***Family:*** ***Haloragaceae***

***Taxon:*** ***Myriophyllum aquaticum***

***Synonym:*** *Enydria aquatica Vell. (basionym)*
*Myriophyllum brasiliense Cambess.*

***Common Name:*** Brazilian water milfoil
parrot's feather
thread of life
water feather

**Questionaire :** current 20090513 **Assessor:** Chuck Chimera **Designation:** H(HPWRA)
**Status:** Assessor Approved **Data Entry Person:** Chuck Chimera **WRA Score 22**

| | | | |
|---|---|---|---|
| **101** | **Is the species highly domesticated?** | **y=-3, n=0** | **n** |
| **102** | **Has the species become naturalized where grown?** | **y=1, n=-1** | |
| **103** | **Does the species have weedy races?** | **y=1, n=-1** | |
| **201** | **Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"** | **(0-low; 1-intermediate; 2-high) (See Appendix 2)** | **High** |
| **202** | **Quality of climate match data** | **(0-low; 1-intermediate; 2-high) (See Appendix 2)** | **High** |
| **203** | **Broad climate suitability (environmental versatility)** | **y=1, n=0** | **y** |
| **204** | **Native or naturalized in regions with tropical or subtropical climates** | **y=1, n=0** | **y** |
| **205** | **Does the species have a history of repeated introductions outside its natural range?** | **y=-2, ?=-1, n=0** | **y** |
| **301** | **Naturalized beyond native range** | **y = 1*multiplier (see Appendix 2), n= question 205** | **y** |
| **302** | **Garden/amenity/disturbance weed** | **n=0, y = 1*multiplier (see Appendix 2)** | **n** |
| **303** | **Agricultural/forestry/horticultural weed** | **n=0, y = 2*multiplier (see Appendix 2)** | **y** |
| **304** | **Environmental weed** | **n=0, y = 2*multiplier (see Appendix 2)** | **y** |
| **305** | **Congeneric weed** | **n=0, y = 1*multiplier (see Appendix 2)** | **y** |
| **401** | **Produces spines, thorns or burrs** | **y=1, n=0** | **n** |
| **402** | **Allelopathic** | **y=1, n=0** | **n** |
| **403** | **Parasitic** | **y=1, n=0** | **n** |
| **404** | **Unpalatable to grazing animals** | **y=1, n=-1** | |
| **405** | **Toxic to animals** | **y=1, n=0** | **n** |
| **406** | **Host for recognized pests and pathogens** | **y=1, n=0** | |
| **407** | **Causes allergies or is otherwise toxic to humans** | **y=1, n=0** | **n** |
| **408** | **Creates a fire hazard in natural ecosystems** | **y=1, n=0** | **n** |
| **409** | **Is a shade tolerant plant at some stage of its life cycle** | **y=1, n=0** | **y** |
| **410** | **Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)** | **y=1, n=0** | **n** |

| | | | |
|---|---|---|---|
| **411** | **Climbing or smothering growth habit** | **y=1, n=0** | **n** |
| **412** | **Forms dense thickets** | **y=1, n=0** | **y** |
| **501** | **Aquatic** | **y=5, n=0** | **y** |
| **502** | **Grass** | **y=1, n=0** | **n** |
| **503** | **Nitrogen fixing woody plant** | **y=1, n=0** | **n** |
| **504** | **Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)** | **y=1, n=0** | **n** |
| **601** | **Evidence of substantial reproductive failure in native habitat** | **y=1, n=0** | **n** |
| **602** | **Produces viable seed** | **y=1, n=-1** | **n** |
| **603** | **Hybridizes naturally** | **y=1, n=-1** | |
| **604** | **Self-compatible or apomictic** | **y=1, n=-1** | **n** |
| **605** | **Requires specialist pollinators** | **y=-1, n=0** | |
| **606** | **Reproduction by vegetative fragmentation** | **y=1, n=-1** | **y** |
| **607** | **Minimum generative time (years)** | **1 year = 1, 2 or 3 years = 0, 4+ years = -1** | **1** |
| **701** | **Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)** | **y=1, n=-1** | **y** |
| **702** | **Propagules dispersed intentionally by people** | **y=1, n=-1** | **y** |
| **703** | **Propagules likely to disperse as a produce contaminant** | **y=1, n=-1** | |
| **704** | **Propagules adapted to wind dispersal** | **y=1, n=-1** | **n** |
| **705** | **Propagules water dispersed** | **y=1, n=-1** | **y** |
| **706** | **Propagules bird dispersed** | **y=1, n=-1** | |
| **707** | **Propagules dispersed by other animals (externally)** | **y=1, n=-1** | **y** |
| **708** | **Propagules survive passage through the gut** | **y=1, n=-1** | |
| **801** | **Prolific seed production (>1000/m2)** | **y=1, n=-1** | **n** |
| **802** | **Evidence that a persistent propagule bank is formed (>1 yr)** | **y=1, n=-1** | **n** |
| **803** | **Well controlled by herbicides** | **y=-1, n=1** | **y** |
| **804** | **Tolerates, or benefits from, mutilation, cultivation, or fire** | **y=1, n=-1** | **y** |
| **805** | **Effective natural enemies present locally (e.g. introduced biocontrol agents)** | **y=-1, n=1** | |

