were considered to either already having a detrimental impact on ecosystems, or have the potential to become established and to do so.

Where species were chosen for addition, and where available, reference was made to the species risk assessments produced by the GB Non-Native Species Secretariat as these provide a rigorous examination of the pathways of introduction and impact of the species in question. A number of species have been recommended for removal from the list, this is mainly due to no evidence being found of establishment in the wild. Removal was therefore recommended to ensure the list remains relevant to management of non-native invasive species.

The intention of Schedule 9 as it relates to invasive non-native species (INNS) is the prevention of deliberate or reckless release into the wild of species which may have a damaging impact on native flora and fauna. Reckless in these circumstances is interpreted as when users have been informed of the risk of release but have failed to take appropriate measures to prevent it. Those species recommended for addition by this report are those for whom deliberate or reckless

release is considered by the authors to be a primary pathway of introduction.

A list of species recommended for addition to, removal from Schedule 9 has been compiled and a summary of this listed in section 9 of the report. Some species have been recommended for retention where it was felt appropriate to make a case for retention should other consultees recommend removal. In total, twelve species have been recommended for addition (eight freshwater, two marine and two terrestrial), nineteen recommended for removal (eight freshwater, nine marine and two terrestrial) and four for retention (two freshwater, two marine). Many other species were considered but discounted as the pathway of introduction was not considered to be mainly deliberate or reckless.

Some comments on the general effectiveness of the Schedule 9 list in context of forthcoming EU legislation have been made.

3. Introduction

Defra and the Welsh Government have asked Natural England and Natural Resources Wales, to work jointly through the JNCC to review Schedule 9 of the Wildlife and Countryside Act. To do this these statutory agencies have formed a working group with representatives of the environmental NGOs and of the horticulture and pet trade bodies. Consultation is part of this process, through which JNCC will make recommendations to the Secretary of State for the Environment, Food and Rural Affairs and to the Minister for the Environment in the Welsh Government for changes to the schedule.

In March JNCC indicated that the consultation would start after the general election in May 2015. The consultation has now started and will continue until **Sunday 2 August 2015**. The Information Pack can be found on the JNCC web page http://jncc.defra.gov.uk/page-7013 . Please note that this is an evidence-based process. A proforma is included in the Information Pack and all evidence in support of proposals must be recorded on the proforma. This consultation response needs to be sent to ant.maddock@jncc.gov.uk by 2 August 2015. Decisions will be based on the evidence provided in the proformae.

This report details NRW's response to the consultation and includes those species that NRW would want to see either added, removed or retained from the list (section 6).

4. General Comments and Recommendations for the Schedule

This report has followed the format required to respond to the consultation by making recommendations for the addition or removal of species from the Schedule 9 list of the Wildlife and Countryside Act 1981. A summary of these is listed in section 9 of this report ordered into freshwater, marine and terrestrial sub-sections.

The review does however offer an opportunity for some general comments on the purpose and effectiveness of the Schedule 9 list as a mechanism for control of INNS. This section of the Act has resulted in very few prosecutions related to release of INNS due to the imprecise wording and consequent difficulty of proving responsibility. Awareness of whether a species is on the list appears low and consequently the potential for responsible vendors to avoid selling listed species limited.

Currently the list contains a number of species for which deliberate introduction is a very minor pathway of establishment, this particularly relates to terrestrial plant species such as rhododendron. In general there is a lack of clarity over the purpose of the Schedule 9 list, this is further complicated by the inclusion of rare, native species.

There is also the commonly encountered situation where a surveyor in the course of their work may take a sample of a species in situ for identification, replacing that sample is technically an offence under the current legislation.

The forthcoming EU INNS Regulation will no doubt strengthen legislation to INNS control. Pending its introduction and once in place for a period of time to assess how it will be implemented in the UK, there will presumably be a point at which legislation related to INNS under the Wildlife and Countryside Act 1981 will need to be reviewed.

5. Principles Used in Responding

The recommendations for addition or removal form the Schedule 9 list have been restricted to species where deliberate or reckless introduction is a primary pathway for the species becoming established. Reckless in this case is considered to be cases when users have been informed of the risk but consequently fail to take appropriate measures to prevent release.

Additions to the list have been restricted to species likely to have a significant impact on natural ecosystems.

Those species included in this report have been listed to coincide with our existing evidence base.

Species information is based on the latest evidence available, with the GB Non-Native Species Secretariat a primary source of information.

Responses have been linked to existing INNS policies e.g. the GB Strategy.

We are assuming that any species included on the IAS European List will also be added to Schedule 9.

Forthcoming changes to the the Freshwater Fishery Legislation could possibly result in fish species not being required on the Schedule 9 list as they will be adequately covered in this revised legislation. Until this becomes clear as the legislation is passed, fish species have been included.

6. Specific Recommendations: Freshwater Species

Name of proposer	Organisation	Contact details
Tristan Hatton-Ellis	**NRW**	**Tristan.hatton-ellis@cyfoethnaturiolcymru.gov.uk / 03000 654 866**

6.1. Animals

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Animal	**Animalia: Chordata: Actinopterygii: Perciformes: Centrarchidae**	**Fish**	*Ambloplites rupestris* (Rafinesque 1817)	**Rock bass**	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Hubble, 2011a) on which much of the information here is based.

The only known population in the UK, to a pond in Oxfordshire, was the result of an introduction prior to 1950: a possible reintroduction may have been attempted in the 1970s. No other introductions are known, and no spread is known beyond the original introduction site.

There is therefore no evidence of spread or further introductions over a period of more than 50 years.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Unknown in GB, especially given the limited distribution and difficulty of confirming current status. Known to predate smaller fish and invertebrates including insects and crustaceans. Research suggests a potential impact on crustaceans, therefore if this species were more widely established it has the potential to have an adverse impact on native species. There is little evidence of harmful impacts elsewhere.

No health, social or economic impacts are documented.

A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a low score of 13.0 (scores for all non-native fish in Britain ranged between 10.0 and 37.3).

1.3 Known native global range of the animal.

Native to North America, St. Lawrence River-Great Lakes, Hudson Bay (Red River), and Mississippi River basins from Quebec to Saskatchewan in Canada, and south to northern Georgia, northern Alabama and Missouri (native only to Meramec River) in the USA.

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Possibly extinct in GB. In 1972 known only from Linkside Lake, Oxford (grid SP 50). Attempts to confirm species status were unsuccessful due to consent problems (>15 landowners). A lakeside resident stated that the lake is difficult to access for anglers and that large pike are said to be present. Possible further attempt at introduction in 1990s (unconfirmed). Introduced to Mexico, France and the Czech Republic (the latter did not establish).

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

Probably extinct in Britain (Copp et al. 2007). At worst, no evidence of spread over a period of c. 80 years.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Only ever known from a single pond / shallow lake in Oxfordshire.

Recommendation: There is no evidence of either ecological impacts or spread of this species either from its original site or from subsequent introductions. Therefore, it is recommended that rock bass is removed from Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Animal	**Animalia: Chordata: Actinopterygii: Perciformes: Centrarchidae**	**Fish**	*Micropterus salmoides*	**Large-mouth black bass**	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

No GB Risk Assessment exists for this species. It is however listed on the factsheet, on which much of the information here is based.

Largemouth black bass is valued within and outside its range for sport fishing (ISSG 2006), and introductions for fisheries purposes are the most likely introduction pathway. In common with other fishery species, this pathway is already regulated via the Prohibition of Keeping or Release of Live Fish (Specified Species) (Wales) Order 2015, and the Importation of Live Fish Act 1980), import and introductions of fish are already controlled.

Accidental introduction is unlikely as this species does not resemble any native or non-native freshwater fish species commonly traded.

Although this is a high risk species (see 1.2 and 1.3), it is now considered extirpated from the wild in Britain and thus no longer qualifies for inclusion on Schedule 9. As this remains a high risk species, the policy implications of this should be considered.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Widely introduced outside its native range including Europe, Asia and tropical areas for fisheries purposes where it is now considered invasive. Globally this is considered to be one of the 100 most invasive species, but British populations did not thrive, most likely due to water temperatures being too cool for regular recruitment. Climate change is likely to increase the susceptibility to invasion in future.

The major impacts of this species are through competition with native predators such as pike, and predation of native fish species which may result in their decline or extinction (ISSG 2006; Hubble 2011b). Adults feed on fishes, crayfish and frogs; young feed on crustaceans, insects and small fishes (Hickley *et al*. 1994). Possible

impacts through competition for food and spawning habitat. *M. salmoides* is known to reduce the abundance of native fish species in at least some locations (e.g. Gratwick & Marshall 2001).

Largemouth Bass Virus (LMBV) was first identified in Florida in 1991 and affects the swim bladder, causing death. LMBV can infect other species (in the US, these include guppies, smallmouth bass, spotted bass, Suwanee bass, bluegill, redbreasted sunfish, white crappie and black crappie) but does not generally cause death. It is unknown why LMBV kills largemouth bass and not other fish, but it is believed that stress (e.g. hot weather, poor water quality, pollution, over-crowding, handling) triggers the disease stage of the virus. Besides fish, LMBV has been found in other cold-blooded animals i.e. amphibians and reptiles, but has never been detected in warm-blooded animals (AIS 2005). It is unknown whether LMBV could be spread to Britain and if so, whether it would infect native species.

M. salmoides can be infected with a number of parasites e.g. it commonly carries the bass tapeworm *Proteocephalus ambloplitis* (e.g. Eure 1976). If reintroduced, it may potentially introduce non-native parasites.

A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a low score of 15.5 (scores for all non-native fish in Britain ranged between 10.0 and 37.3).

1.3 Known native global range of the animal.

North America: St. Lawrence and Great Lakes, Hudson Bay (Red River), and Mississippi River basins from southern Quebec to Minnesota and south to the Gulf; Atlantic Slope drainages from North Carolina to Florida; Gulf Slope drainages from southern Florida into northern Mexico (Hubble 2011b).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Largemouth black bass is considered extirpated in Britain (Davies et al. 2004). NBN contains 14 records for this species, most of which are from a single location near Wareham, and all of which are from 1980 or earlier.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

Largemouth black bass Is considered extirpated in Britain (Davies et al. 2004; Copp et al. 2007).

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Formerly occupied slow-flowing rivers and shallow lakes.

Recommendation: This species has almost certainly been extirpated from the UK. Therefore, it is recommended that largemouth black bass is removed from Schedule 9. It should be noted that this is a relatively high risk species, especially with climate change, and if populations are discovered in future it should be reinstated.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Animal	**Animalia: Chordata: Actinopterygii: Cypriniformes: Cyprinidae**	**Fish**	*Rhodeus sericeus* (Pallas, 1776)	**Bitterling**	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Hubble, 2011c) on which much of the information here is based.

This species is widespread within the aquarium trade. Introductions to ponds and discards from aquaria are therefore likely. There is some uncertainty of the taxonomy of this species and records may also appear under the name *R. amarus*. Note that it is likely that specimens in the aquarium trade may originate from more than one source. It is not known whether hybridisation is possible.

Accidental introductions are rather unlikely due to the specialised life cycle and distinctive appearance of this species.

There are several disparate populations around Britain which are likely to have resulted from deliberate introductions. Other unsuccessful introductions are documented (Davies et al. 2004). There is therefore good evidence that deliberate introductions are a relevant pathway for this species. However, spread has been slow since the original introduction, and there is little, if any, evidence of environmental impact.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

No risk assessment is available, and its environmental impact is largely unknown. The species' parasite assemblage has been described by Dávidová *et al* (2008) but it is unknown whether *R. amarus* facilitates the spread of non-native pararsites. The development of eggs and larvae of bitterlings (including *R. sericeus*) in the gill cavities of Unionid mussels is known to reduce mussels' ventilation rate (Mills *et al* 2005), but it is unknown whether this has a significant ecological impact. They may also predate fish eggs.

Davies et al. (2004) state that it could be 'locally abundant, but not believed to pose a risk to native flora and fauna'. A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a low score of 12.5 (scores for all non-native fish in Britain ranged between 10.0 and 37.3).

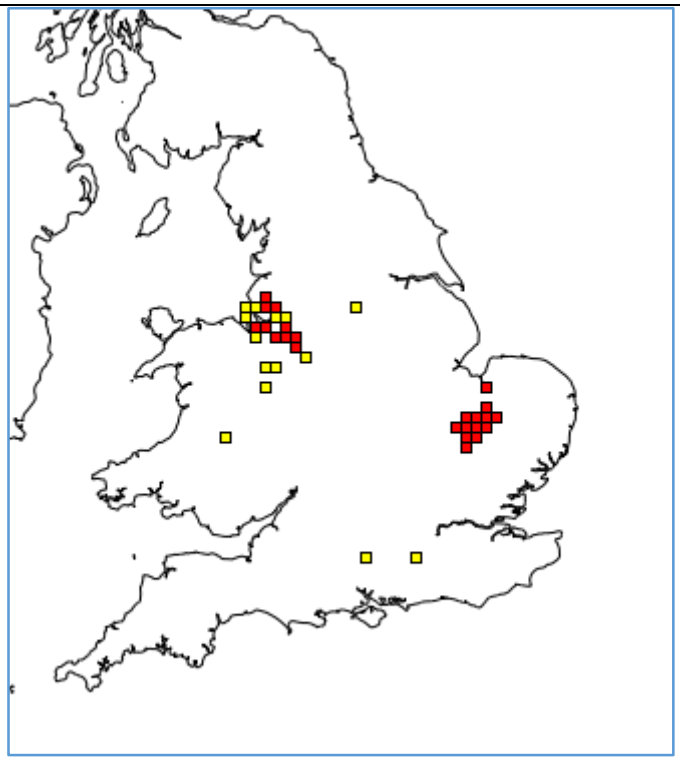
There are no documented economic, health or social impacts.

1.3 Known native global range of the animal.

Found from western Europe north of the Pyrenees (not native to GB) and Alps to the Caspian Sea basin; in the basins of North, southern Baltic, Black, western and southern Caspian and Aegean Seas (from Maritza to Struma drainages). In the Mediterranean basin, only in northern Rhône (France) and Drin drainages (Albania, Montenegro, Macedonia).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

NBN Gateway shows a scattered distribution in England and Wales with foci in the Cheshire Plain and Cambridgeshire. All records are south of a line between the Humber and the Ribble. It is likely that this species is more widespread near to major centres of population, as freshwater fish in general are under-recorded and this species does not occur in habitats likely to be sampled by fisheries staff. It is thought to have been present since the 1920s (Davies et al. 2004).



Distribution of *Rhodeus sericeus* in Britain. Yellow = pre 1990 records; red = post 1990 records. There are no Scottish records.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

Spread has been very slow, probably due to rather specialist habitat requirements including the presence of unionid mussels, which are required for the reproduction of this species.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Slow-flowing rivers, shallow lakes and ponds so long as unionid mussels are present.

Recommendation: This species is generally considered to have a low or no impact on native biodiversity and ecosystem function. Despite being long-established in Britain, spread has been slow and it is unlikely ever to become invasive due to relatively specialist requirements. Therefore, it should be removed from Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Animal	**Animalia: Chordata: Actinopterygii: Perciformes: Centrarchidae**	**Fish**	***Lepomis gibbosus* (L. 1758)**	Pumpkin-seed Sunfish, Pond-perch	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

No GB Risk Assessment exists for this species, though a risk assessment is in production. Information here is mainly based on the factsheet, (Hubble, 2011d).

Pumpkinseed is fairly widespread within the aquarium trade and is sometimes used for research. Introductions to ponds and discards from aquaria are therefore likely.

