

Black bullhead (*Ameiurus melas*)

- A small (c. 30cm long) freshwater catfish from North America, which can be confused with brown bullhead.
- The only known GB population (Essex) has been eradicated.
- Potential vector of pathogens including herpesvirus.
- Nuisance species for anglers.



History in GB

Introduced to GB in 1885. Records exist which showed a further population in Warwickshire in 1989. Knowledge of its current distribution is patchy, but the only confirmed population of at least 250 individuals was eradicated by the EA in Essex in 2016. Its current distribution and establishment in parts of Western Europe indicate that conditions in GB would enable *A. melas* to survive and reproduce.

Native Distribution

Native to North America



Source: IUCN redlist 2016

GB Distribution

Not established



Eradicated

Impacts

Environmental

- The most significant impact from *A. melas* is likely to be related to pathogen introductions. May be a vector of herpesvirus, bacterial diseases including septicaemia, and parasites.
- Limited impacts on the foodweb due to its predation of invertebrates and occasional fish, which could have an indirect impact on other native fish species, particularly in closed systems.

Economic

- None known

Social

- Nuisance species for anglers, known to take bait intended for other species.

Introduction pathway

Ornamental - this species was previously common in the aquarium trade. However, its introduction is now controlled and limited and an ILFA license required.

Spread pathway

Human-aided - the main translocation drivers of this species are anglers and stock contamination.

Natural - once released can disperse via river systems although details of distance not known.

Summary

	Response	Confidence
Entry	UNLIKELY	HIGH
Establishment	VERY LIKELY	VERY HIGH
Spread	SLOW	HIGH
Impact	MODERATE	LOW
Overall risk	LOW	MEDIUM

Rapid Assessment of: *Ameiurus melas* (Black Bullhead)

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GB Non-native species Rapid Risk Assessment (NRA)

1 - What is the principal reason for performing the Risk Assessment? (Include any other reasons as comments)

Response: To assess the risk associated with this species in Great Britain. The non-native species Programme Board has requested an assessment be completed for this species. It has also been requested by the Water Framework Directive Alien Species Group and is listed as a 'watch list' species by horizon scanning research undertaken on behalf of Natural England.

This species has been widely introduced outside its native range (i.e. 23 different countries). It has also been introduced to GB where some populations have established. However, the current knowledge of distribution in GB is patchy with records of a population in 1989 from Radway Grange Lake in Warwickshire (SP370480) and a population in Essex which was cited by Lever 1977, Wheeler 1978 and has recently been confirmed by Novomeská *et al.* (2013) and Ruiz-Navarro *et al.* (2014).

In May 2014, Environment Agency [eradicated](#) the only confirmed population of black bullhead from a fishery in Essex, England. This species is now considered by the Environment Agency to be eradicated from the wild in GB.

2 - What is the Risk Assessment Area?

Response: Great Britain

3 - What is the name of the organism (scientific and accepted common; include common synonyms and notes on taxonomic complexity if relevant)?

Response: *Ameiurus melas* (synonyms *Ictalurus melas*); Black bullhead. It is often confused with *Ameiurus nebulosus* also known as the brown bullhead. Both species look fairly similar and are difficult to tell apart, especially when young. Perhaps the biggest difference between the two is that black bullheads usually lack the colour mottling found on the sides of brown bullheads. The brown bullhead's chin barbels are dark, grayish black, but may have whitish colour at the base. These help to distinguish the brown bullhead from the black bullhead, as the black bullhead's chin barbels are all black.

4 - Is the organism known to be invasive anywhere in the world?