**Designation:** H(HPWRA) **WRA Score** 22

**Supporting Data:**

| | | |
|---|---|---|
| 101 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Is the species highly domesticated? No] No evidence |
| 102 | 2011. WRA Specialist. Personal Communication. | NA |
| 103 | 2011. WRA Specialist. Personal Communication. | NA |
| 201 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Species suited to tropical or subtropical climate(s) 2-high] "Myriophyllum aquaticum (Vell.) Verdcourt is a native aquatic plant of central, eastern and western South America. Its main distribution is at low altitudes, but extending to 1900 m in Brazil and 3250 m in Peru (Orchard, 1981)." |
| 202 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Quality of climate match data 2-high] "Myriophyllum aquaticum (Vell.) Verdcourt is a native aquatic plant of central, eastern and western South America. Its main distribution is at low altitudes, but extending to 1900 m in Brazil and 3250 m in Peru (Orchard, 1981)." |
| 203 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Broad climate suitability (environmental versatility)? Yes] "The plant tolerates a wide range of temperatures, growing most aggressively in tropical areas." |
| 203 | 2009. Hussner, A.. Growth and photosynthesis of four invasive aquatic plant species in Europe. Weed Research. 49: 506–515. | [Broad climate suitability (environmental versatility)? Yes] "Summarising, it can be assumed that at least H. ranunculoides, L. grandiflora and M. aquaticum can grow well under current and likely future central European climate conditions … Hydrocotyle ranunculoides, M. aquaticum and L. grandiflora, are mainly found in their emerged and/or floating growth form in Europe. They survive the European winters in different types of waters (even without any thermal anomaly), either as rhizomes or with small submerged shoots, which may remain green under ice through the winter. For example, H. ranunculoides and M. aquaticum were monitored over the winters 2003/2004 to 2006/2007 and observed to survive under ice for at least 6 weeks" |
| 203 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Broad climate suitability (environmental versatility)? Yes] "M. aquaticum shows a high tolerance to different water levels, which may be important for future habitat conditions in waterbodies and wetlands in Central Europe under the impact of global change with increased water level fluctuations." |
| 204 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Native or naturalized in regions with tropical or subtropical climates? Yes] "Myriophyllum aquaticum (Vell.) Verdcourt is a native aquatic plant of central, eastern and western South America. Its main distribution is at low altitudes, but extending to 1900 m in Brazil and 3250 m in Peru (Orchard, 1981)." |
| 205 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Does the species have a history of repeated introductions outside its natural range? Yes] "This native of South America has become widespread throughout the world as an escape from the aquarium trade." |
| 205 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Does the species have a history of repeated introductions outside its natural range? Yes] "Myriophyllum aquaticum was introduced as an ornamental into Europe at the end of the 19th/beginning of the 20th century (Thiebaut, 2007). The species has spread and currently occurs in several European countries (Diekjobst & Wolff, 1995; Ferreira & Moreira, 1999; Moreira et al., 1999; Denys et al., 2004; Hussner & Lo¨ sch, 2005; Hussner, 2006)." |
| 301 | 1999. Wagner, W.L./Herbst, D.R./Sohmer, S.H.. Manual of the flowering plants of Hawaii. Revised edition.. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI. | [Naturalized beyond native range? Yes] "naturalized in permanent standing or running water, especially in taro paddies and pastures, 0-1,280 m" |
| 301 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Naturalized beyond native range? Yes] "It is naturalized in the rivers and streams of south-western France, Africa, Japan, Java, the United States, New Zealand and eastern Australia." |
| 301 | 2005. Wagner, W.L./Herbst, D.R./Lorence, D.H.. Flora of the Hawaiian Islands website. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm | [Naturalized beyond native range? Yes] "Native to South America. In the Hawaiian Islands, naturalized on Kaua`i, O`ahu, Hawai`i." |