Accidental introductions are rather unlikely due to the distinctive appearance of this species. An accidental introduction has however been documented in Essex which is thought to have occurred when pond plants were introduced to an angling lake, presumably with eggs attached (G. Copp, pers comm).

There are scattered populations around Britain which are likely to have resulted from deliberate releases or introductions. Other unsuccessful introductions are documented (Davies et al. 2004). There is therefore good evidence that deliberate introductions are a relevant pathway for this species and some evidence for accidental transfer.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

No risk assessment is available. Feeds on small fish and other vertebrates, fish eggs and a wide variety of invertebrates (van Kleef *et al*. 2008). May therefore impact negatively on native species directly through predation, or indirectly through competition for food and spawning habitat, though its effect in GB is currently poorly understood. Especially aggressive at spawning time (Hubble 2011d). Due to habitat overlap, also has the potential to threaten amphibians such as great crested newt.

In Mediterranean reservoirs and a Danish lake, *L. gibbosus* has been observed to reduce the abundance of larger forms of zooplankton, which may lead to an

increase of eutrophication effects (Brabrand & Saltveit 1989 in Hubble 2011d). It should be noted that this effect is similar to that of many native coarse fish.

L. gibbosus harbours non-native parasites, including heavy infection with non-native monogenean parasites in Norway (Sterud & Jørgensen 2006 in Hubble 2011d).

There are no documented economic, health or social impacts (Hubble 2011d).

The Water Framework Directive Technical Advisory Group (UKTAG) considers this a low impact species (WFD-UKTAG, 2015). A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a moderate-high score of 27.5 (scores for all non-native fish in Britain ranged between 10.0 and 37.3).

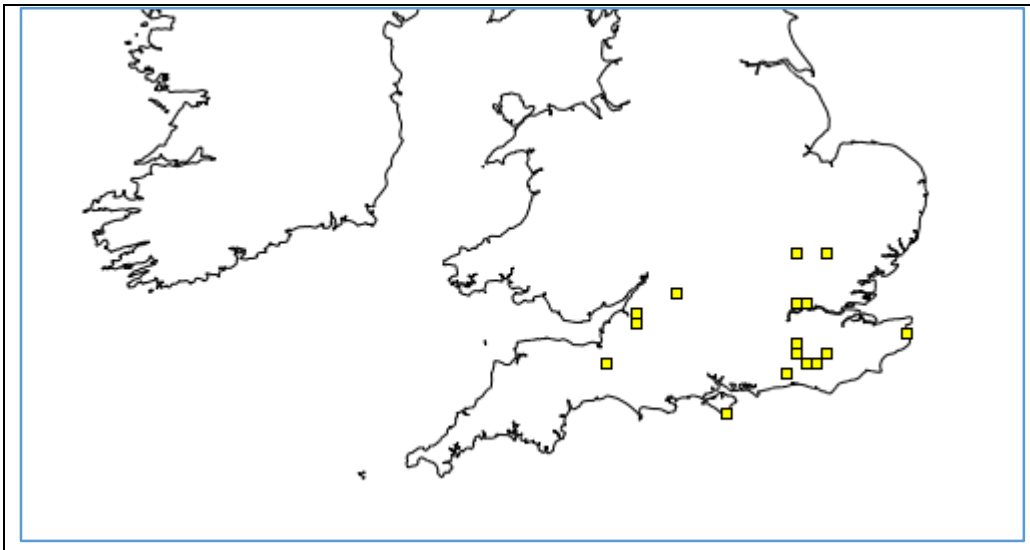
1.3 Known native global range of the animal.

Native to the warm temperature regions of eastern North America from New Brunswick (Canada) to the Florida peninsula (USA) (Hubble 2011d).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

NBN Gateway shows a scattered distribution in southern England up to about as far north as Oxford. It is probably absent from Scotland: 25 marine records from western Scotland are certainly erroneous and are possibly due to confusion with sunfish (*Mola mola*), and the remaining record, from near Dundee, is from 1918.

Pumpkinseed are known to breed in Britain (Davies et al. 2004) although their requirement for water temperatures >20ºC probably limits successful spawning. Climate change in southern Britain may well lead to this species becoming increasingly invasive.



Distribution of *Lepomis gibbosus* in southern Britain. Records from Scotland have been excluded as these are likely to be incorrect or no longer extant. Source: NBN.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

Spread has been very slow, and its scattered distribution is most likely the result of multiple introductions (G. Copp pers com). However, it is likely that natural spread could increase with climate change (Britton et al. 2010).

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Shallow lakes and ponds, and possibly also slow-flowing rivers.

Recommendation: This species is generally considered to have a low impact on native biodiversity and ecosystem function. Despite being long-established in Britain, spread has been slow, probably due to the fragmented nature of its habitat and cool tempreatures. However, it is able to persist and climate change is likely to increase the risk posed by this species. On balance, it should be removed from Schedule 9, but the status of this species should be regularly reviewed.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Animal	**Animalia: Chordata: Actinopterygii: Siluriformes: Siluridae**	**Fish**	***Siluris glanis* (L. 1758)**	Wels	**Retain**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Hubble, 2011e) on which much of the information here is based.

Wels catfish is a popular fishery species and is widely stocked into enclosed standing waters. In common with other fishery species, this pathway is already regulated via the Prohibition of Keeping or Release of Live Fish (Specified Species) (Wales) Order 2015, and the Importation of Live Fish Act 1980), import and introductions of fish are already controlled. However, there is also evidence of illegal introductions and escapes into rivers and natural lakes (Davies et al. 2004). Wels is also sometimes available in the aquarium trade, mainly as a pond fish. As it is a large fish that is likely to outgrow these surroundings, releases of pets are therefore likely.

Accidental introductions are very unlikely due to the distinctive appearance and large size of this species. Escapes may sometimes occur during flood events.

There is therefore good evidence that deliberate introductions are a relevant pathway for this species.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

No risk assessment is available. Wels can reach a very large size (up to 3m in its native range, though British specimens are generally smaller). It is a generalist predator that feeds on anything it can catch (fish, birds, amphibians, mammals, invertebrates). *S. glanis* may impact on native species directly through predation, with possible subsequent ecosystem impacts through tropic cascades reducing water quality (Bruguera 2007 in Hubble 2011e). Recent research in Spain details the changing diet of *S. glanis* as it develops and indicates a statistically significant

negative impact on water-bird abundance, either by direct predation, and/or learned avoidance behaviour (Hubble 2011e).

UKTAG (2015) list wels as an 'unknown' impact species. A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a moderate score of 21.5 (scores for all non-native fish in Britain ranged between 10.0 and 37.3).

There are no documented health or social impacts, although there are rare reports of *S. glanis* attacking humans (Hubble 2011e). There are minor economic benefits via its angling value, but wels can also carry the notifiable disease spring viraemia of carp (SVC) (Davies et al. 2004).

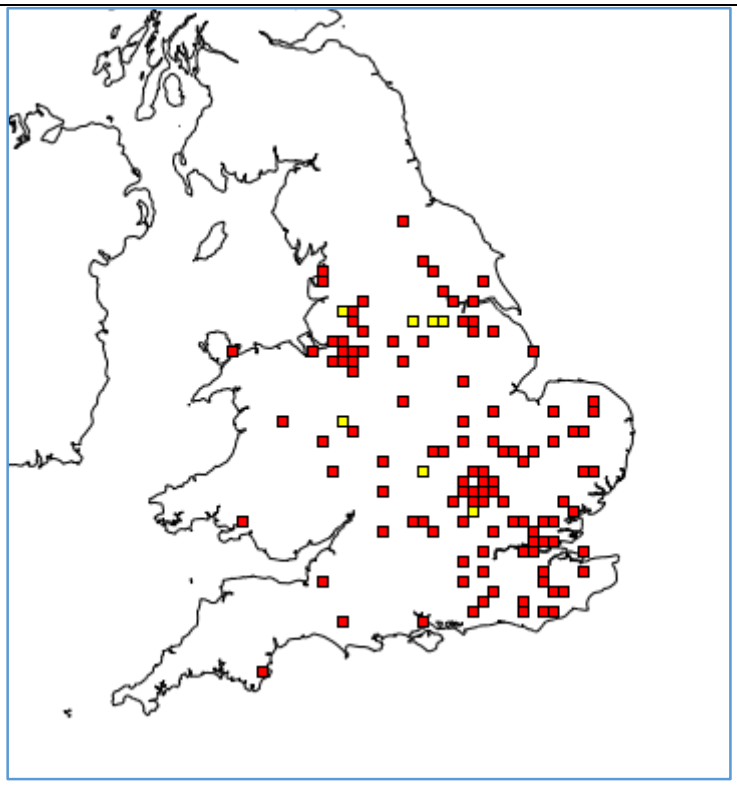
1.3 Known native global range of the animal.

Generally considered an eastern European species, particularly from large rivers such as the Danube. North, Baltic, Black, Caspian and Aral Sea basins, as far north as southern Sweden and Finland; Aegean Sea basin in Maritza and from Struma to Sperchios drainages; Turkey. Absent from the rest of Mediterranean basin as a native species (Hubble 2011e).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

NBN Gateway shows a scattered distribution in England and Wales up to about as far north as the Lake District, but many of these are likely to be in enclosed fisheries with stocked populations. There are no Scottish records.

Wels are known to breed in Britain (Davies et al. 2004; Hubble 2011e) although their requirement for water temperatures >19ºC probably limits successful spawning. It is presently uncertain whether any population in Britain is self-sustaining. However, climate change in southern Britain may well lead to an increasing probability of establishment (Britton et al. 2010), and the widespread presence of many individuals of this relatively long-lived species makes establishment and spread increasingly likely.



Distribution of *Siluris glanis* in southern Britain. Yellow squares are pre-1991 records. Source: NBN.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

There are a large and increasing number of records, but interpretation of these data is complicated by the large number of legally stocked populations in enclosed waters. The preference of this species for large rivers, which cannot be sampled using standard fishery techniques, means that trends in its abundance in the wild are poorly understood.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Large, deep rivers and nutrient-rich lakes. It is also regularly kept in artificial fishing lakes.

Recommendation: This species has the potential to be invasive and to have significant impacts on ecosystem function. It is doubtful that most British populations are currently self-sustaining due to cool temperatures, but this situation is very likely to change. Given the high risk posed by this species, it should be retained on Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Animal	**Animalia: Chordata: Actinopterygii: Perciformes: Percidae**	**Fish**	***Sander lucioperca* (L. 1758)**	Zander, Pikeperch	**Retain**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

In GB the Zander was first introduced in 1878 to lakes at Woburn Park, Bedfordshire, from Germany. Further introductions from Germany to Woburn and from Sweden to Mepal Pit in Cambridgeshire occurred in 1910 and stocks from Woburn Park were successfully relocated to enclosed waters in the southeast of England between 1945 and 1962 (Hubble 2011f). It was then introduced to the Great Ouse Relief Channel, Norfolk, in 1963 which resulted in the first documented self-sustaining populations which subsequently spread rapidly into the adjoining rivers of East Anglia. Since then there have been more illegal introductions of Zander to other parts of the UK with populations established in major rivers such as the Severn, Trent and Thames (Hubble 2011f).

Zander has been introduced for both commercial and recreational fishing and for biomanipulation of other fish populations, especially cyprinids. In GB, it has been introduced for recreational fisheries and caught specimens are rarely removed for consumption by anglers (Hubble 2011f).

No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Hubble, 2011f) on which much of the information here is based.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Zander has been documented to have strongly adverse effects on prey fish densities, including salmonid smolts and especially cyprinids. In some populations the effect on cyprinid densities has been desirable as a method of biocontrol. In most however, especially where other native predatory fish are present, the effect has caused cyprinid population crashes and in the Turkish Lake Egredir, zander introduction has been linked with the extinction of two endemic cyprinid species. In Britain, zander has been shown to cause predator-prey imbalances which are

particularly pronounced during periods of poor prey recruitment. The threat posed has been deemed so serious in East Anglia that a policy of protection of open fisheries from the species has been adopted in this region.

Population densities of the native predators, pike and perch, may potentially be reduced by its' introduction and spread both directly through predation and competition and indirectly by forcing native predators into less favourable habitats (Hubble 2011f).

Whilst it was introduced for recreational fisheries in GB it has attained only a low social impact and recent views are associated with the control and extirpation of zander populations rather than the enhancement. In other countries it is considered a highly desirable species for recreational fisheries. In GB zander is not consumed and has no economic value in recreational fisheries. However, elsewhere it has a high market value and has great importance in commercial and recreational fisheries. The high value of zander in fisheries has resulted in over-fishing in some populations in Finland, and in Denmark it is protected by the Danish Fishery Act (Hubble 2011f).

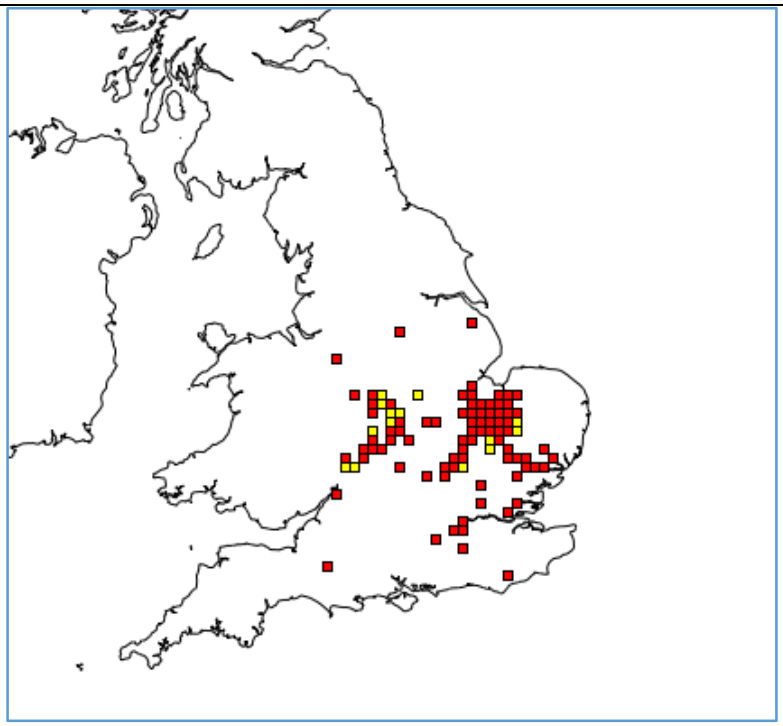
A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a moderate score of 23.0 (scores for all non-native fish in Britain ranged between 10.0 and 37.3). On the UKTAG WFD list, zander is listed as 'moderate' impact (WFD-UKTAG 2015).

1.3 Known native global range of the animal.

Eastern and Central Europe (Armenia, Austria, Bulgaria, Czech Republic, Estonia, Georgia, Germany, Greece, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Russian Federation, Serbia & Montenegro, Slovakia, Ukraine), Scandinavia (Finland, Norway, Sweden) and Western Asia (Afghanistan, Azerbaijan, Iran, Kazakhstan, Uzbekistan) (Hubble 2011f).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Zander is now widespread in southern and central England and certainly forms self-sustaining populations in the wild (Davies et al. 2004, Hubble 2011f). It is well-established in several major rivers including the Severn, Trent, Great Ouse and Thames systems (Davies et al. 2004).



Distribution of *Sander lucioperca* in Britain. Yellow squares are pre-1991 records. Source: NBN.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

There are a large and increasing number of records, suggesting spread by both natural and human means. The preference of this species for large rivers, which cannot be sampled using standard fishery techniques, means that trends in its abundance in the wild are poorly understood.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Large, deep rivers and nutrient-rich lakes. They typically occupy the pelagic zone and require high oxygen concentration (Hubble 2011f).