Response: Despite widespread introductions and establishment across Europe, there is currently no clear evidence of invasion resulting from its introduction outside the native range. This is on the basis that invasion is defined as fast spread and ecological impact on native population. According to the definition of an invasive species in the Invasive Non-Native Framework Strategy for Great Britain, "invasive alien species are species introduced deliberately or unintentionally outside their natural habitats where they have the ability to establish themselves, invade, outcompete natives and take over the new environments." *A. melas* cannot be classified as invasive. Where introduced in other parts of the world *A. melas* has only fulfilled part of the definition as it has been deliberately introduced outside its natural habitats, it has established abundant populations (Thiero

Yatabary 1981; Copp & Penaz 1988; Copp 1989, Belaud 1990; Gozlan et al. 1998; Nowak et al. 2008; Pedicillo et al. 2008; Orrú et al. 2010) but based on the above definition it has failed to invade, outcompete native species and take over the new environments. Other authors have classified this species as invasive but none of them have followed the NN framework strategy for Great Britain and thus reflect a personal perception and classification. For example, in their paper Cucherousset et al. (2006a) have found that after over 85 years of deliberate introduction, young-of-the-year (YOY) and adult *A. melas* accounted for around 20 to 30% of the relative biomass of the fish assemblages, which included 17 other native species. Although abundant, no native species has become extinct (i.e. outcompete native species) and after nearly a century, it has still not taken over the new environments (i.e. <50% of fish assemblages). Therefore, it is very important to refer to the above definition and to be careful in the interpretation of the results. It is also important to place the results in a wider context, as for example in Cucherousset et al.'s (2006a) paper, the Brière marsh has rapidly changed during the last century due to a complete shift in the management of aquatic habitats and this may have artificially sustained the abundance of *A. melas*.

5 - What is the current distribution status of the organism with respect to the Risk Assessment Area?

Response: There have been some reports of establishment (see Q1). Currently, the only certainty about its status is that this species has been introduced into the wild in GB and that it has survived in at least one location, a pond called Tom's Pond (51°42'26''N; 0°10'58''E), Essex, England, where at least 250 individuals have been collected (Novomeská et al. 2013; Ruiz-Navarro *et al.* 2014).

6 - Are there conditions present in the Risk Assessment Area that would enable the organism to survive and reproduce? Comment on any special conditions required by the species?

Response: Although the temperature threshold for reproduction is indicated to be 20–21°C, which in theory would limit its establishment within the warmest part of GB, its current distribution and establishment in Albania, Austria, Belgium, Denmark, France, Germany and Netherland among other countries, indicates that the conditions present in GB would enable *A. melas* to survive and reproduce. *A. melas* does not have mass shoal reproduction but results from an elaborate reproductive and nest guarding behaviour that accounts for a high survival rate of the offspring.

7 - Does the known geographical distribution of the organism include ecoclimatic zones comparable with those of the Risk Assessment Area or sufficiently similar for the organism to survive and thrive?

Response: Yes (see above response)

8 - Has the organism established viable (reproducing) populations anywhere outside of its native range (do not answer this question if you have answered 'yes' to question 4)?

Response: Yes (see establishment section below)

9 - Can the organism spread rapidly by natural means or by human assistance?

Response: Yes. *A. melas* has spread and is considered invasive in other parts of Europe. The situation in GB is different, with relatively little spread since this species was introduced in the 19th century.

10 - Could the organism itself, or acting as a vector, cause economic, environmental or social harm in the Risk Assessment Area?

Response: *A. melas* could act as a vector for a few pathogens including pathogens responsible for Infection haematopoietic necrosis (IHN) to which rainbow trout (*O. mykiss*) and Atlantic salmon (*S. salar*) are susceptible (<http://www.scotland.gov.uk/Topics/marine/Fish-Shellfish/FHI/importexport/vectorspecies>). Based on the economic importance of these target salmonid species, we could expect economic, environmental and social risks in GB. That being said, these pathogens are not specific to *A. melas* and are therefore not a threat specific to this species (i.e. added vector).

Entry Summary

Estimate the overall likelihood of entry into the Risk Assessment Area for this organism (comment on key issues that lead to this conclusion).

Response: *unlikely*
Confidence: *high*

Comments (include list of entry pathways in your comments):

A. melas has already been introduced and established populations have been reported in the RAA (DAISIE <http://www.europe-aliens.org> & IMPASSE database - not yet available online). However, its introduction is now controlled and limited due to the restrictions imposed by the current ILFA legislation. This species was originally part of the ornamental trade but is now no longer available. In addition, this is a species easily recognisable in a fish consignment and therefore it is less likely to be introduced as a contaminant of other fish stock imports.