| | | |
|---|---|---|
| 301 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Naturalized beyond native range? Yes] "Myriophyllum aquaticum was introduced as an ornamental into Europe at the end of the 19th/beginning of the 20th century (Thiebaut, 2007). The species has spread and currently occurs in several European countries (Diekjobst & Wolff, 1995; Ferreira & Moreira, 1999; Moreira et al., 1999; Denys et al., 2004; Hussner & Losch, 2005; Hussner, 2006). The rapid growth of M. aquaticum has caused problems at some locations in Europe and local weed management for this species became necessary in parts of south western and western Europe (Moreira et al., 1999; Shaw, 2003)." |
| 302 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Garden/amenity/disturbance weed? No] |
| 303 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Agricultural/forestry/horticultural weed? Yes] "Parrot's feather also limits the recreational use of infested waters and, in some areas, invades rice fields, affecting crop yield." |
| 303 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Agricultural/forestry/horticultural weed? Yes] "Myriophyllum aquaticum is an aquatic plant of still or slow flowing waters. The species mostly occurs in its emerged growth form in dense stands, but submerged shoots can also be found. Due to its rapid growth, M. aquaticum is considered one of the most important aquatic weeds worldwide. In southern Europe, M. aquaticum occurs in irrigation and drainage systems, rice fields and lowland wetlands." |
| 304 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Environmental weed? Yes] "It rapidly colonizes wetlands and forms dense stands that exclude native water plants. Light is strongly reduced and water flow impeded." |
| 304 | 2009. Hussner, A.. Growth and photosynthesis of four invasive aquatic plant species in Europe. Weed Research. 49: 506–515. | [Environmental weed? Yes] "Hydrocotyle ranunculoides, M. aquaticum and L. grandiflora form large dense floating mats, which may lead to serious problems for human use (Pot, 2002), and for the local biodiversity of infested waters (EPPO, unpubl. data). Hussner (2008) described the displacement of native submerged aquatic species due to the expansion of dense (>200 m of shoots m)2; Hussner & Losch, 2007) floating mats of H. ranunculoides and M. aquaticum (Hussner, 2008). At these sites, shading by the floating weed mats reduced the oxygen content of the underlying water layers to <1 mg O2 L)1 (Hussner, 2008; A. Hussner, unpubl. obs.). Floating weed mats such as these, have reached densities of up to 70 kg wet weight m)2 (H. ranunculoides, Newman & Dawson, 1999), 20–26 kg fresh weight (M. aquaticum; Monteiro & Moreira, 1990; Hussner, 2008) and 2 kg dry weight (dw; L. grandiflora; Dandelot et al., 2005) in Europe. One effect of the changing oxygen concentration in the water was the change in habitats, for example, for Corbicula spp. (bivalve molluscs), which now settle on the shoots of H. ranunculoides directly below the water surface (A. Martens, G. Schoolmann, K. Grabow & A. Hussner, unpubl. obs.)." |
| 304 | 2011. Weedbusters. Myriophyllum aquaticum. http://weedbusters.co.nz/weed_info/detail.asp?WeedID=16 | [Environmental weed? Yes] "Forms dense mats, shading out existing native species and preventing new seedlings of native species from establishing, and replaces species that usually grow on the margins of waterbodies. Large clumps dislodge, causing flooding, and rotting vegetation stagnates water, killing fauna and flora. " |
| 305 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Congeneric weed? Yes] "Myriophyllum spicatum…This aquatic is most common in waters of 1-3 m depth, but can invade waters up to 10 m deep. Stems easily fragment and the plant spreads vegetatively. It forms dense stands that shade out other species and alter the temperature profile of the water body. It flourishes in lakes with nutrient rich water, and the spread of the plant is promoted by eutrophication." |
| 401 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Produces spines, thorns or burrs? No] "A submerged aquatic plant with rhizomes and glaucous or grey-green stems up to 2 m long. Leaves are borne in whorls of 4-6, 15-35 mm long, and deeply dissected into 8-30 fine segments." |
| 402 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Allelopathic? No] No evidence |
| 402 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Allelopathic? No] No evidence |
| 403 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Parasitic? No] No evidence |
| 404 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Unpalatable to grazing animals? Unknown] "In some countries it is used as a shade plant in fish ponds and is considered a useful stock plant." |

