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@fera.gsi.gov.uk

GB NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

For more information visit: www.nonnativespecies.org

	Name of Organism:	***Myriophyllum aquaticum* - Parrot's Feather**
	Objectives:	Assess the risks associated with this species in GB
	Version:	FINAL 29/03/11

N	QUESTION	RESPONSE	COMMENT
1	What is the reason for performing the Risk Assessment?		Request made by the GB Programme Board
2	What is the Risk Assessment area?	GB	
3	Does a relevant earlier Risk Assessment exist?	NO OR UNKNOWN (Go to 5)	An EPPO fact sheet has been produced but no risk assessment that I'm aware of.
4	If there is an earlier Risk Assessment is it still entirely valid, or only partly valid?		
A	**Stage 2: Organism Risk Assessment SECTION A: Organism Screening**		
5	Identify the Organism. Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	YES (Give the full name & Go to 7)	Myriophyllum aquaticum (Vell.) Verdc. Also known as *Enydria aquatica* Vell., *Myriophyllum brasiliense* Cambess., *Myriophyllum proserpinacoides* Gillies ex Hook. & Arn. Note that M. brasiliense is considered a different species in the trade and is considered less cold tolerant than M. aquaticum.
6	If not a single taxonomic entity, can it be redefined?		
7	Is the organism in its present range known to be invasive, i.e. to threaten species, habitats or ecosystems?	YES (Go to 9)	
8	Does the organism have intrinsic attributes that indicate that it could be invasive, i.e. threaten species, habitats or ecosystems?		
9	Does the organism occur outside effective containment in the Risk Assessment area?	YES (Go to 10)	
10	Is the organism widely distributed in the Risk Assessment area?	YES & Future conditions/management procedures/policies are being considered (Go to 19)	BSBI indicates approximately 400 hectads. Recent rapid spread to native habitats is entirely due to the popularity of this plant in the late 1990s on television gardening programs.
11	Does at least one species (for herbivores, predators and parasites) or suitable habitat vital for the survival, development and multiplication of the organism occur in the Risk Assessment area, in the open, in protected conditions or both?		
12	Does the organism require another species for critical stages in its life cycle such as growth (e.g. root symbionts), reproduction (e.g. pollinators; egg incubators), spread (e.g. seed dispersers) and transmission, (e.g. vectors)?		
13	Is the other critical species identified in question 12 (or a similar species that may provide a similar function) present in the Risk Assessment area or likely to be introduced? If in doubt, then a separate assessment of the probability of introduction of this species may be needed.		
14	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?		
15	Could the organism establish under protected conditions (e.g. glasshouses, aquaculture facilities, terraria, zoological gardens) in the Risk Assessment area?		
16	Has the organism entered and established viable (reproducing) populations in new areas outside its original range, either as a direct or indirect result of man's activities?		
17	Can the organism spread rapidly by natural means or by human assistance?		
18	Could the organism as such, or acting as a vector, cause economic, environmental or social harm in the Risk Assessment area?	YES OR UNCERTAIN (Go to 19)	Significant costs are associated with control of this species, either by mechanical control, manual control or application of herbicides. Dense infestations can exclude native species, or cause flooding in slow flowing channels.
19	This organism could present a risk to the Risk Assessment area and a detailed risk assessment is appropriate.	Detailed Risk Assessment Appropriate GO TO SECTION B	

20	This organism is not likely to be a harmful non-native organism in the Risk Assessment area and the assessment can stop.		