Although this species was common in the aquarium trade in the UK (see for example <http://www.scotcat.com/factsheets/melas.html>) since November 1998 a licence is required to keep *A. melas* in the UK. “Ornamental” does not refer stricto-sensu to aquarium trade but also includes species sold in garden centres for garden ponds. This is similar for other species such as, for example, golden orfe or sterlet. It is still sold by some fish farms in the US [see for example <http://www.smithcreekfishfarm.com/p-94-the-bullhead-catfish.aspx>] and therefore this species is technically still available on the “ornamental” market (albeit at low levels). Based on the need for a licence and the fact that we do not have a native catfish species in the UK, in comparison to other species it would be relatively easy to control their import. Having said that, their presence in Europe and the UK does not prevent intentional translocations (albeit illegal).

In GB, anglers are mainly attracted towards the European catfish (Wels) *Silurus glanis*. Nonetheless, translocations from established populations are highly likely due to anglers’ behaviour and interest in exotic species. The current distribution of *A. melas* in the UK remains unclear but the only confirmed population (now eradicated) was found in Essex (Lever 1977; Novomeská et al. 2013; Ruiz-Navarro et al. 2014) with unconfirmed sightings in west Yorkshire; the west midlands and East and South East London (IMPASSE database). The latter records are unconfirmed because land owners refused to allow samples to be taken from their waters (EA personal com.).

The risk of entry is given as unlikely because this species is currently not available in the ornamental trade, no consignments containing the species have entered the UK since before 2000 (see Copp et al. 2007), there have been no movements of the species (Copp et al. 2010a, 2010b) and this species is believed to have been eradicated from the wild.

Establishment Summary

Estimate the overall likelihood of establishment (comment on key issues that lead to this conclusion).

Response: *very likely*
Confidence: *very high*

Comments (state where in GB this species could establish in your comments, include map if possible):

This response is based on the confirmed presence of a self-sustaining population in England (Novomeská et al. 2013; Ruiz-Navarro *et al.* 2014) and the species' current distribution and the establishment of *A. melas* in Europe, including all major catchments in France as well as Belgium, the Netherlands through the River Rhine, as well as Austria, Slovakia right down to Hungary and Romania through the Danube River (Boët 1981, Keith & Allardi 2001; Cucherousset *et al.* 2006a, Musil *et al.* 2008, Novak *et al.* 2010). It is also present to the south in Italy and north in Denmark although *A. melas* populations are not too abundant. Figure 1 shows that climate matching between current established populations in Europe and Climatic condition in GB are overlapping with a possible northern limit above a line going from Bristol to York. Based solely on climatic conditions, Wales also seems less likely to support *A. melas* populations (Gallardo and Aldridge 2013). See also Novomeska & Kovac (2009) for life history underpinning the spread of *A. melas*. Ruiz-Navarro *et al.* (2014) states that temperature is not a limiting factor to the species' invasiveness in the UK and that given the opportunity to be more widely dispersed, the species is likely to become invasive in the UK. Although, the species' native range encompasses colder climate zones (updated Köppen-Geiger climate maps; see Peel *et al.* 2007) than are found in the UK and there are self-sustaining populations in Poland, which shares climate zones with the species' native range, it does not indicate that all parts of GB have suitable climatic conditions to allow *A. melas* to establish a population. In effect, the climatic constraint is not the low temperature but the length and amount of high temperature during summer months. For example, although the temperature in Poland goes down fairly low, summers are hot for several months (typical continental climate) which allows species with reproductive thermal limits to establish. This is not the case in the northern part of GB. The map shows the potential for the species to establish in parts of GB as the temperature threshold for reproduction of this species is indicated to be 20–21°C. This information is illustrative and relevant to reproduction rather than growth.

