

Water lettuce (*Pistia stratiotes*)



- Floating aquatic plant native throughout the tropics.
- Highly invasive in tropical areas, where it forms dense mats and is considered one of the world's worst invasive species. However, it is not able to establish in GB so impacts here are unlikely.
- A large rise in winter temperatures would be required to enable this species to overwinter, which is unlikely.

History in GB

First recorded in GB in 1983 in a pond at Walthamstow. Up to 1986, it was recorded in one 10km square, by 1999 it was recorded in 7, and by 2010 it had been seen in 22. Currently listed in 36 sites in the NBN gateway where the plant has been observed in summer, but it is ephemeral and dies in winter. To enable this species to overwinter, the average winter temperature would need to increase significantly to above 9°C, and preferably above 16°C. This is unlikely to happen based on projected climate change.

Native distribution

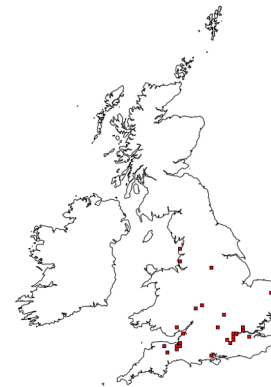
Found throughout the tropics but of uncertain native range. First record was from the Nile in Africa, but the plant's origin may be South America.



Source: NNSIP 2017

Distribution in GB

(ephemeral records, not established)



Source: NBN 2017

Impacts

It is unlikely *P. stratiotes* will extend beyond indoor cultivation, and will not survive winters in GB. It will therefore not have significant impacts in GB.

Environmental

- In tropical areas *P. stratiotes* can form dense mats which disrupt entire ecosystems, by blocking light and oxygen.

Economic

- Can be a serious problem in the tropics where it clogs waterways and damages fisheries.

Social

- In India, *P. stratiotes* harbours mosquitoes that transmit lymphatic filariasis.

Introduction pathways

Ornamental - traded in horticulture and as an aquarium plant; sometimes discarded in the wild.

Spread pathways

Natural - unlikely to spread widely due to limiting climatic conditions.

Summary

	Risk	Confidence
Entry	VERY LIKELY	VERY HIGH
Establishment	VERY UNLIKELY	HIGH
Spread	SLOW	VERY HIGH
Impacts	VERY LOW	VERY HIGH
Conclusion	VERY LOW	HIGH

Information about GB Non-native Species Risk Assessments

The Convention on Biological Diversity (CBD) emphasises the need for a precautionary approach towards non-native species where there is often a lack of firm scientific evidence. It also strongly promotes the use of good quality risk assessment to help underpin this approach. The GB risk analysis mechanism has been developed to help facilitate such an approach in Great Britain. It complies with the CBD and reflects standards used by other schemes such as the Intergovernmental Panel on Climate Change, European Plant Protection Organisation and European Food Safety Authority to ensure good practice.

Risk assessments, along with other information, are used to help support decision making in Great Britain. They do not in themselves determine government policy.

The Non-native Species Secretariat (NNSS) manages the risk analysis process on behalf of the GB Programme Board for Non-native Species. Risk assessments are carried out by independent experts from a range of organisations. As part of the risk analysis process risk assessments are:

- Completed using a consistent risk assessment template to ensure that the full range of issues recognised in international standards are addressed.
- Drafted by an independent expert on the species and peer reviewed by a different expert.
- Approved by an independent risk analysis panel (known as the Non-native Species Risk Analysis Panel or NNRAP) only when they are satisfied the assessment is fit-for-purpose.
- Approved for publication by the GB Programme Board for Non-native Species.
- Placed on the GB Non-native Species Secretariat (NNSS) website for a three month period of public comment.
- Finalised by the risk assessor to the satisfaction of the NNRAP.

To find out more about the risk analysis mechanism go to: www.nonnativespecies.org

Common misconceptions about risk assessments

To address a number of common misconceptions about non-native species risk assessments, the following points should be noted:

- Risk assessments consider only the risks posed by a species. They do not consider the practicalities, impacts or other issues relating to the management of the species. They therefore cannot on their own be used to determine what, if any, management response should be undertaken.
- Risk assessments are about negative impacts and are not meant to consider positive impacts that may also occur. The positive impacts would be considered as part of an overall policy decision.
- Risk assessments are advisory and therefore part of the suite of information on which policy decisions are based.
- Completed risk assessments are not final and absolute. Substantive new scientific evidence may prompt a re-evaluation of the risks and/or a change of policy.