Recommendation: This species is invasive, has significant impacts on ecosystem function, and is spreading within Britain. Given the high impact of this species, it should be retained on Schedule 9. It should be noted that the scientific name of this species has changed from *Stizostedion lucioperca* to *Sander lucioperca*.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	**Animalia: Chordata: Actinopterygii: Cypriniformes: Cyprinidae**	**Fish**	***Pseudorasbora parva* (Temminck & Schlegel, 1856)**	Topmouth gudgeon	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Topmouth gudgeon has mainly spread via releases of pets, use as baitfish, and accidental stocking with contaminated batched of native coarse fish, followed by natural spread (Hubble 2011g). The small adult size facilitates escape from enclosed stillwaters and quick colonisation of connected waterbodies. For example, this is how topmouth gudgeon colonised Tadburn Lake, which drains the original introduction site and joins the River Test approximately 4km downstream (Hubble 2011g).

See the GB non-native species risk assessment for topmouth gudgeon.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Topmouth gudgeon has various impacts that include strong competition with native fish species, acting as a vector for several serious fish diseases and significant effects on food webs of freshwater habitats. It can reach very high densities. For further details see the GB non-native species risk assessment for topmouth gudgeon.

A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a high score of 35.0 (scores for all non-native fish in Britain ranged between 10.0 and 37.3). UKTAG (2015) list topmouth gudgeon as a high impact species for Water Framework Directive purposes, and it is listed as an Alert Species by the GB Non-native Species Secretariat.

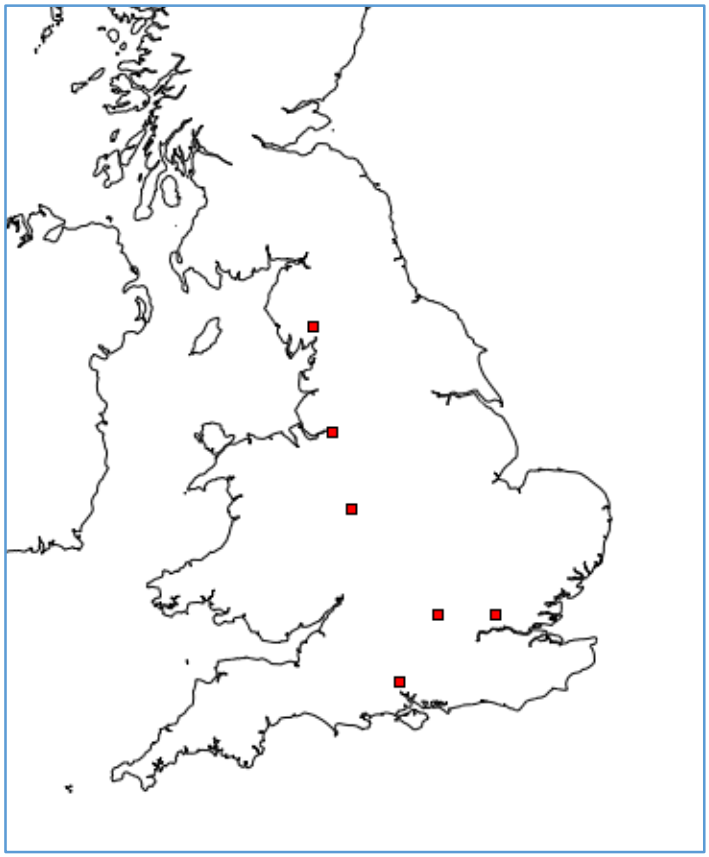
1.3 Known native global range of the animal.

East Asia, including the basins of the rivers Amur, Yang-tze, Huang-ho, Japanese islands (Kiusiu, Sikoku and the southern and central parts of Honsiu), western and

southern parts of the Korean Peninsula and Taiwan (Minkiang river system) (Hubble 2011g).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Topmouth gudgeon has a scattered distribution in Britain, reflecting multiple, recent introductions. Not all records are shown on NBN, however (for example there are two populations in South Wales that are subject to an eradication programme: NRW unpublished data). So far this species is not thought to have spread widely, and there has been a relatively aggressive policy of eradication at known sites (Britton et al. 2006, Brazier 2014).



Distribution of *Pseudorasbora parva* in Britain. All records are recent: two known sites in South Wales are not shown. Source: NBN.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

This species has been increasing due to both human introductions and natural spread. To some extent this has been mitigated by eradication attempts.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Found in a wide variety of habitats; most abundant in well vegetated small channels, ponds and small lakes. Often associated in GB with isolated water-bodies such as ornamental ponds and lakes, plus water-courses and water-bodies connected to areas of introduction such as commercial fisheries (Hubble 2011g).

Recommendation: Topmouth gudgeon is a highly invasive non-native species that is spread by both deliberate and accidental human introduction. It has strong ecological impacts and is established in the wild, albeit with restricted distribution at present. It is strongly recommended that this species is added to Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Animal	**Animalia: Chordata: Actinopterygii: Cypriniformes: Cyprinidae**	**Fish**	***Carassius auratus* (L., 1758)**	Goldfish	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Goldfish is a familiar species that has been kept as a pet and in garden ponds across the UK since at least the 17th century. Releases of unwanted specimens are widespread in a range of waters. There may also be occasional escapes e.g. from garden ponds (Hubble 2011h).

Accidental introductions are possible due to the similarity of wild-type forms of this species to small individuals of other cyprinids, especially crucian carp *Carassius carassius*.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Competes with native fish for spawning habitat and food. Readily hybridises e.g. with the native Crucian carp (*Carassius carassius*), reducing populations of unhybridised native species. Habitat damage e.g. through the impact on water quality by increasing turbidity and reducing macrophyte cover. Growth of cyanobacteria (associated with 'blooms') such as *Microcystis aeruginosa* has been shown to be increased by passage through the goldfish gut with algal growth also possibly increased by re-suspension of nutrients. Disease transmission, hosting non-native parasites. Predation of fish eggs and possibly other fish.

There may be damage to habitats and/or native fish populations; hence associated loss of ecosystem services and amenity value. There could be costs due to eradication of goldfish and related diseases/parasites, protection of native species, or tackling damage to habitats.

Parasites include anchor worm, flukes, fish leech, fish lice (e.g. *Argulus*), fungi, ciliates (e.g. *Ichthyophthirius multifilis* or 'Ich', *Trichodina* and *Chilodinella*) and flagellates (e.g. *Costia*, also known as *Ichthyobodo*).

A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a high score of 30.2 (scores for all non-native fish in Britain ranged between 10.0 and 37.3). UKTAG (2015) list goldfish as a high impact species for Water Framework Directive purposes, and it is listed as an Alert Species by the GB Non-native Species Secretariat.

1.3 Known native global range of the animal.

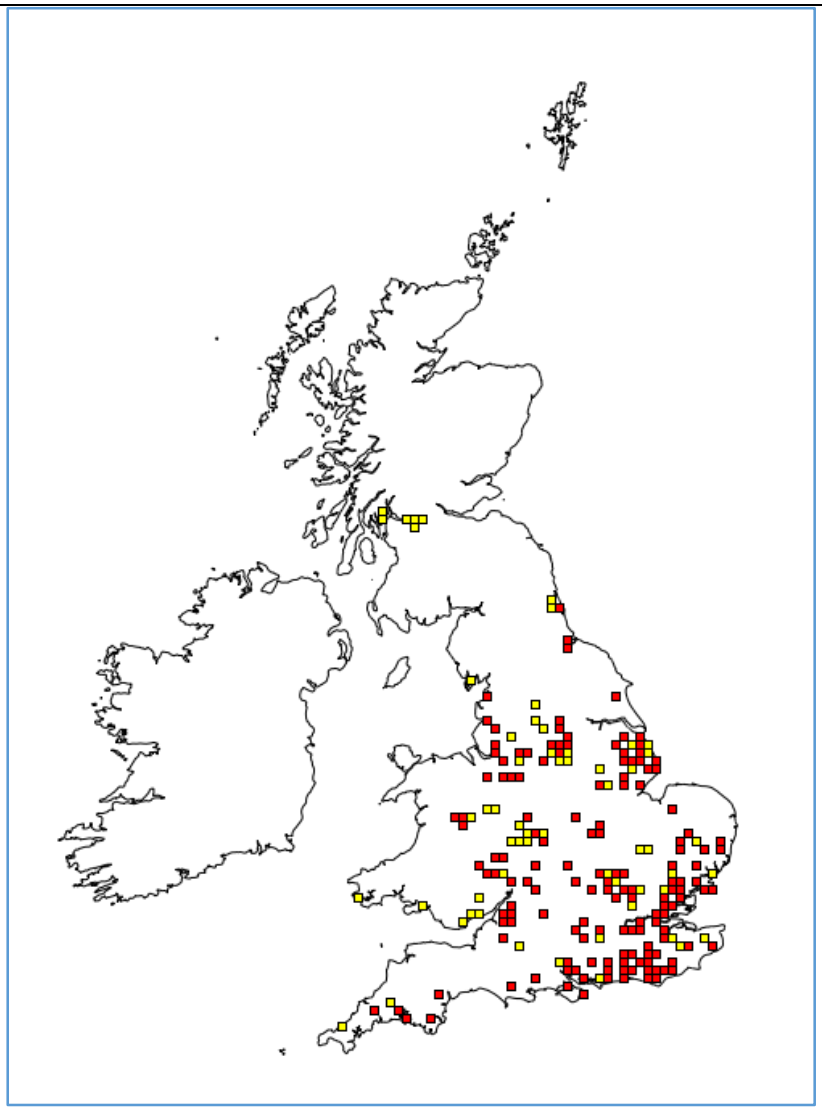
Asia (central Asia, China & Japan), with many imports e.g. from China where the Goldfish (*C. a. auratus*) was bred from the Giebel or Prussian Carp (*C. a. gibelio*). This selective breeding began during the 1st century AD. Rapidly reverts to wild type fish.

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Goldfish now has a widespread distribution as a wild fish in Britain, reflecting multiple introductions and natural spread. There is a strong relationship between 10km square occupancy and human population density, reflecting the main introduction pathway.

Goldfish routinely spawn in garden ponds where conditions allow. The near ubiquity of 'wild type' forms in wild populations provides unequivocal evidence of successful spawning in the wild, since wild type goldfish are almost never found as pets.

Britton et al. (2010) predicted increasing climatic suitability for this species in the future, suggesting that spawning success and therefore invasiveness is likely to increase.



Distribution of *Carassius auratus* in Britain. Yellow squares are from 1990 and earlier red are 1991 and later. Source: NBN.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

This species has been increasing due to both human introductions and natural spread. No structured survey data are available that can provide a reliable indication of long-term trends, however.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Still and stagnant waters (ponds, lakes); also some slow-flowing river waters and ditches. (Hubble 2011h).

Recommendation: Goldfish is an invasive non-native species that is spread by both deliberate and accidental human introduction. It has strong ecological impacts and is well established in the wild, with climate change likely to encourage spread in future. It is recommended that this species is added to Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	**Animalia: Chordata: Actinopterygii: Siluriformes: Ictaluridae**	**Fish**	***Ameiurus melas* (Rafinesque, 1820)**	Black bullhead	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Introduced as an ornamental species; possibly also escapes from aquaculture (Hubble 2011i). It is unlikely to be introduced by other pathways.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Little information is available on the impact of this species in Britain. Where it has been introduced to Europe, impacts on the ecological community due to dominance, bioaccumulation of pollutants, impacts due to competition (for food and/or space) with native species, and impacts due to predation of native species have all been reported (Hubble 2011i). There may also be impacts (direct or indirect) through increased turbidity related to reduced macrophyte growth and reduced stability of substrates (Hubble 2011i).

The generalist and opportunistic feeding habit has been analysed in Spain and Portugal (Leunda *et al* 2008 in Hubble 2011i) and indicates potential impacts on a wide range of potential prey species as well as impacts through competition. In this study, black bullheads consumed plant material, terrestrial prey and co-occurring fish species (native or exotic), taking the most abundant and available prey. With no positive relationship between black bullhead size and fish prey size, it is likely that they fed on dead or dying vulnerable fishes as well as predating smaller-sized active fishes.

Black bullhead can be a nuisance species for fisheries via competition and taking lines for other species (Hubble 2011i).

A FISK invasiveness screening (Copp et al. 2005; Britton et al. 2010) recorded a medium-high score of 28.8 (scores for all non-native fish in Britain ranged between 10.0 and 37.3). UKTAG (2015) list black bullhead as an unknown impact species for Water Framework Directive purposes.

1.3 Known native global range of the animal.

North America: Great Lakes to northern Mexico. (Hubble 2011i).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

The status of black bullhead in Britain is presently uncertain. There is a long-standing (1989) record on NBN from Radway Grange Lake in Warwickshire, and there are anecdotal reports of persistent populations in Essex and reports of individuals in rivers (Hubble 2011i). The Environment Agency recently carried out an eradication attempt at one population and a subsequent press release claimed that this resulted in eradication of this species from Britain (GB NNSS, 2014). However, the press release did not discuss the Warwickshire site, the possibility of other sites existing or the need for post-project monitoring to determine if the eradication attempt had succeeded.

For the moment it is recommended that a more precautionary approach be taken and that this species is considered likely to still be established in the wild.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

As the species is present at very few sites and its status is uncertain, no trend information are available.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Most records are from ponds and lakes, but the species can also occur in slow-flowing rivers (Hubble 2011i).

Recommendation: Black bullhead is a highly invasive non-native species that is mainly spread by both deliberate human introduction. It has strong ecological impacts and is established in the wild, albeit with very restricted distribution at present. It is recommended that this species is added to Schedule 9, but that this is reviewed in due course once its status in Britain becomes clearer.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Crustacea: Malacostraca: Amphipoda: Gammaridae	Crustacean	*Dikerogammarus villosus* (Sowerby, 1894)	Killer shrimp	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Deliberate introduction of this species is rare, though it was introduced to Poland as fish food. This route is considered unlikely in the UK.

Principally spread via accidental transfer via boating and inland shipping, especially water transfers associated with canals and ballast / bilge water in vessels (Aldridge 2011a). Potentially could be spread in or on equipment regularly used in water, such as dive gear and angling equipment (Aldridge 2011a). Addition of this species to Schedule 9 would be a useful lever for promoting biosecurity procedures, as users of affected sites would be required to 'show that they took all reasonable steps and exercised all due diligence to avoid committing the offence' (Sect. 14, (3)).

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Killer shrimp is a highly aggressive and voracious predator and is regarded as one of the most damaging invasive species in Western Europe (Aldridge 2011a). The species affects ecosystems through direct predation and through cascading indirect effects across trophic levels. Killer shrimp is a major predator of native shrimps, other invasive shrimps, mayflies, damselflies, leeches, chironomids, cladocera, isopods, snails, fish eggs and larvae (Aldridge 2011a). Sometimes macroinvertebrates are killed but not eaten, perhaps in order to remove competitors. Killer shrimps are also coprophagus, feed on detrital material and have been observed to eat zebra mussel byssus threads. It is likely that macroinvertebrate populations will decline and services such as leaf shredding and nutrient processing will be affected. However, other species may benefit from the increase in prey abundance as killer shrimp populations increase.

Killer shrimp is likely to affect the quality and distribution of fisheries (Aldridge 2011a). Observations suggest that trout and perch are feeding increasingly on Killer shrimp, which could drive changes in distribution of fish and catchability for anglers. The shrimp may also serve as an intermediate host for acanthodephalan parasites

including *Echinorhyneys truttae* and *Pomphorynclus laevis* which cause disease in salmonids and reduce fishery value.