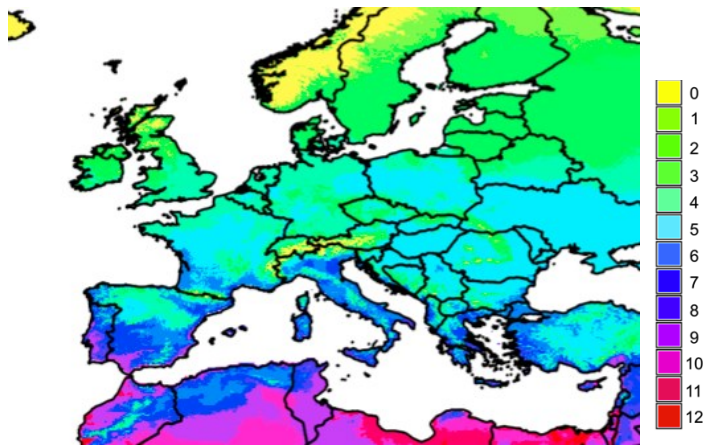


Figure 1: Map of the number of months above 12°C.

In addition, due to the nest guarding reproductive behaviour there is an increased chance of establishment due to greater offspring survival (Campbell and Branson 1978; Dennison and Bulkley 1972; Forbes and Flook 1985; Wallace 1969). *A. melas* is a bottom-dweller, usually living over soft mud where there is plenty of underwater vegetation. It is therefore tolerant of high carbon dioxide and low oxygen levels and levels of pollution (e.g. PCBs) that other fish cannot tolerate (Lesko *et al.* 1996; Valters *et al.* 2005; Weintraub and Birnbaum 2008; Yoo and Janz 2003).

An eradication attempt was undertaken in Essex by a local angling club and failed (Gordon Copp pers com) and this was followed in 2014 with a successful eradication by the Environment Agency

(<http://www.nonnativespecies.org/news/index.cfm?id=151>;

<https://www.facebook.com/environmentagency/posts/10152290572698026>).

Spread Summary

Estimate overall potential for spread (comment on key issues that lead to this conclusion).

Response: *slow*
Confidence: *high*

Comments (include list of spread pathways in your comments):

Owing to the current import restrictions resulting from the need of an ILFA licence and the difficulty in obtaining supplies of this species through the ornamental trade, the main pathway of spread is likely to be translocation across catchments by humans. *A. melas* appears only to be present in a few locations within GB (possibly none now, following the eradication of the Essex population) limiting its potential spread through a translocation pathways. The main translocation drivers are anglers and stock contamination from import or movement of fish. Anglers' interest in *A. melas* remains extremely limited and although we cannot totally rule out this pathway, the risk of spread via human translocations is expected to be low.

Similarly, due to the morphological characteristics of *A. melas*, it is more likely to be noticed as a contaminant of fish stock movement. However, it is important to notice that given that the species resides on the bottom except as a juvenile, it is more likely than some other species to be overlooked when consignments are examined

Therefore, the overall potential spread is likely to be slow.

Impact Summary

Estimate overall severity of impact (comment on key issues that lead to this conclusion)

Response: *moderate*
Confidence: *low*

Comments (include list of impacts in your comments):

There is very limited scientific evidence of potential impact across all the introduced and established population of *A. melas* in Europe. Based on its diet (mostly invertebrates but occasionally fish as seen in Declerck et al. 2002), it is likely to have a limited impact on the foodweb. However, in certain conditions, in particular in closed systems, large populations could be formed and therefore a greater depletion at the base of the foodweb could have an indirect impact on other native fish species. This is a potential outcome based on similar observations on bottom feeders (Britton et al. 2010a), but until now there is no evidence to support this specifically for *A. melas* with the possible exception of the studies by Braig & Johnson (2003) and Lionberger and Hubert (2007). However, the conclusions of the latter study remain fairly vague. There is also a study by Leunda et al. (2008) that highlights *A. melas* as a consumer of plant material, terrestrial prey and co-occurring fish species (native or exotic), and they thus conclude that *A. melas* could be considered as generalist or opportunistic, foraging on the most abundant and available prey. It also shows that fishes as prey items were present in less than 10% of *A. melas* specimens in all habitat types and that the abundance of fish items in each stomach was quite low (<2%). It is also mentioned that there was no positive relationship between black bullhead size (total length) and fish prey size, probably indicating a lack of selective predation on fishes. Again, this study lacks evidence of the impact of *A. melas* diet on native populations mostly due to a lack of measure of prey availability in the studied systems. However, a more recent dietary study on the English population (Ruiz-Navarro et al. 2014) found that fish were an important component in the species' diet, both in gut contents (30%; Table 1 in that paper) and in isotopic signature (Fig. 3 in that paper), with fish representing a more important dietary component than macroinvertebrates (Ruiz-Navarro et al. 2014).