Period for comment

Draft risk assessments are available for a period of three months from the date of posting on the NNSS website*. During this time stakeholders are invited to comment on the scientific evidence which underpins the assessments or provide information on other relevant evidence or research that may be available. Relevant comments are collated by the NNSS and sent to the risk assessor. The assessor reviews the comments and, if necessary, amends the risk assessment. The final risk assessment is then checked and approved by the NNRAP.

*risk assessments are posted online at:

<https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?sectionid=51>

comments should be emailed to nnss@apha.gsi.gov.uk

Rapid Assessment of: *Pistia stratiotes*, Water Lettuce
Author: Jonathan Newman

Version: Draft 1 (March 2012), Peer Review (October 2013), NNRAP 1st review (October 2013), Draft 2 (January 2015), NNRAP 2nd review (February 2015), Draft 3 (May 2015)

Signed off by NNRAP: February 2015

Approved by Programme Board: February 2017

Placed on NNSS website: April 2017

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: This species has been identified as a medium potential risk by PlantLife's horizon scanning.

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: *Pistia stratiotes* L.

Synonyms: (<http://www.theplantlist.org/tpl/record/kew-156674>)

Apiospermun obcordatum (Schleid.) Klotzsch

Limnonesis commutate (Schleid.) Klotzsch

Limnonesis friedrichsthaliana Klotzsch

Pistia aegyptiaca Schleid

Pistia aethiopica Fenzl ex Klotzsch

Pistia africana C. Presl

Pistia amazonica C. Presl

Pistia asiatica Lour.

Pistia brasiliensis Klotzsch

Pistia commutata Schleid

Pistia crispata Blume

Pistia cumingii Klotzsch

Pistia gardneri Klotzsch

Pistia horkeliana Miq.

Pistia lepreuri Blume

Pistia linguiformis Blume

Pistia minor Blume

Pistia natalensis Klotzsch

Pistia obcordata Schleid

Pistia occidentalis Blume

Pistia schleideniana Klotzsch

Pistia spathulata Michx.

Pistia stratiotes var *cuneata* Engl.

Pistia stratiotes var *obcordata* (Schleid.) Engl.

Pistia stratiotes var *spathulata* (Michx.) Engl.

Pistia texensis Klotzsch

Pistia turpini Blume

Pistia turpinii K. Koch

Pistia weigeltiana C. Presl

Water lettuce, floating aroid; Nile cabbage; pistia; shell-flower; tropical duckweed; water bonnet; water

cabbage; water fern; water lily

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

Response: Yes, In Asia, Africa, North America, Central America and the Caribbean, Europe and Oceania (CABI, 2015, <http://www.cabi.org/isc/datasheet/41496>) . *P. stratiotes* is a perennial monocotyledonous aquatic plant present, either naturally or through human introduction, in nearly all tropical and subtropical fresh waterways. It floats on the water surface, with roots hanging below floating leaves. Its growth habit can make it a weed in waterways, where it can kill native submerged plants and reduce biodiversity. (CABI, <http://www.cabi.org/isc/datasheet/41496>)

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

Response: There are 36 sites listed in the NBN gateway (accessed January 2015) where the plant has been observed as an ephemeral in summer. There are no known overwintering sites in the RAA. Occurrence is therefore stochastic and may be under-recorded.

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: Yes. *Pistia* will reproduce vegetatively during summer conditions in the RAA. It produces daughter plantlets on the Bridgwater and Taunton Canal . Flowering and seeding have not been produced.

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: No. The overwintering conditions reported in Šajna *et al.*, (2007) relate to hydrothermal springs in otherwise cold climates. The growth area of *Pistia* seems to be limited by low temperatures (Small, 1933; Muenscher, 1967; Wiggins, 1980). However, scattered ephemeral populations have been reported in cold climates in the Netherlands, the Erie Canal in upstate New York and in Lake Erie in northern Ohio (Dray and Center, 2002). In these colder areas, the plant can act like an annual, re-infesting from seed each spring. Other ephemeral populations may rely on actual re-introductions.

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: n/a

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

Response: yes, very rapidly (refer to section below on spread)

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

Response: No

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: *very likely*

Confidence: *very high*

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

The species is traded both as a horticultural commodity and as a lifestyle commodity (Java Plants, 2012, accessed 26th March 2012, http://www.java-plants.com/product_info.php?products_id=102&gclid=CL31taSrhK8CFdISfAodET9N4g and others.