The GBNNSS Rapid Risk Assessment (2010) for this species indicates that the risk posed by this species is Very High, with High Confidence, and it is listed as an Alert Species. UKTAG (2015) list killer shrimp as a high impact species for Water Framework Directive purposes.

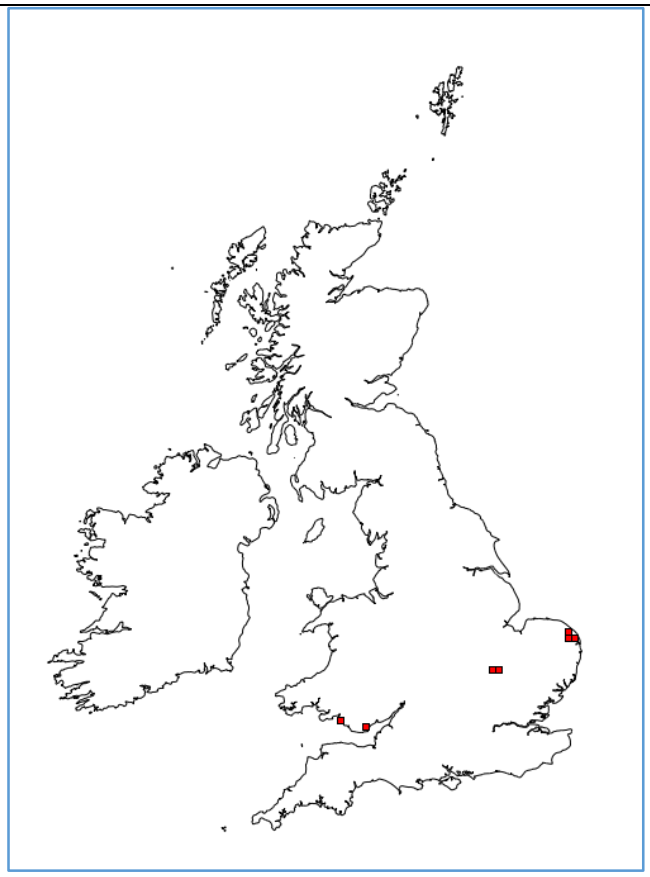
1.3 Known native global range of the animal.

Ponto-Caspian: native range is in the lower courses of large rivers in the Black and Caspian Sea basins (Aldridge 2011a).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Killer shrimp is presently restricted to a small number of sites in Britain: two lakes in south Wales; Grafham Water, and the Norfolk Broads. There are no Scottish records.

The first record was in 2010. Large populations are evident at most sites where it is known to be present. As individuals of this species are short-lived, populations are certainly at least self-sustaining. At present it is uncertain whether these populations result from a single introduction to the UK followed by subsequent human mediated spread, or separate independent introductions.



Distribution of killer shrimp *Dikerogammarus villosus* in the UK. All records are 2010 or later, though it is likely that some populations have been present for longer.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

The species was first found in 2010, though it is likely that it was established before then. It was first detected at Grafham Water and subsequently in the two Welsh sites and the Broads, but it is not clear that this is the order of colonisation. Populations have expanded rapidly in favourable sites and are apparently colonising new sites in and on boats.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Killer shrimps currently occupy reservoir habitats. They are mainly found in habitats with an artificial bank structure, high oxygen saturation and a low conductivity. They select hard structures such as stones, cobbles and tree roots and are also thought to be associated with zebra mussel beds. Many GB canals, rivers and reservoirs would therefore provide suitable habitat. Given their high salt tolerance the species could potentially penetrate brackish zones of GB rivers. The species is not typically found on sandy substratum or in areas with high current velocity.

Recommendation: Killer shrimp is a highly invasive non-native species that is mainly spread by accidental human introduction. It has very strong ecological impacts and is established in the wild, albeit with restricted distribution at present. It is strongly recommended that this species is added to Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Crustacea: Malacostraca: Amphipoda: Gammaridae	Crustacean	*Dikerogammarus haemobaphes* (Eichwald, 1841)	Demon shrimp	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Deliberate introduction of this species is considered unlikely in the UK.

Aldridge (2013) discusses likely pathways as follows: “No specific studies have been reported on the vectors and pathways for *D. haemobaphes* spread, but downstream drift is likely to generate the fastest dispersal within a catchment (van Riel et al., 2006). The discovery of specimens in two canals adjacent to the River Severn, separated by many locks, suggests it may be distributed with boat traffic. The association of the species with macrophytic vegetation (Musko, 1990) suggests that overland transport may be possible on contaminated outboard engines and fishing gear.

Studies in GB of possible vectors and pathways for the congeneric, *D. villosus*, suggests that particularly important overland vectors might include outboard engines, rubber waders, fishing gear (such as keep nets), and pleasure craft. There is some uncertainty over the role of wildfowl as vectors for *Dikerogammarus* spp., but this cannot be ruled out as snails have been shown to be transported long distances in this manner (Gittenberger et al., 2005).”

Addition of this species to Schedule 9 would be a useful lever for promoting biosecurity procedures, as users of affected sites would be required to ‘show that they took all reasonable steps and exercised all due diligence to avoid committing the offence’ (Sect. 14, (3)).

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Like the related killer shrimp, demon shrimp is a highly aggressive and voracious predator and is regarded as one of the most damaging invasive species in Western Europe (Aldridge 2013). The species affects ecosystems through direct predation and through cascading indirect effects across trophic levels. Aldridge (2013) provides a detailed discussion in the rapid risk assessment for thjs species.

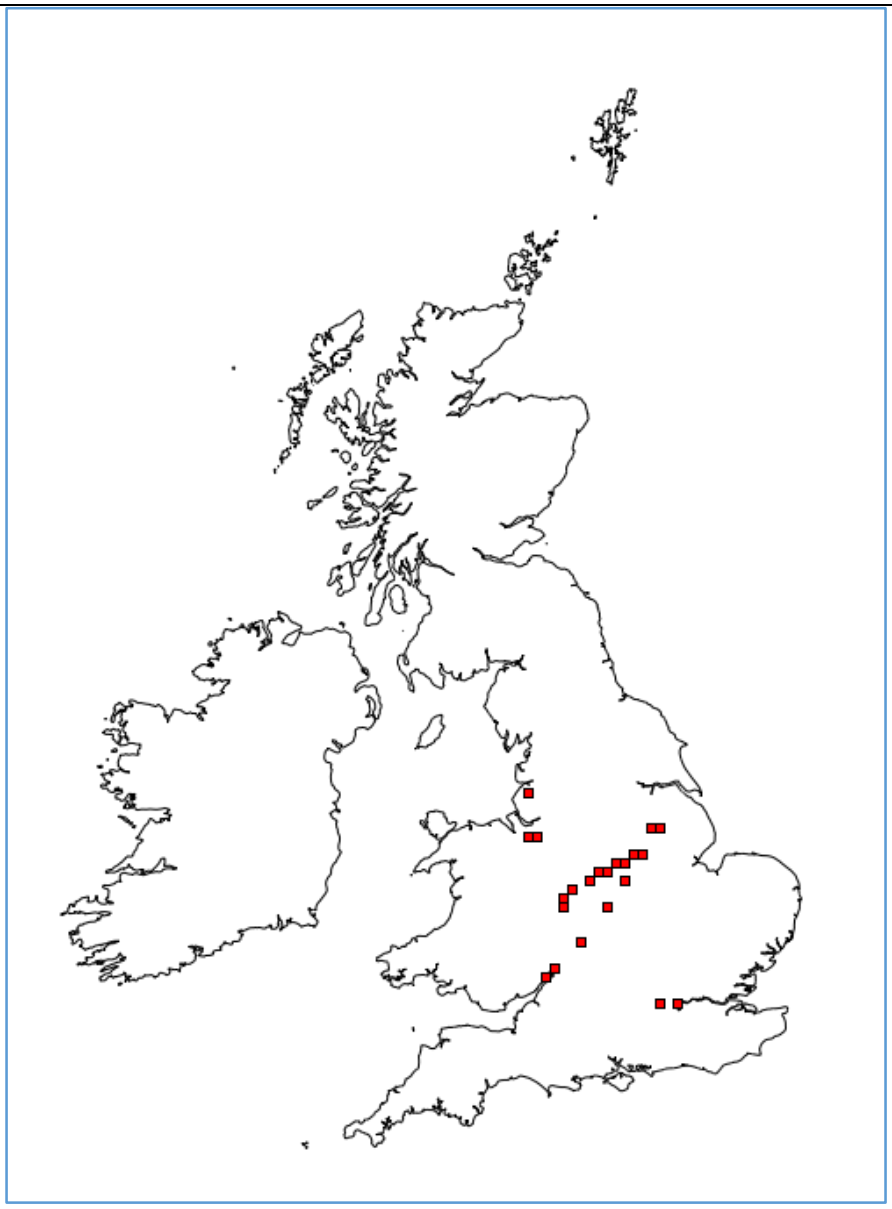
The GBNNSS Rapid Risk Assessment (Aldridge 2013) for this species indicates that the risk posed by this species is High, with Moderate Confidence, and it is listed as an Alert Species. UKTAG (2015) list demon shrimp as a high impact species for Water Framework Directive purposes.

1.3 Known native global range of the animal.

Ponto-Caspian: native range is in the lower courses of large rivers in the Black and Caspian Sea basins (Aldridge 2013).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Killer shrimp was first detected in 2012 in preserved samples from the River Severn near Tewkesbury. Subsequent field surveys found it to be established in the Severn and Trent catchments and associated canals over a wide area. The species has now been found in East Anglia and in the Thames (Aldridge 2013). As yet there are no Scottish or Welsh records.



Distribution of *Dikerogammarus haemobaphes* in Britain. All records are 2012 or later, though it is likely that some populations have been present for longer.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

Since the species was only detected in 2012, no data on trends in abundance are available. However, spread appears to have been relatively rapid and is likely to be ongoing in affected river systems.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

D. haemobaphes is found within a broad range of conditions, but prefers solid substrates, macrophytes and filamentous algae in rivers, lakes and canals (Aldridge

2013). It tolerates salinities from freshwater up to 8‰ and is able to tolerate temperatures up to 30°C Aldridge 2013).

Like the killer shrimp, *D. villosus, D. haemobaphes* shows a strong preference for beds of the Ponto-Caspian zebra mussel, *Dreissena polymorpha*. In laboratory experiments Kobak & Zytkowicz (2007) found *D. haemobaphes* to choose live zebra mussels over dead shells, and to select these two habitats over stones and empty plates. It is likely that zebra mussels in GB may provided important habitats in many locations, and may be especially important in facilitating spread through the Midland canal system. Zebra mussels are distributed broadly through GB from East Anglia to Cardiff Bay and from West Sussex to the Forth & Clyde Canal in Scotland (Aldridge, 2013).

Recommendation: Demon shrimp is a highly invasive non-native species that is mainly spread by accidental human introduction. It has very strong ecological impacts and is established in the wild, albeit with restricted distribution at present. It is strongly recommended that this species is added to Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Crustacea: Malacostraca: Amphipoda: Gammaridae	Crustacean	*Hemimysis anomala* (G.O. Sars, 1907)	Bloody-red mysid	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

The bloody-red mysid was intentionally introduced into water bodies in the former USSR to try to boost fish productivity (Aldridge 2011b). However, deliberate introduction of this species is considered unlikely in the UK.

The species has spread across Europe through canals and rivers, aided by river transport and transport in boat ballast. It is not known how they were transported to GB but one of the sites where mysids were first found is an international rowing lake, so it is possible they were introduced with boats and equipment used for racing (Aldridge 2011b).

Since being introduced to eastern Europe, *H. anomala* has spread over most of western Europe. It reached Finland in 1992, Germany, the Netherlands and Belgium in the late 1990s and France and Britain in 2004/5 (Aldridge 2011b). It has also spread to the Great Lakes in North America, most likely by transport in ballast water (Aldridge 2011b).

Addition of this species to Schedule 9 would be a useful lever for promoting biosecurity procedures, as users of affected sites would be required to 'show that they took all reasonable steps and exercised all due diligence to avoid committing the offence' (Sect. 14, (3)).

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Aldridge (2011b) summarises their impact as follows: "Bloody-red mysids form large colonies, are omnivorous and so can have large ecosystem impacts across trophic levels. Juveniles feed mainly on phytoplankton whilst adults consume large numbers of zooplankton – dramatic decreases in cladocerans have been observed in some cases, but further study is needed. The physicochemical environment is affected by high inputs of fecal pellets, and algal growth is changed.

By lengthening food chains there is a risk of increased biomagnification and accumulation of contaminants in consumers at higher trophic levels. If top consumers, such as fish, are eaten by people this could cause health concerns.

Despite being introduced to increase fish production, stocks often do not grow. Changes in food webs and increased predation of zooplankton by mysids may reduce essential food supplies for fish, so reducing the economic value of fisheries."

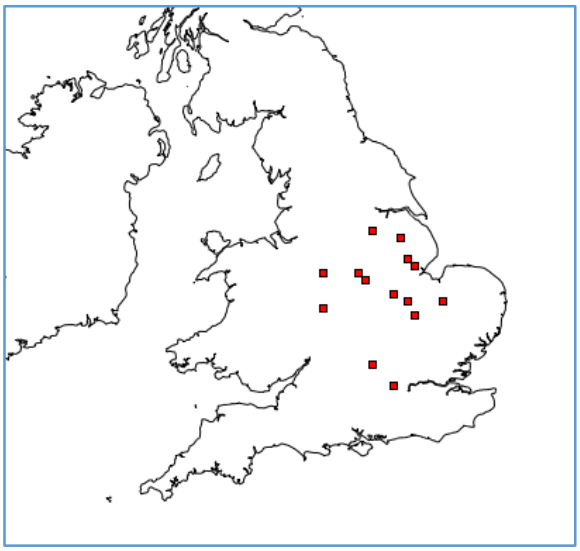
There is no GBNNSS Risk Assessment for this species. UKTAG (2015) list demon shrimp as a high impact species for Water Framework Directive purposes.

1.3 Known native global range of the animal.

The bloody-red mysid is a Ponto-Caspian species, native to the lower reaches of rivers that flow into the Black Sea, the Azov Sea and the eastern Caspian Sea. (Aldridge 2011b).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Bloody-red mysid was first was first detected in 2004 in a recreational lake near Nottingham. It has since been detected in various artificial waters, especially lakes and canals across a wide area of southeastern England, often during *Dikerogammarus* surveys. As this is a short-lived species, these populations must be self-sustaining.



Distribution of *Hemimysis anomala* in Britain. All records are 2004 or later.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

No detailed population data is available, but the wide range of records suggests that this species is spreading. Large swarms have been reported at some sites (Aldridge 2011b).

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

H. anomala is found in lakes, canals and slow-flowing rivers. Like other pont-Caspian species it has a preference for artificial or modified waters.

Recommendation: Bloody-red mysid is a highly invasive non-native species that is mainly spread by accidental human introduction. It has strong ecological impacts and is established in the wild. It is strongly recommended that this species is added to Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Mollusca: Bivalvia: Veneroidea: Cyrenidae	Clam	*Corbicula fluminea* (O.F. Müller, 1774)	Asian clam	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Asian clam was first found in Britain in 1998. The introduction pathway into GB is unknown, but introduction from USA into Europe was via ballast water (Zieritz 2011), and the most likely pathway is probably associated with boats either in ballast or bilge water, or as a fouling organism. Potentially, any activity that results in the movement of complex equipment, water, sediment or other material (e.g. plants) could result in spread. Deliberate introduction of this species in unlikely.

Addition of this species to Schedule 9 would be a useful lever for promoting biosecurity procedures, as users of affected sites would be required to 'show that they took all reasonable steps and exercised all due diligence to avoid committing the offence' (Sect. 14, (3)).