A. melas predation on native species would only represent a risk if it leads to a significant increase of native

species mortality and to a decline of native species abundance. This is currently not shown in scientific literature despite over a century of *A. melas* introduction (Keith & Allardi 2001; Cucherousset et al. 2006a). Similarly, the presence of *A. Melas* in high abundance could impact on the turbidity of the water and thus impact the diversity and abundance of macrophytes (Braig & Johnson 2003), though this is not specific to *A. melas* (see carp for example).

Under experimental conditions, an indirect behavioural interference with pike *Esox Lucius* predation has been reported. However, there is no understanding if this behaviour is likely to persist in the wild and what are the implications for pike survival. Another, indirect impact resulting from *A. melas* introduction could be a modification of the turbidity with potential indirect effects on other native species foraging. Again, literature on this topic linked specifically to *A. melas* is limited but a study carried on by Kreutzenberger *et al.* (2008) showed that even at extreme biomasses, the turbidity due to the presence of *A. melas* remained significantly lower than the natural turbidity of the open marsh. The greater impact on turbidity within shallow systems may be an indirect one through the destruction of macrophytes and subsequent destabilization of unconsolidated substrates.

The greatest source of impact arising from *A. melas* is likely to be related to pathogen introductions. These are herpesvirus, known as Channel Catfish Virus disease or bacterial diseases, such as columnaris disease, bacterial septicemia by pseudomonas or aeromonas, parasites such as trichodina sp., but so far the most feared *Ichthyophthirius multifilii* has not been traced. *A. melas* has been identified as a potential vector of pathogens responsible for Infection haematopoietic necrosis (IHN) of which rainbow trout (*O. mykiss*) and Atlantic salmon (*S. salar*) are susceptible (<http://www.scotland.gov.uk/Topics/marine/Fish-Shellfish/FHI/importexport/vectorspecies>). However, all wild species are generally host of a wide range of pathogens and there is no clear scientific evidence that *A. melas* represents a greater risk than any other fish species currently in GB.

Therefore, this risk is overall moderate but due to the limited scientific knowledge, confidence is low.

Climate Change

What is the likelihood that the risk posed by this species will increase as a result of climate change?

Response: *very low*

Confidence: *high*

Comments (include aspects of species biology likely to be effected by climate change (e.g. ability to establish, key impacts that might change and timescale over which significant change may occur):

The risk from *A. melas* in the wild is very unlikely to change in the next decade. This is because the climate in GB is already well within the current climatic tolerance of this species (which ranges from Denmark to Italy). Over a longer time period (e.g. to 2065) and based on an intermediate climate change scenario (RCP 4.5 - likely range of 0.9-2.0°C global warming increase by 2065) the risk from this species is likely to stay the same, because if we look at other areas where *A. melas* has already been introduced for over 100 years in rivers with summer and winter water temperatures exceeding the climate change forecast for the UK (e.g. River Garonne, Camargue in the south of France), this species has never been considered as invasive despite self-sustaining population or a potential risk for local fish diversity.

Conclusion

Estimate the overall risk (comment on the key issues that lead to this conclusion).

Response: *low*

Confidence: *medium*

Comments: Given this species is believed to have been eradicated from the wild in GB, is unlikely to enter, and based on our current understanding of its ecological impact across its introduced range and the future risk of *A. melas* spread in GB, the overall risk posed by this species is low. Medium confidence reflects uncertainty about the potential unconfirmed presences of this species in parts of GB, potential for illegal introductions and uncertainty around impacts. Its potential impact is likely to arise from the species acting as a vector for an infectious pathogen, although this risk would be moderate based on the non-specificity of the pathogens associated with *A. melas*.

That being said, under specific conditions, in particular small closed water bodies and a high density of *A. melas*, the overall risk is likely to increase to a 'high' status.

References

Provide here a list of the references cited in the course of completing assessment

List:

Other potentially useful references

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