B	SECTION B: Detailed assessment of an organism's probability of entry, establishment and spread and the magnitude of the economic, environmental and social consequences			
	Probability of Entry	**RESPONSE**	**UNCERTAINTY**	**COMMENT**
1.1	List the pathways that the organism could be carried on. How many relevant pathways can the organism be carried on?	few - 1	LOW - 0	Horticultural trade, aquaria and garden ponds. *Myriophyllum* species are popular in the aquatic nursery trade. Fragmentation of natural populations in flowing systems, perhaps enhanced by recreational boating, angling or by deliberate transplantation.
1.2	Choose one pathway from the list of pathways selected in 1.1 to begin the pathway assessments.			Horticultural trade
1.3	How likely is the organism to be associated with the pathway at origin?	very likely - 4	LOW - 0	Deliberate trade
1.4	Is the concentration of the organism on the pathway at origin likely to be high?	very likely - 4	LOW - 0	Deliberate trade
1.5	How likely is the organism to survive existing cultivation or commercial practices?	very likely - 4	LOW - 0	Deliberately cultivated
1.6	How likely is the organism to survive or remain undetected by existing measures?	unlikely - 1	LOW - 0	Common species in trade
1.7	How likely is the organism to survive during transport /storage?	very likely - 4	LOW - 0	Deliberate trade
1.8	How likely is the organism to multiply/increase in prevalence during transport /storage?	unlikely - 1	LOW - 0	Conditions for growth are not normal in transport, but survival of plants is a requirement.
1.9	What is the volume of movement along the pathway?	minor - 1	LOW - 0	Most are now grown in the UK and Europe. The number of plants in the trade is estimated to be of the order of 20,000 per annum. This includes those species mis-identified as M. aquaticum, such as M. robustum, M. heterophyllum, M. brasiliense, and M. prospernaciodes. This figure is based on informal talks with the aquatic nursery trade on volumes sold in 2009.
1.10	How frequent is movement along the pathway?	often - 3	LOW - 0	A common species in trade
1.11	How widely could the organism be distributed throughout the Risk Assessment area?	very widely - 4	LOW - 0	BSBI indicates approximately 400 hectads. Spread of species reliant on fragmentation is very rapid overwinter (Newman, Pers. Obs.) wile M. aquaticum is most common in ponds and static waters, those ponds linked to flowing streams and rivers will provide opportunities for further spread. Recent work but Hussner (unpubl.) shows that introduction of non-native invasive species is correlated with population number, implying increased "ownership" of the species within a defined area. Spread within areas of high population numbers is most likely, either due to increased trade in the commodity, or through increased inocula in the populated environment.
1.12	How likely is the organism to arrive during the months of the year most appropriate for establishment ?	very likely - 4	LOW - 0	Sold in spring for planting in garden ponds
1.13	How likely is the intended use of the commodity (e.g. processing, consumption, planting, disposal of waste, by-products) or other material with which the organism is associated to aid transfer to a suitable habitat?	very likely - 4	LOW - 0	The species is deliberately planted as an ornamental species
1.14	How likely is the organism to be able to transfer from the pathway to a suitable habitat?	very likely - 4	LOW - 0	the species is normally deliberately introduced by human intervention… because this is a popular horticultural species, it is often planted in garden ponds, and may be discarded accidentally into natural habitats. Transfer by large wildfowl is also possible.