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Asiatic clam has a high filtration rate and can attain very high population densities (Zieritz 2011), which can substantially alter ecosystem dynamics by increasing sedimentation and changing substrate composition. Suspension and deposit feeding may affect planktonic food webs and reduce recruitment of other species with planktonic larvae (Sousa et al. 2008).

It can sequester an enormous portion of the carbon available for benthic production, thereby altering ecosystem functioning. Asiatic clam also competes with native filter feeding bivalves and snails feeding on organics in sediments (Sousa et al. 2008; Zieritz 2011). Mass mortalities are documented which cause water pollution, killing other biodiversity, and it is a vector of parasites and pathogens (Sousa et al. 2008).

Accumulations of shells can block water intakes and irrigation channels (Zieritz 2011).

There is no GBNNSS Risk Assessment for this species. UKTAG (2015) list Asiatic clam as a high impact species for Water Framework Directive purposes, and is also listed as invasive in North America, South America and continental Europe.

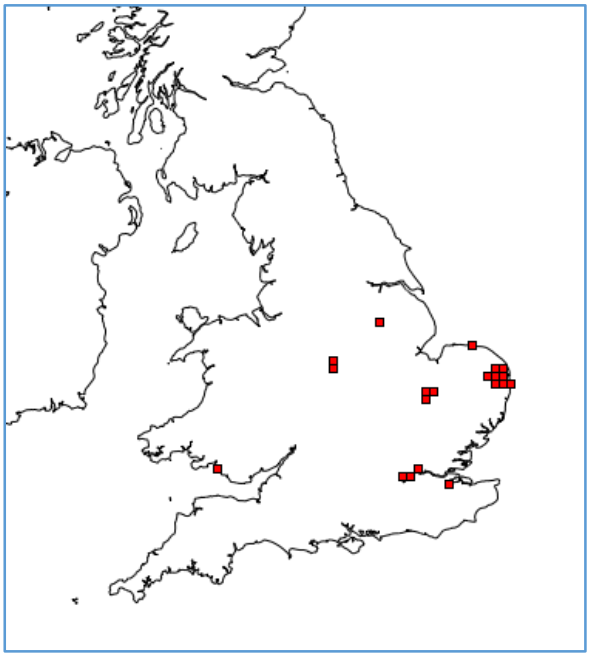
1.3 Known native global range of the animal.

Native to Southern and Eastern Asia (eastern Russia, Thailand, Philippines, China, Taiwan, Korea, and Japan), Australia, and Africa (Zieritz 2011).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Asiatic clam was first found in 1998 in the River Chet (Norfolk Broads) (Zieritz 2011). It has since spread to other water bodies, mostly rivers. There are now 192 records from eastern England including the Thames and Great Ouse. A single record for south Wales is thought to be extirpated as the habitat where this species occurred, a dock, has now been flooded with salt water.

As this is a short-lived species, these populations must be self-sustaining.



Distribution of *Corbicula fluminea* in Britain. All records are 1998 or later.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

This species appears to be spreading rapidly in southern English rivers. In places, densities of over 2,500 individuals / m^2 have been recorded (Zieritz 2011).

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

C. fluminea is a predominantly a species of slow-flowing rivers and canals in Britain at present.

Recommendation: Asian clam is a highly invasive non-native species that is mainly spread by accidental human introduction. It has strong ecological impacts and is established in the wild. It is strongly recommended that this species is added to Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Mollusca: Bivalvia: Veneroidea: Cyrenidae	Clam	*Dreissena bugensis* Andrusov, 1897	Quagga mussel	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Quagga mussel was first found in Britain in 2014 at Wraysbury Reservoir and the linked Wraysbury River, near London (Environment Agency 2014). The pathway for invasion is unknown but is most likely to be linked to boats. Water transfers are likely to have expedited the spread of this species, which has a planktonic larval phase.

Deliberate introduction of this species is considered unlikely in the UK. The Dutch have in the past introduced the closely related zebra mussel (*D. polymorpha*) to certain lakes with the aim of improving water clarity.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Quagga mussels are closely related to zebra mussels (*D. polymorpha*), which is already on Schedule 9. Evidence elsewhere suggests that they are very likely to competitively displace *D. polymorpha* in many locations.

Their effects on native biodiversity and ecosystem function are very similar to *D. polymorpha*. These effects include massive filtration of water resulting in major shifts to food webs and decline of planktonic communities (Aldridge 2014b); provision of habitat for other invasive species such as *Dikerogammarus* and *Hemimysis* spp; extirpation of native mussel species through competition and biofouling (Aldridge 2014b).

Health and social impacts of quagga mussel are limited. The sharp shells may cause injuries in recreational areas. It is also a nuisance when it grows on recreational boats (Zieritz 2014).

Quagga mussel can have significant economic impacts via fouling of infrastructure including commercial ships and boats, water treatment plants and power station cooling intakes (Aldridge 2014b; Zieritz 2014). Aldrige (2014b) notes that: “Quagga

and zebra mussels are also prolific biofoulers in industries that use raw water. The combined effect of these species on North American electric generation and water treatment facilities between 1989 and 2004 is estimated to be $US267 million (Connelly et al, 2007). Zebra mussel management in GB is estimated to cost approximately £5m per year (Oreska & Aldridge, 2010)."

There is no GBNNSS Risk Assessment for this species, but this is listed as an Alert Species following its recent discovery. They were until recently on the UK Alarm list and will be added to the UKTAG list in time for the next River Basin Planning Cycle (UKTAG 2015).

1.3 Known native global range of the animal.

Native to the lower Dnieper and Bug rivers (Aldridge 2014b), from where it has spread westwards along the canal network.

Zieritz (2014) notes the following:
"Range expansion in the Ponto-Caspian area started in the 1980s into the Don River from where it, possibly via the Don-Volga canal, reached the Volga River in the early 1990s. Since 2005, it has extended its distribution area westward into the Romanian Danube. In April 2006, it was discovered in Western Europe, near Willemstad, the Netherlands, and a year later in the Main River in Germany. Colonisation of North America started in the late 1980s, when it appeared in the Great Lakes. It has since been reported from the Mississippi and Ohio Rivers, and several states such as Nevada, Arizona and Utah. It has already become a major invasive species in both the Volga River and the North American Great Lakes."

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Quagga mussel was first found in Britain in 2014 at Wraysbury Reservoir, near London. Subsequent investigations have found it to be well established in a series of public water supply reservoirs to the north and west of London (Environment Agency 2014). These records are not presently recorded on NBN. Environment Agency assessments indicate that these populations are too well established for eradication to be feasible. Bioclimatic models suggest that there is wide habitat suitability for this species in Britain (Aldridge 2014b).

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

This species appears to be spreading rapidly in the London area. Due to its recent detection, rate of spread cannot yet be determined, but based on experience elsewhere this is likely to be rapid in the absence of biosecurity measures.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Quagga mussel is predominantly a species of standing waters and slow-flowing rivers, especially where hard substrates are available for attachment.

Recommendation: Quagga mussel is a highly invasive non-native species that is mainly spread by accidental human introduction. It has strong ecological impacts and is becoming established in the wild. It is strongly recommended that this species is added to Schedule 9.

6.2. Plants

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae: Trachaeophyta: Alismatales: Araceae:	Flowering Plant	*Pistia stratiotes* L.	Water-lettuce	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Water lettuce is a floating plant widely available from garden centres and aquarium shops. Introduction to the wild is typically from discarded aquarium or pond contents (Ison 2012).

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

The impacts of this species are negligible in Britain, because it is not frost-hardy and does not set seed (Ison 2012). Consequently, populations are transient in Britain. In warmer climates it can be a serious invasive, with dense mats forming that clog waterways, cause deoxygenation of the water column and kill fish.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

This is a tropical species, though its native range is uncertain as it has been widely introduced.

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

This species is not confirmed as being invasive anywhere in Britain, because populations are transient (Ison 2012). Although this is a relatively large and easily

identified plant, there are only 23 separate records of this species on NBN, scattered over a wide area of southern England and over a period between 1983 and 2015. However, of these only two occur within the same 10km square but in different years, supporting the view that there are multiple introductions but populations do not persist.

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

There is no evidence of establishment of this species anywhere in Britain at present.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Transient in lakes, canals, ponds and slow-flowing rivers.

Recommendation: Although highly invasive in the tropics and relatively frequently introduced through aquarium discards, water lettuce does not establish in the wild in Britain and therefore cannot be considered 'ordinarily resident'. It should therefore be removed from Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae: Trachaeophyta: Magnoliopsida: Commelinales: Pontederiaceae	Flowering Plant	*Eichhornia crassipes* (Mart.) Solms	Water-hyacinth	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Water hyacinth is a floating plant widely available from garden centres and aquarium shops. Introduction to the wild is typically from discarded aquarium or pond contents. The plants do not survive the winter (Lansdown 2011a).

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

No impacts are known in Britain, because it is not frost-hardy and does not set seed (Lansdown 2011a). Consequently, populations are transient in Britain. In warmer climates it can be a serious invasive, with dense mats forming that clog waterways, cause flooding and deoxygenation of the water column, and kill fish (Lansdown 2011a).

The UKTAG (2015) list this a low impact species for WFD.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

Native to the Amazon Basin, but widely introduced to tropical areas (Lansdown 2011a).

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

This species is not confirmed as being invasive anywhere in Britain, because populations are transient (Lansdown 2011a). Although this is a relatively large and distinctive plant, there are only 10 separate records of this species on NBN over a period between 1996 and 2010. Several of these are in the Somerset Levels, suggesting that there may be a problem with illegal releases in this area (interestingly this is the same area where repeat records of *Pistia* were found). However, of these only two occur within the same 10km square but in different years, supporting the view that there are multiple introductions but populations do not persist.

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

There is no evidence of long-term establishment of this species anywhere in Britain at present.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Transient in lakes, canals, ponds and slow-flowing rivers.

Recommendation: Although highly invasive in the tropics and relatively frequently introduced through aquarium discards, water hyacinth does not establish in the wild in Britain and therefore cannot be considered 'ordinarily resident'. It should therefore be removed from Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae: Pteridophyta: Polypodiopsida: Salvinales: Salvinaceae	Fern	*Salvinia molesta* Mitchell	Giant Salvinia	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Giant salvinia is a floating plant sometimes available from garden centres and aquarium shops. It is probably a sterile hybrid between two other species (Lansdown 2011b) There are however no records from the wild in Britain (Lansdown 2011b; NBN data 2015) and therefore no evidence for a pathway.

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

No impacts are known in Britain, because it is not frost-hardy (Lansdown 2011b). Consequently, populations are transient in Britain. In warmer climates it can be a serious invasive, with dense mats forming that clog waterways, cause flooding and deoxygenation of the water column, and kill fish (Lansdown 2011b).

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

Native to southeast Brazil and northern Argentina, but widely introduced to tropical areas of the Old World where it can be very invasive (Lansdown 2011b).

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

This species is not confirmed as being invasive anywhere in Britain, because populations are transient (Lansdown 2011b). There is no evidence of it being established in the wild at any time in Britain (Lansdown 2011b).

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

This species is not established in the wild.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

This species is not established in the wild. If it were to establish, it would most likely be in standing or slow-flowing nutrient-rich waters.

Recommendation: Although highly invasive in the tropics giant salvinia has never occurred in the wild in Britain and therefore cannot be considered 'ordinarily resident'. Moreover, as this is a tropical species, introductions are unlikely to establish. It should therefore be removed from Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae: Trachaeophyta: Alismatales: Alismataceae:	Flowering Plant	*Sagittaria latifolia* Willd.	Duck-potato	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Duck-potato is an aquatic plant sometimes available from garden centres and aquarium shops. Most populations in the UK are the result of repeated intentional introductions, in particular discards from ornamental ponds and aquaria (Lansdown 2011c).

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

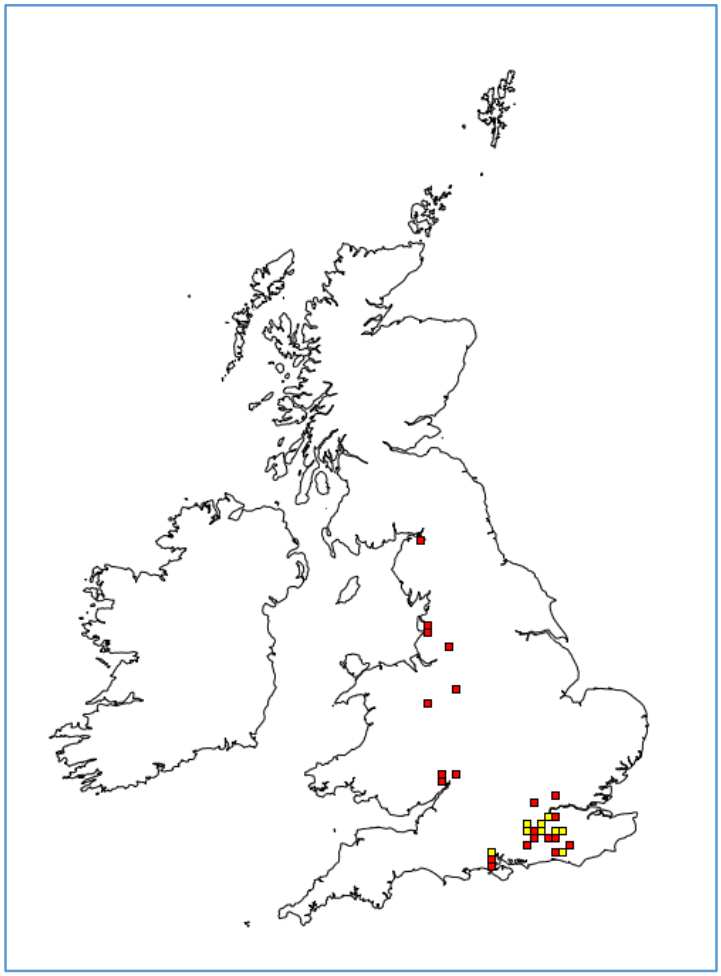
Although widely naturalised in various European countries, the Himalayas and Hawaii and considered potentially invasive using a scoring system (Weber & Gut 2004), there is no clear evidence that duck potato has had any significant impact on biodiversity, ecosystems or human interests outside its native range (Weber & Gut 2004, CABI 2014, Lansdown 2011c). The most likely impact in Britain would be competition with the native *S. sagittifolia*, which has similar habitat requirements. There is no GB NNSS risk assessment.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

Duck potato is native to the Americas, from California and eastern North America, south through Mexico and Central America to Colombia, Ecuador and Venezuela (Lansdown 2011c).

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

The first record of this species was on Epsom Common in 1941 (Lansdown 2011). There are scattered and reasonably well-established populations of duck potato across much of England, though there are no confirmed Welsh or Scottish records. The majority of the approximately 100 records are in the London area, although many of these have not been confirmed since before 1990 and may no longer be extant. There is the possibility for confusion with the native arrowhead (*S. sagittifolia*).



1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

Although repeated introductions seem to occur, there is little evidence of spread in most instances and some populations seem to have died out.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Standing or slow-flowing nutrient-rich waters with a deep silty bed.

Recommendation: Although well established, there is no clear ecological or economic impact of duck potato and therefore it should be removed from Schedule 9.

7. Specific Recommendations: Marine Species

7.1. Animals

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Chordata: Ascidiacea: Aplousobranchia: Didemnidae:	Sea squirt	Didemnum vexillum Kott, 2002	Carpet Sea Squirt	Add

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Association with marinas suggests transfer on hulls of leisure craft. Noted in northern France as early as 1998 and probably spread from France to GB. Movements of aquaculture stock has role in some introductions: occurrences on intertidal oyster trestles in Ireland apparently associated with importation of oysters from France. Ballast water is also a likely pathway of introduction.