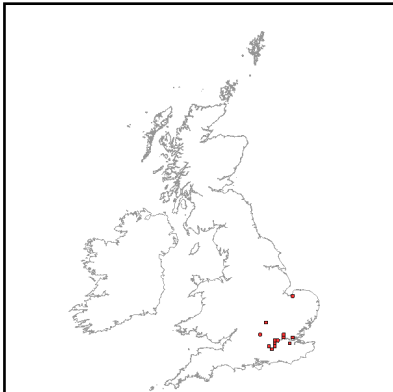
Establishment Summary

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

Response: *very unlikely*

Confidence: *high*

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



The last recorded occurrence in the NBN Gateway for this species is date 1999, but the author has been sent viable samples from the Canal Network in 2009 and 2010. Both the Bridgewater & Taunton Canal and the Grand Union Canal are susceptible to annual reintroductions of this species (NBN Gateway, <http://data.nbn.org.uk>). This species is unlikely to pose a high risk unless cold tolerant varieties arise in cultivation either in the RAA or in the Netherlands, but survival in suitable refugia where warm water is in constant supply (*e.g.* power stations) is a possibility, especially in areas that remain free of air frosts. The minimum water temperature for survival in its invasive range in Europe is 9°C (Mazzeo *et al.*, 1993) and Šajna *et al.*, (2007) showed that although the species survived over winter in Slovenian conditions (in a thermal stream), the minimum water temperature was always above 26°C.

Spread Summary

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

Response: *slow*

Confidence: *very high*

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

The species limited by the temperature profile of the RAA and is unlikely to spread widely of its own accord. However, spread is most likely due to repeated introductions leading to ephemeral populations in favourable summers.

Impact Summary

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

Response: *minimal*

Confidence: *very high*

Comments (include list of impacts in your comments):

General impacts (worldwide) from Global Invasive Species Database: *P. stratiotes* can inflict a severe impact on the environment and economy of infested areas. The dense mats created by connected rosettes of the plant lead to the majority of problems encountered with water lettuce. These mats can have a negative economic effect by blocking waterways, thus increasing the difficulty of navigation and hindering flood control efforts. Mats of *P. stratiotes* can also disrupt natural ecosystems. They can lead to a lower concentration of oxygen in covered waters and sediments by blocking air-water interface and root respiration. Extremely thick mats of *P. stratiotes* can prevent sunlight from reaching underlying water. The cumulative effect of these negative characteristics of the plant is a loss of biodiversity in invaded habitats. *P. stratiotes* mats can also serve as a breeding place for mosquitoes (Rivers, 2002).

However, it is unlikely that *P. stratiotes* will extend beyond indoor cultivation, and will not survive winters in the UK

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: *very 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):

A very significant rise in average winter temperatures is required to enable this species to overwinter. The average winter temperature must be above 9°C, and preferably above 16 °C. This is unlikely to happen in the RAA.

Conclusion

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

Response: *very low*

Confidence: *high*

Comments:

The occurrence of this species in the RAA is due to regular reintroductions from trade or garden escapes, or even deliberate plantings. However, it is unlikely that the species will survive frost free winter periods with temperatures below 5°C for more than 4 – 6 weeks, and will not survive any frost period at all. Rapid growth during favourable weather is limited by periods when water temperatures are above 15°C during both night and day and when day length is longer than 12 hours (Cancian *et al.*, 2009). The water temperature optimum for growth is c. 24 - 26°C which is unlikely to be reached for enough time to allow for significant biomass accumulation in natural situations, but may occur in shallow garden ponds in sunny positions.

Management options (brief summary):

1 - Has the species been managed elsewhere? If so, how effective has management been?

Response:

Yes. Biological control is very effective using the weevil *Neohydronomus affinis* (CSIRO, 2011)

2 - List the available control / eradication options for this organism and indicate their efficacy.

Response:

Biological control is very effective and should be used as a first resort.
Mechanical removal or manual removal of small patches is effective in the RAA
Chemical control is not possible using 2,4-D amine or Glyphosate in the RAA
Environmental control using shade would be an effective measure.

3 - List the available pathway management options (to reduce spread) for this organism and indicate their efficacy.

Response:

Restriction of trade, both horticultural (*e.g.* garden centres) and lifestyle options (*e.g.* Ikea) would limit the desirability of the species and may limit the possibility of cold tolerant varieties developing in cultivation in Europe.

4 - How quickly would management need to be implemented in order to work?

Response:

Not very quickly. Growth is relatively slow in the southern part of the RAA and if control is not implemented it is likely that cold winter temperatures would prevent survival of floating plants.

References

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

List:

- Cancian, L.F., Camargo, A.F.M. and Silva, G.H.G. (2009) Crescimento de *Pistia stratiotes* em diferentes condições de temperatura e fotoperíodo. *Acta Botanica Brasilica*, **23**(2): 552-557
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- Small, JK (1933) Florida to Texas Coastal Plain. Manual of the Southeastern Flora. Lancaster, USA: The Science Press Printing Company.
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