	Probability of Establishment	RESPONSE	UNCERTAINTY	COMMENT
1.15	How similar are the climatic conditions that would affect establishment in the Risk Assessment area and in the area of current distribution?	moderately similar - 2	LOW - 0	The plant originates from South America and is known not to tolerate very cold winters present in continental Europe. However, it is know to survive most winters in the UK in its current area of distribution. Personal observation suggests that emergent biomass is relatively susceptible to frosts, but submerged biomass tends to tolerate colder conditions, if not encased in ice. This allows regeneration from submerged material in the following spring. However, regrowth from submerged material is slower than from material with emergent biomass that survives over winter. An experimental population survived encasement in ice and overnight temperature of -14.9 degrees C in January 2010. This population is still viable and producing green shoots as of 1st March 2010. It appears that this species is tolerant of much colder temperatures than previously observed. (Newman, Pers. Obs.). The inability to store phosphate in rhizomes overwinter may limit its distribution in colder areas with oligotrophic water, but overwintering in eutrophic ponds is possible due to compensation in continued P supply in the following spring (Barko and Smart, 1981; Sytsma and Anderson, 1993). No further literature on this subject has been found.
1.16	How similar are other abiotic factors that would affect establishment in the Risk Assessment area and in the area of present distribution?	slightly similar - 1	LOW - 0	Most infestations are human assisted in the introduced range, resulting in introduction to habitats that may not be entirely appropriate. Although the GB distribution is slewed to the south of the country at present, this may reflect availability of propagules, or proximity of suitable native habitats in more densely populated areas. Recent work supporting this by Hussner et al. (unpubl.) has shown that establishment of aquatic invasive species is correlated with population numbers. Water chemistry is not an important factor governing establishment in GB conditions. It is unlikely that limiting nutrient conditions will be encountered anywhere in the UK
1.17	How many species (for herbivores, predators and parasites) or suitable habitats vital for the survival, development and multiplication of the organism species are present in the Risk Assessment area? Specify the species or habitats and indicate the number.	very many - 4	LOW - 0	Freshwater bodies and ecosystems abound in GB, particularly slow-flowing water bodies, ditches, canals, lakes and ponds.
1.18	How widespread are the species (for herbivores, predators and parasites) or suitable habitats vital for the survival, development and multiplication of the organism in the Risk Assessment area?	widespread - 4	LOW - 0	see 1.17
1.19	If the organism requires another species for critical stages in its life cycle then how likely is the organism to become associated with such species in the risk assessment area?	N/A		
1.20	How likely is it that establishment will not be prevented by competition from existing species in the Risk Assessment area?	very likely - 4	LOW - 0	The habit preferences of floating and amphibious macrophytes do not overlap with many native species (except *Glyceria maxima*). Therefore there is little competition from existing species.
1.21	How likely is it that establishment will not be prevented by natural enemies already present in the Risk Assessment area?	very likely - 4	LOW - 0	There are no known natural enemies in GB
1.22	If there are differences in man's management of the environment/habitat in the Risk Assessment area from that in the area of present distribution, are they likely to aid establishment? (specify)	very likely - 4	LOW - 0	Mechanical control will increase fragmentation of the plant which will aid dispersal within systems and increase the likelihood of spread between systems. The lack of suitable herbicides for use in the EU, which limits fragmentation, means that mechanical control is the only option. It is difficult to remove all fragments (Newman, pers. Obs.) and recolonisation is rapid after such management.
1.23	How likely is it that existing control or husbandry measures will fail to prevent establishment of the organism?	moderately likely - 2	MEDIUM -1	Improvements in formulations of glyphosate have improved control. The use of TopFilm (Newman, unpubl.) also improves control of this species using glyphosate. There is some uncertainty about application timing which is why uncertainty is medium.
1.24	How often has the organism been recorded in protected conditions, e.g. glasshouses, elsewhere?	occasional - 2	LOW - 0	It is grown in glasshouse conditions by aquatic nurseries.
1.25	How likely is the reproductive strategy of the organism and duration of its life cycle to aid establishment?	very likely - 4	LOW - 0	The species is dioecious and only female plants have become established in the UK. In its native range seed set is rare (Preston & Croft 1997). Introduced populations spread by asexual (vegetative) means There are no specialised vegetative propagules, but stems are brittle and small fragments break off parent plants with ease, floating away to become established elsewhere.
1.26	How likely is it that the organism's capacity to spread will aid establishment?	very likely - 4	LOW - 0	see above for asexual reproduction strategies.
1.27	How adaptable is the organism?	moderately adaptable - 2	MEDIUM -1	Although some populations survive cold winters, the tolerance of this species to cold European winters is not well understood. It may be able to tolerate
1.28	How likely is it that low genetic diversity in the founder population of the organism will not prevent establishment?	very likely - 4	LOW - 0	asexual reproduction only
1.29	How often has the organism entered and established in new areas outside its original range as a result of man's activities?	many - 3	LOW - 0	**Europe:** Austria, France, Germany, Portugal, United Kingdom. **Asia:** Cambodia, Indonesia (Java), Japan, Malaysia, Philippines, Thailand, Vietnam. Africa: Madagascar, South Africa, Zimbabwe. **North America**: Mexico, USA (Alabama, Arizona, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Missouri, New Jersey, New York, North Carolina, Massachusetts, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Washington). **Central America and Caribbean**: Costa Rica, Nicaragua. **Oceania:** Australia (New South Wales, Queensland, South Australia, Tasmania, Victoria, Western Australia), New Zealand.