1.2 Evidence that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Capable of forming very large colonies, and likely to have considerable effect on pre-existing sessile hard-surface communities through overgrowth interactions etc. Extreme abundance in Oosterschelde, Netherlands (covering >95% of substratum in some areas) accompanied by dramatic decline in brittlestar *Ophiothrix fragilis* and sea-urchin *Psammechinus miliaris*. On pebble gravel bottom of Georges Bank off Massachusetts (where locally covered majority of seabed), significant alteration in species composition of benthos compared to uncolonised, including increases in two polychaete species. Possible impacts on the shellfish industry. Larvae of Bay Scallop *Argopecten irradians* avoided settlement on *D. vexillum*, suggesting reduction in suitable

settlement area where *D. vexillum* abundant; result of potential significance to fishery for Sea Scallop (*Placopecten magellenaicus*) on Georges Bank off Massachusetts, where *D. vexillum* locally abundant. *D. vexillum* readily overgrows mussels and aquaculture gear. In the Marlborough Sounds mussel farming area of New Zealand, despite initial concern and substantial expenditure on control measures, effects were less severe than initially feared and farmers subsequently opted for a 'live with it' policy, rather than seeking funds for ongoing intensive control measures.

Recent work on the west coast of Ireland shows heavily infestations on oyster farms.

A risk assessment of high has been carried out for this species which can be found here.

Other information has come from the factsheet (Bishop, 2012)

1.3 Known native global range of the animal.

Native range probably NW Pacific and likely to have spread from Japan, although previously overlooked there.

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Recorded in autumn 2008 from a marina in N. Wales and one in Plymouth; photographic evidence of occurrence in 2005 in a marina in the Dart Estuary (Devon).

Established populations found in six marinas: N Wales 1, Devon 1, the Solent (Hampshire) 3 and the Clyde 1. One or a few colonies found in each of three more: Devon 1, the Solent (Hampshire and Isle of Wight) 2. (Records for England and Scotland from unpublished Defra-funded surveys, 2009.) Eradication attempted in the N Wales marina 2009-10 which has been unsuccessful.

Map from NBN accessed 24/07/15.

NBN data is under representative of the spread of the species as it does not yet show information from the south coast or Scotland.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

In Europe it was first recorded in the Netherlands (1991), and subsequently in northern France (1998), Ireland (2005) and northern Spain (2008) then in the UK in 2008. This shows its ability to rapidly spread. It is also spreading on the west coast of Ireland.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Recorded in GB on rocky intertidal in Kent as well as from marinas and adjacent shallow artificial structures usually at depths from 30 to 65m at salinities > 26 ppt and temperatures of -2oC to 24oC. In other areas of introduction, also occurs on natural cobble or gravel seabed to 80m depth, in tide pools on shore, in seagrass beds and on bivalve aquaculture installations.

Recommendation: Add, although not very widespread in GB yet it is likely to be impossible to eradicate, natural dispersal is slow but it can easily spread by other pathways such as recreational boating.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Arthropoda: Malacostraca Amphipoda: Caprellidae:	Shrimp	*Caprella mutica* Schurin, 1935	Japanese skeleton shrimp	Add

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Typically found on a range of natural substrata including hydroids and attached or drifting macro-algae (seaweed), and also artificial substrata such as ropes, buoys, boat hulls and floating pontoons. Often found associated with areas of human activity; marinas, harbours, aquaculture sites.

This association with human activity and artificial structures means that its accidental introduction and spread in the wild is likely to be high.

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

It has an environmental impact in aquarium trials the Japanese skeleton shrimp has displayed aggressive competitive behavior, displacing native skeleton shrimps from the substrate even at low densities. While this behavior has not been observed in the wild, Japanese skeleton shrimps have been recorded living in close proximity to native shrimps under the same environmental conditions, suggesting that similar situations may arise. The wider environmental implications have yet to be confirmed, but it is possible that it will have a significant impact on benthic communities.

It also has a socio-economic impact in the summer months, high densities of Japanese skeleton shrimp have been known to block water intakes on pumps for the feeding systems at caged fish sites and have settled on mussel lines which should have been covered with juvenile mussels. Economic costs associated with removal of fouling organisms and loss of utility may be incurred.

A risk assessment of medium has been carried out for this species which can be found here.

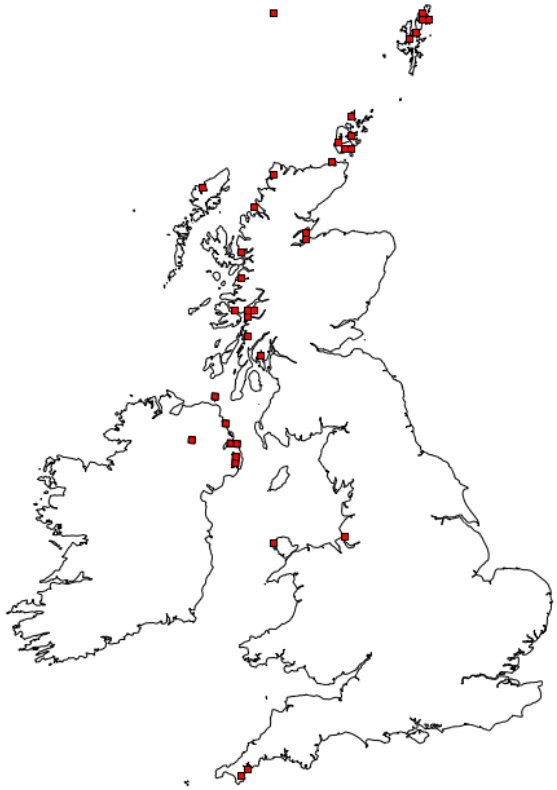
Other information has come from the factsheet (Sweet, 2012)

1.3 Known native global range of the animal.

Native to sub-boreal waters of North-East Asia.

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Widely distributed within the Northern hemisphere and recently found in New Zealand. In GB the Japanese skeleton shrimp has been recorded from southern and south west England, the west coast of Scotland and the Western Isles.



Accessed from the NBN 24/07/15.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

A rapidly invading species; within 40 years the Japanese skeleton shrimp has spread throughout the Northern hemisphere and has recently been found in New Zealand. In the UK, its range has extended throughout the North Sea and Celtic Sea coasts and the English Channel in less than 14 years. Established non-native populations are now found on both coasts of North America, Western Europe and New Zealand.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

The Japanese skeleton shrimp has been found in high concentrations in marine Special Areas of Conservation (SACs) designated for their biogenic reefs. It tends to be found in areas of human activity on natural and artificial substrata including hydroids, macro-algae, mooring ropes and buoys, but has yet to be found in natural habitats.

Recommendation: Add, this species can have both environmental and socio-economic effects and its association with artificial substrata and human activities as well as its increasing distribution mean that it should be added to the list.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia: Mollusca: Gastropoda: Littorinimorpha : Calyptraeidae:	Marine snail	Crepidula fornicata Linnaeus, 1758	American Slipper Limpet	Retain

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Will attach to a number of commercial species transported for culture, including oysters (variety of species), mussels and scallops. This is the primary reason for European spread (Blanchard 1997). Able to attach to and travel with a variety of mobile host species, including the common whelk, scallops, species of crab and turtles. Transport attached to ships hulls, temporary harbour installations rafts and fishing gears (pots and buoys). Attach to and travel with floating litter and debris (reviewed in Sewell *et al*. 2008).

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

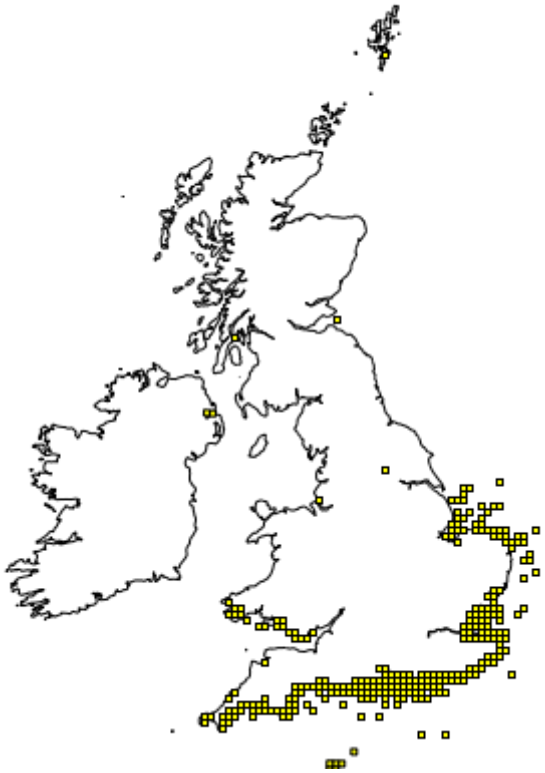
Adult *C. fornicata* consume the same prey as the blue mussel *M. edulis* potentially resulting in trophic competition. It is likely that increased competition will impact mussel communities. Trophic competition is also reported with the Pacific oyster *Crassostrea gigas* (Blanchard et al, 2008; Decottignies et al, 2007). Competition may also occur with other species in the area. The consumption of larvae by *C. fornicata* may limit the settlement of other species including the native oyster *Ostrea edulis* (Walne, 1956). Likely to smother areas previously dominated by bivalves (Minchin *et al*., 1995), again including the native oyster *Ostrea edulis* (Walne, 1956). Should *C. fornicata* cover a sufficient area of the seabed following introduction, it is conceivable that certain species will be locally reduced or lost as a result of reduced or lost suitable habitat. Evidence suggests that negative impacts may be severe on course sand substrata, where reduced bivalve abundance has been recorded on the French Coast (de Montaudouin & Sauriau, 1999). *C.fornicata* may deter predators from mussel beds (Thieltges, 2005a) and increase pressure on alternative prey species. Will attach to a variety of 'host' species including oysters (both native and Pacific) (de Montaudouin & Sauriau, 1999). It is highly likely that the additional energetic demand associated with carrying *C. fornicata* individuals and colonies will have adverse effects on the host, including potential impacts on spawning, feeding and migratory behaviour. Large clumps of *C. fornicata* can disturb normal water flow, leading to the accumulation of fine sediments. Areas of hard or even substrate may be changed dramatically, to fine, nutrient rich sediment with slipper limpet stacks. The accumulation of fine sediments and suspended matter particles may reduce levels of suspended organic matter in the water column. Increased sedimentation caused by slipper limpets may threaten maerl beds (identified as a threat in Brittany; Clark, 2008).

1.3 Known native global range of the animal.

Atlantic Coast, the Pacific Coast and the Gulf of Mexico. States of Mississippi, Massachusetts, Florida, New Hampshire, North Carolina, Connecticut, New York, New Jersey, Virginia, Georgia, Louisiana and Texas in the USA. Nova Scotia, Prince Edward Island and New Brunswick in Canada and, Mexico (MarLIN, 2003).

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Widely distributed in South west England and Wales and spreading Northwards. Established population found in Belfast Lough, northeast Ireland in 2009 (McNeill *et al*, 2010). Studies undertaken to evaluate risk and measures implemented in North Wales to try and prevent introduction into Menai Strait with Mussel Seed Culture (Sewell *et al* 2008). Scoping study undertaken to evaluate potential for removing *C. fornicata* for control and commercial gain (FitzGerald 2007).



Accessed from the NBN 27/07/2015

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

This species appears to be expanding its range Northwards across GB naturally. However, this is exacerbated by climate change and possible movements of dredge spoil and aquaculture practices. See also answer to 1.4.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Crepidula fornicata is typically found attached to shells and stones on soft substrata around the low water mark and the shallow sublittoral. It is often attached to the shells of mussels *Mytilus edulis* and oysters *Ostrea edulis*.

Recommendation: Maintain: spread of this species can be limited by control of aquaculture practices and implementation of effective biosecurity measures

associated to activities such as dredging and dredge disposal where known populations of *C. fornicata* exist.

7.2. Plants

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae: Chlorophyta: Ulvophcase: Bryopsidales: Codiaceae:	Green seaweed	Codium fragile subsp. tomentosoides (van Goor) P.C.Silva, 1955	**Green sea fingers**	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Invasive risk assessment has not been undertaken. No clear pathway, widespread species with natural dispersal a likely pathway.

No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Sweet, 2011a) on which much of the information here is based.

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

In Canada green sea fingers has displaced native seaweed species and become the dominant canopy species in some areas, consequently altering community structure and composition, where conditions permit. Most significant impacts have occurred where algal diversity in the invaded area is low. In Great Britain algal diversity is high and green sea fingers has not yet occurred in nuisance densities.

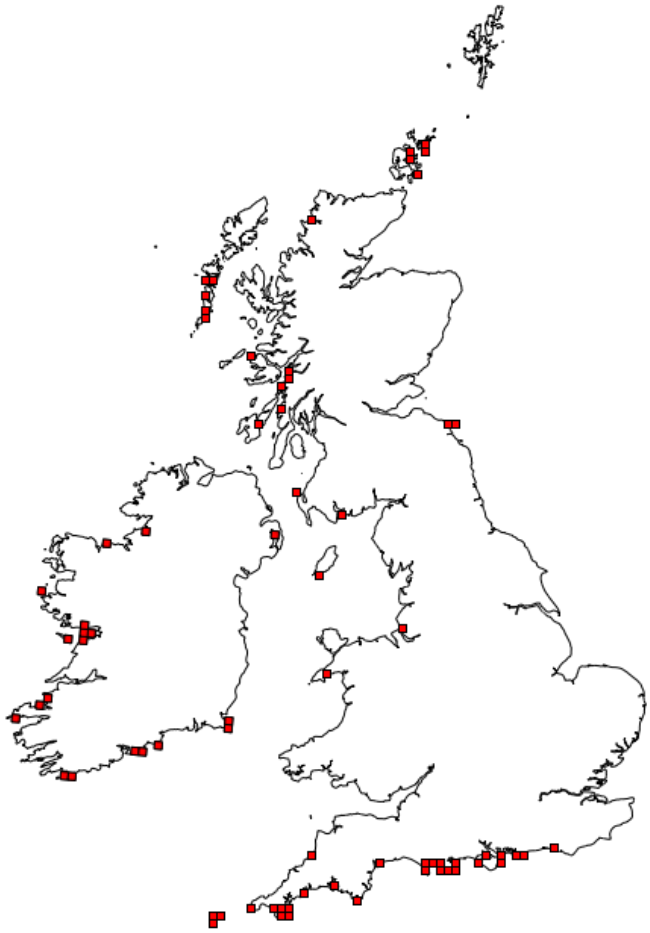
Where it occurs in high densities, green sea fingers can be a fouling nuisance to shellfish beds, smothering mussels and scallops, clogging scallop dredges and interfering with harvesting. It also fouls boats, fishing nets, wharf pilings and jetties. Economic losses may be incurred through cleaning costs, loss of utility and reduced harvest.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

Native range from around Japan in the Pacific Ocean.

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

Occurs along nearly the whole coastline of the eastern United States. In GB it is found from the Scilly Isles, Channel Islands, South Wales, the south coast of England and the west coast of Scotland to Argyll.



Map from NBN accessed 24/07/15

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

First recorded in 1939, now reasonably widespread (NBN data).

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Occurs on rock and coralline algae in pools and on open rock from the mid to lower shore, and in shallow subtidal waters. On sandy or muddy bottoms it attaches to

bivalve shells, rocks or artificial structures. It mainly inhabits protected bays and estuaries but also occurs on semi-exposed shores.

Recommendation: Remove, the main pathway is likely to be natural dispersal rather than human interaction.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae: Rhodophytae: Florideophyceae: Gigartinales: Dumontiaceae:	Red seaweed	*Pikea californica* Harvey, 1853	**Captain's Pike Weed**	**Remove**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

A red seaweed up to 24 cm tall (but usually to 10 cm), forming dense bushy fronds attached by small disc-shaped holdfasts. The main axis is compressed; up to two mm broad and 1.5 mm thick, and branches irregularly. The apices bear irregularly pinnate, spine-like ramuli (small branches). No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Sweet, 2011b) on which much of the information here is based.

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

There are no known environmental or socio-economic impacts associated with this species.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

Native to the Pacific Ocean; Japan and the west coast of North America.

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

Common on the Isles of Scilly but not found on mainland GB coasts or elsewhere in Europe, little evidence of invasiveness,

Data from the NBN accessed on the 25/07/15.

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

The method of introduction is uncertain, but Captain Pike's weed may have been transported to the Isles of Scilly from California by flying boats during World War II.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

In the Isles of Scilly Captain Pike's weed is found on strongly wave-exposed bedrock from the lower shore to depths of 14 m.

Recommendation: Remove, there are no known environmental or socio-economic impacts associated with this species and it has a very localised distribution.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae: Rhodophytae: Florideophyceae: Bonnemaisoniales: Bonnemaisoniaceae:	Seaweed	*Asparagopsis armata*, Harvey, 1855	Hooked asparagus seaweed	Remove

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

The life cycle of harpoon weed has two morphologically different phases; the sexual (gametophyte) plant is rosy, yellowish pink or whitish pink, erect and spreading, with many feathery branches; up to 30 cm tall with some branches developing as conspicuous harpoon-like barbed structures up to 10 mm long. The asexual (tetrasporophyte) plant is rosy pink, filamentous, and forms fine woolly balls 10 - 20 mm in diameter.

Harpoon weed most likely spread to GB from alien populations already established in Europe, by rafting and drifting on surface currents. It may have been introduced to mainland Europe, where it was first recorded in the Bay of Biscay, France, in 1925 with oyster imports. Hull fouling has also been suggested as a possible vector.

No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Sweet, 2011c) on which much of the information here is based.

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human

interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

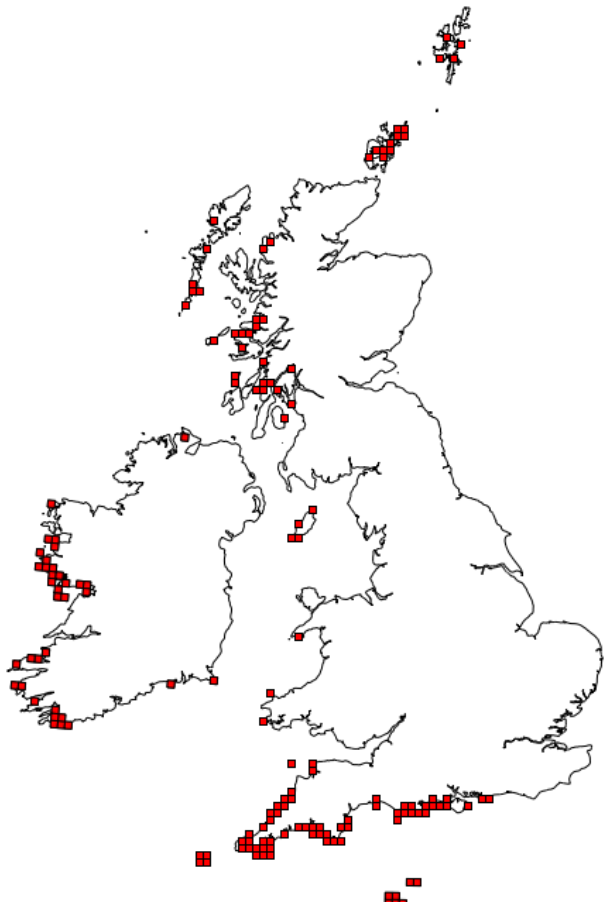
Harpoon weed is reported to dominate algal assemblages in some locations; it forms bloom-like outbreaks and is known to cover 100% of the upper infralittoral (0 – 10 metres depth) during winter in the NW Mediterranean. None of these properties are evident in GB. Can cause a minor nuisance by sticking to the clothing of people swimming and snorkelling using its barbs. Economic losses to fisheries have been reported due to harpoon weed clogging up fishing nets when it occurs in bloom-like outbreaks. In Ireland, harpoon weed has recently been identified as a commercially important species for the production of cosmetics.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

Harpoon weed is endemic to the Southern Hemisphere and thought to originate from Australia and New Zealand.

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

The barbed gametophyte stage of the harpoon weed is only common at south western locations, but the tetrasporophyte phase (known as ‘Falkenbergia’) has spread north to Shetland.



Map from NBN accessed 24/07/15

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

The *Falkenbergia* stage was first recorded in GB in 1949 at Lundy in the Bristol Channel, following its discovery in Galway Bay, Ireland in 1939.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

The gametophyte occurs in shallow subtidal waters or deep pools on the lower shore, attached to a variety of substrates including rock, and sometimes attaches to other seaweeds by its barbed branchlets. The Falkenbergia stage is typically found subtidally; it is epiphytic or sometimes free-living. It is also known to grow in abundance amongst eelgrass beds, for example in the Scilly Isles.

Recommendation: Remove? There is no evidence that this species is causing an environmental impact in GB however, its recent recently been identification as a

commercially important species for the production of cosmetics in Ireland could encourage its spread.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Chromista: Ochrophyta: Phaeophyceae: Fucales:	Seaweed	*Sargassum muticum* (Yendo) Fensholt, 1955	Wireweed	Remove

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Unintentional introduction with commercial oysters from the Canadian state of British Columbia or possibly Japan into France where it may then have reached GB by natural dispersal or as a fouling organism on boats and shellfish.

The most pathway in GB is natural dispersal.

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Wireweed out-competes native species because it is fast growing and reproduces within the first year of life by self-fertilisation producing large numbers of offspring. Abundance of wireweed has been correlated with reduction in diversity of native seaweeds and other species such as sea oak. Dense stands reduce light, increase sedimentation and alter temperature in rockpools.

Wireweed is considered a nuisance in harbours, beaches and shallow waters and can impair recreational activities such as swimming, diving, sailing and kayaking through entanglement.

Wireweed fouls commercial oyster beds and fishing gear increasing costs associated with these activities. Dense stands may inhibit recreational activities reducing tourism and recreation related financial income in some places. Removal from man-made structures also contributes to economic costs.

A risk assessment of medium has been carried out for this species which can be found here.

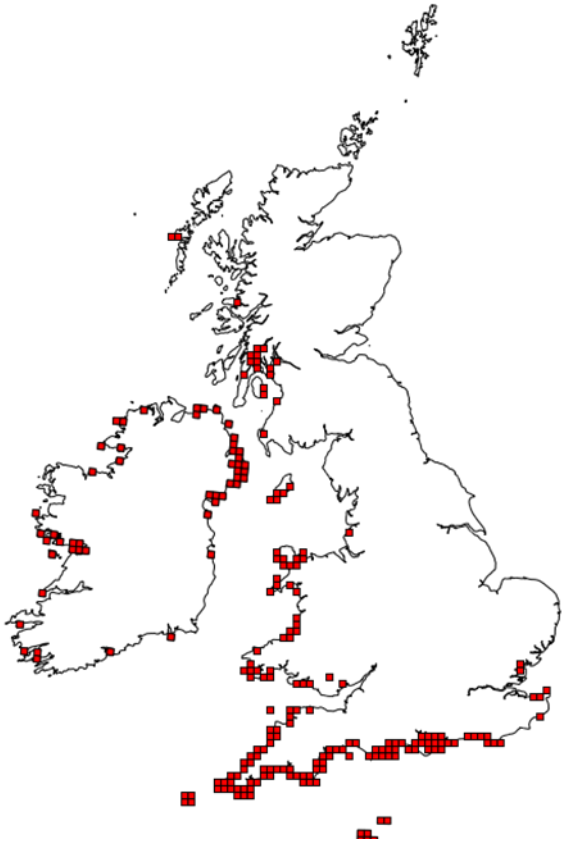
Other information has come from the factsheet (Sewell, 2011).

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

The native range of wireweed is the north-western Pacific shores of Japan, Russia, Korea and China.

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

Wireweed is present at suitable habitats along the south and west coasts of England, Wales and Scotland. Very wide spread species.



Map from NBN accessed 24/07/15

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

Wireweed first appeared on the Isle of Wight in 1973 and has since spread along the south coast of England and into Wales, Ireland and Scotland. Fast spreading.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Grows on hard surfaces in shallow waters and intertidally, particularly in rockpools. The species can also tolerate estuarine conditions. It can become detached and found floating in the sea.

Recommendation: Remove, although an impacting species the species is now so wide spread and spread by natural dispersal that its listing on schedule 9 has no benefit.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Chromista: Ochrophyta: Phaeophyceae: Laminariales: Laminariaceae:	Seaweed	*Macrocystis pyrifera (Linnaeus) C.Agardh, 1820*	Giant Kelp	Remove

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

M. pyrifera is one of the fastest-growing organisms on Earth. They can grow at a rate of 0.6 metres (2 ft) a day to reach over 45 metres (148 ft) long in one growing season.

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Not present in the UK and no risk assessment has been carried out for this species it has been utilised as a food source and a dietary supplement however commercial production has never been widespread as it was not economically viable although it is currently used as a food source for abalone culture.

As a large fast growing species which likes cooler waters it could potentially outcompete other kelps in UK waters causing changes to the ecosystem however, there is no evidence that they are currently found in the UK.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

M. pyrifera is found in North America (Alaska to California), South America, South Africa, New Zealand, and southern Australia. It thrives in cooler waters where the ocean water temperature remains below 70 °F (21 °C).

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

Not known in the UK, no records found on the NBN gateway.

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

Not known in the UK

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Not known in the UK

Recommendation: Remove, not known to exist in the UK.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Chromista: Ochrophyta: Phaeophyceae: Laminariales: Laminariaceae:	Seaweed	*Macrocystis angustifolia* Bory de Saint-Vincent, 1826	Giant Kelp	Remove

1.7 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Taxonomic synonym of *Macrocystis pyrifera* (Linnaeus) C. Agardh see entry for Macrocystis *pyrifera*.

Information taken from algaebase:

Reference for synonymy: Demes, K.W, Graham, M.H. & Suskiewicz, T.S. (2009). Phenotypic plasticity reconciles incongruous molecular and morphological taxonomies: the giant kelp, *Macrocystis* (Laminariales, Phaeophyceae), is a monospecific genus (note). *Journal of Phycology* 45(6): 1266-1269.

1.8 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

See entry for *Macrocystis pyrifera*.

1.9 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

See entry for *Macrocystis pyrifera*.

1.10 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

See entry for *Macrocystis pyrifera*.

1.11 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

See entry for *Macrocystis pyrifera*.

1.12 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

See entry for *Macrocystis pyrifera*.

Recommendation: Remove, see entry for *Macrocystis pyrifera*.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Chromista: Ochrophyta: Phaeophyceae: Laminariales: Laminariaceae:	Seaweed	*Macrocystis integrifolia* Bory de Saint-Vincent, 1826	Giant Kelp	Remove

1.13 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Taxonomic synonym of *Macrocystis pyrifera* (Linnaeus) *C. Agardh* see entry for Macrocystis *pyrifera*.

Information taken from algaebase:

Reference for synonymy: Demes, K.W, Graham, M.H. & Suskiewicz, T.S. (2009). Phenotypic plasticity reconciles incongruous molecular and morphological taxonomies: the giant kelp, *Macrocystis* (Laminariales, Phaeophyceae), is a monospecific genus (note). *Journal of Phycology* 45(6): 1266-1269.

1.14 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

See entry for *Macrocystis pyrifera*.

1.15 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

See entry for *Macrocystis pyrifera*.

1.16 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

See entry for *Macrocystis pyrifera*.

1.17 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

See entry for *Macrocystis pyrifera*.

1.18 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

See entry for *Macrocystis pyrifera*.

Recommendation: Remove, see entry for *Macrocystis pyrifera*.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Chromista: Ochrophyta: Phaeophyceae: Laminariales: Laminariaceae:	Seaweed	*Macrocystis laevis* C.H.Hay 1986	Giant Kelp	Remove

1.19 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Taxonomic synonym of *Macrocystis pyrifera* (Linnaeus) C. Agardh see entry for Macrocystis *pyrifera*. Information taken from algaebase: **Reference for synonymy:** Demes, K.W, Graham, M.H. & Suskiewicz, T.S. (2009). Phenotypic plasticity reconciles incongruous molecular and morphological taxonomies: the giant kelp, *Macrocystis* (Laminariales, Phaeophyceae), is a monospecific genus (note). *Journal of Phycology* 45(6): 1266-1269.

1.20 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

See entry for *Macrocystis pyrifera*.

1.21 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

See entry for *Macrocystis pyrifera*.

1.22 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

See entry for *Macrocystis pyrifera*.

1.23 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

See entry for *Macrocystis pyrifera*.

1.24 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

See entry for *Macrocystis pyrifera*.

Recommendation: Remove, see entry for *Macrocystis pyrifera*.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Chromista Ochrophyta Phaeophyceae Laminariales Laminariaceae	Seaweed	*Laminaria japonica* Areschoug 1851[1]	Japanese kelp	Remove

1.25 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

[1] This name is currently regarded as a taxonomic synonym of Saccharina japonica (Areschoug) C.E.Lane, C.Mayes, Druehl & G.W.Saunders. Citation: M.D. Guiry in Guiry, M.D. & Guiry, G.M. 2015. *AlgaeBase*. World-wide electronic publication, National University of Ireland, Galway.

Saccharina japonica is a commercially important species and is extensively cultivated in China, Japan and Korea. No information on this species being invasive.

1.26 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

No known information on the impact of this species

1.27 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

The species is native to Japan, but has been cultivated in China, Japan, Russia, France, and Korea. It is one of the two most consumed species of kelp in China and Japan.

1.28 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

One reference on a website to it being found in France. One unreferenced mention of the species being introduced into the Mediterranean with the likely pathway listed as aquaculture. No information on its presence or distribution in the UK.

1.29 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

No information on its presence or distribution in the UK.

1.30 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Not known in the UK. *Saccharina japonica* is native to Japan and grows well in clear, cold seas, especially in more exposed sites. It is strictly subtidal (usually above 15 meters depth) and needs rocky substrate to grow on.

Recommendation: Remove, not found in the UK and environmental impacts or level of invasiveness unknown.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Chromista Ochrophyta Phaeophyceae Fucophycidae Laminariales Alariaceae	Seaweed	*Undaria pinnatifida* (Harvey) Suringar	Wakame	Retain

1.31 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Introduced to GB via secondary introductions from France, where it was introduced unintentionally with Pacific oysters and intentionally to be grown as a commercial food crop. It is thought to have been accidentally introduced to GB from continental Europe attached to ships' hulls. It has been accidentally introduced to Australia, New Zealand, Tasmania, and the Mediterranean Sea (France, Italy). I was deliberately introduced to Brittany for commercial exploitation. As a potential food crop there is a danger that it could be intentionally moved.