1.30	How likely is it that the organism could survive eradication campaigns in the Risk Assessment area?	moderately likely - 2	LOW - 0	Eradication of this species if difficult because of its growth strategy. Submerged nodes are not subject to herbicide treatment and can regrow when emergent material has been killed. Mechanical control increases fragmentation and causes spread.
1.31	Even if permanent establishment of the organism is unlikely, how likely is it that transient populations will be maintained in the Risk Assessment area through natural migration or entry through man's activities (including intentional release into the outdoor environment)?	very likely - 4	LOW - 0	This species is widely traded in the Risk Assessment Area and will not be eradicated quickly.

	Spread	RESPONSE	UNCERTAINTY	COMMENT
2.1	How rapidly is the organism liable to spread in the Risk Assessment area by natural means?	intermediate - 2	MEDIUM -1	Spread between isolated ponds is difficult and could be mediated by transfer on the feet of large birds (Geese and Swans). Spread within flowing systems is more likely due to increased risk of fragmentation over winter.
2.2	How rapidly is the organism liable to spread in the Risk Assessment area by human assistance?	rapid - 3	LOW - 0	Deliberate planting in garden ponds and deliberate / accidental transfer to the wild aids rapid spread within the country, increasing the risk of escape to natural areas.
2.3	How difficult would it be to contain the organism within the Risk Assessment area?	difficult - 3	LOW - 0	This plant is traded widely between European countries, and I imported form South America into various European countries
2.4	Based on the answers to questions on the potential for establishment and spread define the area endangered by the organism.		LOW - 0	The habitats at most risk are natural ponds and slow flowing rivers and canals in close proximity to areas with high population numbers. Dispersal is most likely on a local scale, and so all ponds are the most likely at risk habitat. The question of low temperature limitation has not been adequately addressed, and although temperature limits growth rates in Spring (Newman pers. Obs), it is likely that all ponds, slow flowing canals, backwaters in rivers and other static areas within GB will be at risk from this species.

	Impacts	RESPONSE	UNCERTAINTY	COMMENT
2.5	How important is economic loss caused by the organism within its existing geographic range?	minor - 1	LOW - 0	There are few economic impacts in the native range
2.6	Considering the ecological conditions in the Risk Assessment area, how serious is the direct negative economic effect of the organism, e.g. on crop yield and/or quality, livestock health and production, likely to be? (describe) in the Risk Assessment area, how serious is the direct negative economic effect of the organism, e.g. on crop yield and/or quality, likely to be?	major - 3	MEDIUM -1	The NAPRA economics spreadsheet calucalted a predicted cost of £15.4 million over 25 years for eradication and control costs over the whole of GB. Not all sites would be controlled as private areas would be exempt from any control programme. Anderson (1993) outlines the ways in which aquatic weeds such as M. aquaticum can have detrimental impacts, including interference with the flow of irrigation water, transport, hydro-electric power production, fisheries, recreation, and increased risk of health hazards. M. aquaticum is a particular problem in irrigation channel and river systems". Where these impacts relate to GB (e.g. irrigation, drainage, transport, fisheries, recreation and health) they can have significant direct costs, as well as costs associated with control and maintenance.
2.7	How great a loss in producer profits is the organism likely to cause due to changes in production costs, yields, etc., in the Risk Assessment area?	minimal - 0	LOW - 0	The species is not a crop pest and does not affect commercial production systems, except perhaps for restriction of water supply which is as yet Unquantified.
2.8	How great a reduction in consumer demand is the organism likely to cause in the Risk Assessment area?	minimal - 0	LOW - 0	The species does not affect consumer demand
2.9	How likely is the presence of the organism in the Risk Assessment area to cause losses in export markets?	very unlikely - 0	LOW - 0	There is no effect on export markets
2.10	How important would other economic costs resulting from introduction be? (specify)	minor - 1	LOW - 0	There are effects on amenity value of ponds, some effects of fishing income, but few economic impacts are predicted. The economic costs of loss of angling income are unknown, in addition, the costs of direct management of the species are also unknown, but likely to exceed £1,000 per acre including disposal.
2.11	How important is environmental harm caused by the organism within its existing geographic range?	major - 3	LOW - 0	It is a problem weed in its native South America (Fernandez et al., 1993) and is aggressively spreading in Southern Africa, South East Asia, USA (Anderson, 1993) and Portugal (Teles and Pinto da Silva, 1975). In its native range it is listed as a weed of lakes, ponds, marshes, fens and irrigation channels in Argentina and Brazil, while in lakes and ponds only in Chile (Fernandez et al. 1993). Elsewhere in its range it causes significant problems, e.g. interference with fisheries in South Africa (Jacot-Guillarmod, 1977), major problems for hydroelectric power production and forestry development in Argentina (Fernandez et al., 1993), increased incidence of mosquitoes in California (Anderson, 1993) and it is one of the two most important aquatic weeds at 39% of sites surveyed in the Sorraia river system in Portugal. In California it infested 24% of irrigation channel systems with 914 km of waterway affected by 1985, with direct control costs approximately Euro 200,000 over a 2-year period (Anderson 1993). Hussner and Hilt (2009) show that the presence of neophytes, including M. aquaticum, cause a loss in native species in very short timescales of less than 10 years in rivers in northern Germany. No further literature was found.
2.12	How important is environmental harm likely to be in the Risk Assessment area?	major - 3	MEDIUM -1	Many of the problems this species causes in other parts of world (e.g. California and Portugal) also occur in GB. While M. aquaticum may provide cover for some aquatic organisms, it can seriously change physical and chemical characteristics of water bodies, and infestations alter aquatic ecosystems by shading out algae that serve as the basis of the aquatic food chain (EPPO datasheet). In eutrophic coastal or brackish waters conditions it has been observed to displace native species (EPPO datasheet). In Guernsey, a reduction in native biodiversity has occurred: Myriophyllum aquaticum is a major problem in ponds and wetlands, where it has eliminated many native species (David, 2003 in Varnham, 2006). No published data from other areas of GB is available. No further literature was found.
2.13	How important is social and other harm caused by the organism within its existing geographic range?	moderate - 2	LOW - 0	see comment to 2.11
2.14	How important is the social harm likely to be in the Risk Assessment area?	moderate - 2	LOW - 0	Once established, rapid decline in biodiversity and amenity values are noted
2.15	How likely is it that genetic traits can be carried to native species, modifying their genetic nature and making their economic, environmental or social effects more serious?	moderately likely - 2	HIGH -2	Hybridisation between M. spicatum and M. sibiricum has already occurred in the USA.. It is possible that M. verticillatum and M. aquaticum could hybridise, although this has not yet been noted.
2.16	How probable is it that natural enemies, already present in the Risk Assessment area, will have no affect on populations of the organism if introduced?	likely - 3	MEDIUM -1	No significant herbivory has been noted in UK populations.
2.17	How easily can the organism be controlled?	with some difficulty - 2	LOW - 0	The loss of diquat as an aquatic herbicide has limited the options for chemical control to glyphosate. The addition of TopFilm (Newman unpubl..) has improved control by improving the adherence of the herbicide solution to the hydrophobic leaf surface.
2.18	How likely are control measures to disrupt existing biological or integrated systems for control of other organisms?	very unlikely - 0	LOW - 0	Not applicable to aquatic weed control
2.19	How likely is the organism to act as food, a host, a symbiont or a vector for other damaging organisms?	very unlikely - 0	LOW - 0	None known

2.20	Highlight those parts of the endangered area where economic, environmental and social impacts are most likely to occur		LOW - 0	The habitats at most risk are natural ponds and slow flowing rivers and canals in close proximity to areas with high population numbers. Dispersal is most likely on a local scale, and so all ponds are the most likely at risk habitat. The question of low temperature limitation has not been adequately addressed, and although temperature limits growth rates in Spring (Newman pers. Obs), it is likely that all ponds, canals, backwaters in rivers and other slow flowing or static waterbodies within GB will be at risk from this species.

Summarise Entry	very likely - 4	LOW - 0	Already present
Summarise Establishment	very likely - 4	LOW - 0	Already established
Summarise Spread	rapid - 3	LOW - 0	Traded extensively in the UK, and fragmentation is important over winter.
Summarise Impacts	major - 3	LOW - 0	Shallow ponds and margins of all watercourses are at risk from invasion by this species.
Conclusion of the risk assessment	HIGH -2		
Conclusions on Uncertainty		LOW - 0	

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