1.32 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

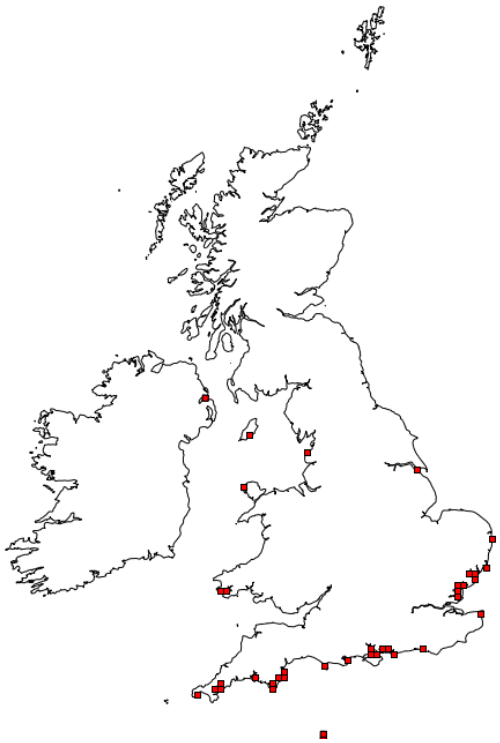
Wakame is likely to compete for space and resources with native species of kelp and other brown seaweeds. It may also compete with other epibenthic animals and seaweeds. No GB Risk Assessment exists for this species. It is however listed on the factsheet, (Sewell, 2012) on which much of the information here is based

1.33 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

Native to cold temperate areas of Japan, China and Korea.

1.34 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

On the British coast its range had extended between Ramsgate and Torquay, in 2004. Wakame Is now also found on the shores and marinas around Plymouth and elsewhere on the South Coast of England. Records on NBN from South Wales, Anglesey and the north west coast of England.



Accessed from the NBN on the 24/07/15

1.35 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

After being recorded from the Hamble in 1994 its range had extended between Ramsgate and Torquay, in 2004. Some evidence of an increasing trend, NBN shows records from South Wales, Anglesey and the north west coast of England.

1.36 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Found subtidally and in the very low intertidal can rapidly colonize new or recently disturbed man-made structures such as floating marina pontoons, rope, pylons, vessel hulls and navigation buoys. It can grow at depths of up to 18 m and can grow in a wide range of wave exposures, from sheltered marinas to the open coast. May also grow on loose cobbles and shells.

Recommendation: Retain, it could be deliberately introduced to a new area as it has been in Brittany.

8. Specific Recommendations: Terrestrial Species

8.1. Animals

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia; Chordata; Amphibia; Anura; Ranidae	Amphibian	*Lithobates catesbeianus* (Shaw 1802)	American bullfrog	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Bullfrogs have been deliberately released as unwanted pets and have escaped from garden ponds where they had been confined as tadpoles (Marchant 2012). Others have been imported accidentally with fish stocks or aquatic plants. Introductions outside GB have also been made for biological control of insect pests and as stocking for human consumption (Marchant 2012).

1.2 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

This species feeds day and night on a wide range of prey, including amphibians, fishes, small mammals, ducklings and small bird species, molluscs, crustaceans and insects. Both predation and competition may adversely affect populations of native frogs, toads and newts (Marchant 2012). American bullfrogs and other non-native amphibians may carry the chytrid fungus *Batrachochytrium dendrobatidis*, and can spread the disease chytridiomycosis to native amphibians (Marchant 2012).

There are no known socio-economic impacts.

Control and monitoring costs so far are thought to have exceeded £100,000 (Marchant 2012). This is an alert species on the GB NNSS website and an invasive species action plan is under development.

1.3 Known native global range of the animal.

Native to North America from Mexico to southern Canada.

1.4 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

The first single in Britain was found in East Sussex in 1996, and breeding was first noted at the same site in 1999 (Marchant 2012). The initial population was successfully eradicated by 2004, after the removal of at least 9,000 animals. In 2006, a further breeding population was discovered in Essex: 100 animals were removed in 2007 but only five in 2008, suggesting that the population had already been greatly reduced. Presence, but not breeding, has been noted at a few further sites in SE England, and e-DNA studies suggest that this species is now fairly widespread in eastern and southern England.

1.5 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

Natural spread and increase is very likely and seems to occur quickly. Only aggressive control and eradication programmes have kept this species in check in Britain.

1.6 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Ponds, lakes and canals.

Recommendation: This species is still establishing in southern Britain, and eradication may still be possible. However, it certainly occurs in the wild and is capable of spreading rapidly. There is clear evidence that American bullfrog is having, or is likely to have, a significant deleterious impact on native biodiversity and it should therefore be added to Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia; Chordata; Amphibia; Anura; Alytidae	Amphibian	*Alytes obstetricans* (Laurenti 1768)	Midwife toad	**Rem**

1.7 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Probably originally arrived as accidental import of tadpoles with nursery water plants from France. Has spread to new sites mostly through deliberate garden introductions (Wilkinson & Baker 2012). Rare in the pet trade.

Apparently very little spread outside suburban garden localities though around 10 colonies in total are thought to persist (Wilkinson & Baker 2012).

1.8 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

None known. The species MAY host the pathogenic amphibian chytrid fungus (*Batrachochytium dendrobatidis*) and therefore potentially impacts native amphibians. This has, however, not been demonstrated to date and ongoing declines of midwife toads in Spain suggest that the species is at least as susceptible to chytrid as native amphibians. The species was brought to GB prior to the emergence of the chytrid in Europe. There are no known competitive or other negative impacts (Wilkinson & Baker 2012).

There are occasional complaints about calling males in residential areas. No economic impacts are recorded (Wilkinson & Baker 2012).

1.9 Known native global range of the animal.

Western Europe (Wilkinson & Baker 2012).

1.10 Animals Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

Introduced to a nursery in Bedford in 1898. This has probably been the source of other colonies both deliberately and accidentally established in Yorkshire, Nottinghamshire, mid Wales and elsewhere.

1.11 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

Thought stable or slowly increasing in GB. Population decreases in parts of its natural range. Not known to be established elsewhere outside its natural range.

1.12 Animals Please specify the types of habitats occupied by the animal in England and Wales.

In GB, this species is found mainly in and around the gardens or nurseries at which it was originally established. Requires warm but humid habitats and ponds (or sometimes flowing water) for breeding (Wilkinson & Baker 2012).

Recommendation: Midwife toad has been present in Britain for more than 100 years, but has hardly spread from its existing locations. There are no known ecological effects, and the only documented impact is the minor nuisance value of calling males in urban areas. Based on this it should be removed from Schedule 9.

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/ Rem
Animal	Animalia; Chordata; Amphibia; Anura; Bombinatoridae	Amphibian	*Bombina variegata*	**Yellow-bellied Toad**	**Rem**

No risk assessment is available for this species. The information summarised here is based on the factsheet (Brown 2011).

1.13 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this animal in the wild.

Yellow-bellied toad was first recorded in Britain in 1965 (Brown 2011). It is thought to have been deliberately or accidentally introduced via the pet trade (Brown 2011).

1.14 Evidence that that the animal poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

There is no clear evidence of ecological or socioeconomic impacts of this species, and introduced populations do not generally persist in Britain (Brown 2011).

1.15 Known native global range of the animal.

Yellow-bellied toad is native to western and central Europe where it is declining, mainly due to habitat loss (Brown 2011). It is listed on Annex II of the Habitats Directive.

1.16 **Animals** Please specify the evidence for the animal being established (i.e. breeding and producing offspring which reach maturity) in the wild and its known range in Great Britain (attach map if possible).

The NBN contains only a single record for this species, in Kent. At times since the 1960s the species has bred in England (e.g. Essex, Surrey, Devon) (Brown 2011). In Surrey the species persisted in a small pond for over a decade, but long term

survival in GB does not seem to be viable (Brown 2011). There are current limited populations in Essex.

1.17 Animals If possible, please provide data on trends in the animals' abundance in England and Wales and Great Britain.

There is no evidence of natural spread from any introduction site.

1.18 Animals Please specify the types of habitats occupied by the animal in England and Wales.

Yellow-bellied toad requires shallow, muddy, usually temporary ponds for breeding with few predators.

Recommendation:
This species has never been properly established in the wild in the UK and has no known impacts. It should therefore be removed from Schedule 9.

8.2. Plants

Plant or animal	Nomenclature	Type of organism	Scientific name and authority	English name	Add/Rem
Plant	Plantae; Asparagaceae; Scylloidieae; Hyacinthaceae	Flowering Plant	*Hyacinthoides hispanica* and hybrids (syns. *Endymion campanulatus*, *Endymion hispanica*, *Endymion hispanicus*, *Hyacinthoides non-scripta hispanica*, *Hyacinthoides non-scripta* subsp. *hispanica*, *Scilla hispanica, Scilla non-scripta* subsp. *hispanica*, *Hyacinthoides hispanica* x *non-scripta*, *Hyacinthoides* x *massartiana*, *Hyacinthoides* x *variabilis*, *Scilla* ? x *patula*	Spanish bluebell and associated hybirds and cultivars	**Add**

1.1 Evidence that human activity results in or is likely to result in the intentional or accidental introduction or spread of this plant (includes vascular plants, bryophytes, algae, fungi) in the wild.

Often planted in the wild (the hybrids are widely sold as native Bluebells) or introduced into wild places with garden waste. Whilst patches increase in size they tend not to disperse far from their site of introduction. Where this species occurs in proximity to the native Bluebell or hybrids, fertile intermediates arise.

Both *H. hispanica* and *H. x massartiana* hybridise freely with the native Bluebell producing fertile seed.

Only *Hyacynthoides non-scripta* the native bluebell, occurs naturally in the UK. All other species have been imported since Victorian times for ornamental purposes. This long history of introduction has resulted in hybridisation over much of the UK due to cross pollination, however the full impact was not realised until a report produced by Plantlife (2003) following a national survey concluded that one sixth of bluebells were found to be hybrids or non-native.

Although there is some direct planting within woodland, generally as the result of error in planting schemes aimed at woodland creation, much of the impact is unintentional through garden escape or cross-pollination where in close proximity. The difficulty of obtaining the native bluebell bulb for planting schemes is likely to be a contributory factor in the planting of non-native species in planting schemes. A more vigorous and robust species than the native bluebell, it can quickly become dominant where planted. As a result, introduction is also commonly through dumping of garden waste containing bulbs which easily become established.

1.2 Evidence that the plant (includes vascular plants, bryophytes, algae, fungi) poses, or could in future pose, a threat to wildlife or biodiversity or human interests (arrival dates, patterns of spread, pathway *etc*.). If one of the GB NNSS risk assessments has been used, please provide the reference.

Both *H. hispanica* and *H. x massartiana* hybridise freely with the native Bluebell producing fertile seed. Both alien taxa are clearly increasing, and although many localities are within pollination distance of native Bluebell woods, large-scale degradation of important native Bluebell populations has not yet occurred.

Ecologically, the erosion by hybridisation of the integrity of a native species with a limited worldwide distribution is the main concern. This would seem most likely to occur where ancient woodlands lie in proximity to cities or other human habitation.

The continued introduction of non-native species into areas in and around native woodland will further degrade the population of the native species, where it may already be too late to prevent complete hybridisation in future decades if action is not forthcoming.

Bluebell is not specifically covered currently by legislation other than Section 8 of the WCA, however it forms an important component of the ground vegetation of SAC woodland communities. Loss of this component of a community would arguably result in Favourable Conservation Status becoming unachievable.

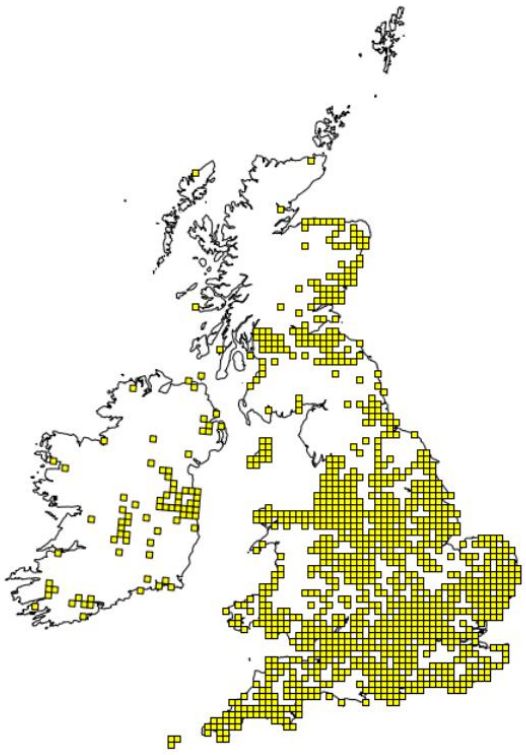
Bluebell woodland is a unique habitat in the UK although not recognised through specific legislative protection, it has a long history of cultural reference through the arts and literature. It is without doubt a much loved feature of the British landscape with a very high cultural value.

1.3 Known native global range of the plant (includes vascular plants, bryophytes, algae, fungi). If the species is native to parts but not all of Great Britain please state the area where it is native.

A European endemic, native to the western Iberian peninsula and possibly north Africa. Naturalized elsewhere in S. and W. Europe, also considered 'established' in Belgium, Germany and Norway.

1.4 Known invasive range of the plant (includes vascular plants, bryophytes, algae, fungi) within Great Britain.

Has been present since the 19th century, spread is now in many 10k squares in Wales in lowland and coastal areas.



Source : NBN Gateway

1.5 Trends in the plant's (includes vascular plants, bryophytes, algae, fungi) abundance in England and Wales and Great Britain.

Although expansion of the non-native species and related hybrids is slow, it is steady and progressive. It has been estimated that without action, within 50-100 years the native species will have been entirely lost from the UK (Plantlife 2015). Where cross-pollination is occurring, complete loss of the native species is to be expected.

1.6 Types of habitats occupied by the plant (includes vascular plants, bryophytes, algae, fungi) in Great Britain.

Woodland, grassland, bracken / heath, urban habitats,

Recommendation: Spanish bluebell and any related hybrids should be added to the Schedule 9 list.

9. Summary of Recommendations and Conclusions

Freshwater species
Add
Topmouth gudgeon – *Pseudorasbora parva*
Goldfish – *Carassius auratus*
Black bullhead – *Ameiurus melas*
Killer shrimp – *Dikerogammerus villosus*
Demon shrimp – *Dikerogammerus haemobaphes*
Bloody-eyed mysid – *Hemimysus anomala*
Asian clam – *Corbicula fluminea*
Quagga mussel – *Dreissena bugensis*

Remove
Rock bass – *Ambloplites rupestris*
Large-mouth black bass – *Micropterus salmoides*
Bitterling – *Rhodeus sericeus*
Pumpkinseed – *Lepomis gibbosus*
Water lettuce – *Pistia stratiodes*
Water hyacinth – *Eichornia crassipes*
Giant salvinia – *Salvinia molesta*
Duck potato – *Sagittaria latifolia*

Retain
Wels catfish – *Siluris glanis*
Zander – *Sander lucioperca*

Marine species
Add
Carpet sea-squirt – *Didemnum vexillum*
Japanese skeleton shrimp – *Caprella mutica*

Remove
Green sea fingers – *Codium fragile subsp. Tomentosoides*
Captain's pike weed – *Pikea californica*
Hooked asparagus seaweed – *Asparagopsis armata*
Wireweed – *Sargassum muticum*
Japanese kelp – *Laminaria japonica*
Giant kelp – *Macrosystis pyrifera*
Giant kelp – *Macrocystis angustifolia*
Giant kelp – *Macrosystis integrifolia*
Giant kelp – *Macrosystis laevis*

Retain
American slipper limpet – *Crepidula fornicate*
Wakame – *Undaria pinnatifida*

Terrestrial species
Add
American bullfrog – *Lithobates catesbeianus*
Spanish bluebell – *Hyacynthoides hispanica and hybrids*

Remove
Midwife toad – *Alytes obstetricans*
Yellow-bellied toad – *Bombina variegata*

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Data Archive Appendix

No data outputs were produced as part of this project.

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