| | | |
|---|---|---|
| 404 | 2003. Department of Conservation and Recreation. Potential Invader - Parrot Feather: An Exotic Aquatic Plant - Myriophyllum aquaticum. Commonwealth of Massachusetts - DCR, http://www.mass.gov/dcr/watersupply/lakepond/factsheet/Parrot%20Feather.pdf | [Unpalatable to grazing animals? Unknown] "Due to the woody stems and high tannin concentration, most fish find Parrot Feather unpalatable" |
| 405 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Toxic to animals? No] No evidence |
| 405 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Toxic to animals? No] No evidence |
| 405 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Toxic to animals? No] No evidence |
| 406 | 2011. WRA Specialist. Personal Communication. | [Host for recognized pests and pathogens? Unknown] |
| 407 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Causes allergies or is otherwise toxic to humans? No] No evidence |
| 407 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Causes allergies or is otherwise toxic to humans? No] No evidence |
| 408 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Creates a fire hazard in natural ecosystems? No] "A submerged aquatic plant with rhizomes and glaucous or grey-green stems up to 2 m long. Leaves are borne in whorls of 4-6, 15-35 mm long, and deeply dissected into 8-30 fine segments." |
| 409 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Is a shade tolerant plant at some stage of its life cycle? Yes] "The peak in submersed shoot biomass indicates that this growth form is adapted to shade environments and is capable of reduced photosynthetic rates to survive in these environments (Salvucci and Bowes 1982)." |
| 410 | 2009. Hussner, A./Meyer, C./Busch, J.. The influence of water level and nutrient availability on growth and root system development of Myriophyllum aquaticum. Weed Research. 49: 73–80. | [Tolerates a wide range of soil conditions? No. Nutrient rich soils preferred] "It is clear that M. aquaticum, preferring nutrient rich sites (Sytsma & Anderson, 1993b), showed almost exclusively responses to water level when growing on nutrient rich substrate. Growing on substrate with a low nutrient availability, there was no significant response to different water levels. Biomass, total shoot length, root densities were stable at low values. Low water level and low nutrient availability are both moderate stress situations for M. aquaticum, limiting the growth of this species. Stress interactions could have none, potential negative or positive effects on plant performance. However, the effects of stress combination can vary, depending on the relative level of each of the different stresses combined and the plant species (Mittler, 2006). In M. aquaticum, low nutrient availability does not allow a positive growth response with increasing water level, while high nutrient availability does." |
| 411 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Climbing or smothering growth habit? No] "A submerged aquatic plant with rhizomes and glaucous or grey-green stems up to 2 m long. Leaves are borne in whorls of 4-6, 15-35 mm long, and deeply dissected into 8-30 fine segments." |
| 412 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Forms dense thickets? Yes] "It rapidly colonizes wetlands and forms dense stands that exclude native water plants." |
| 501 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Aquatic? Yes] "A submerged aquatic plant with rhizomes and glaucous or grey-green stems up to 2 m long. Leaves are borne in whorls of 4-6, 15-35 mm long, and deeply dissected into 8-30 fine segments." |
| 502 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Grass? No] Haloragaceae |
| 503 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Nitrogen fixing woody plant? No] Haloragaceae |

| | | |
|---|---|---|
| 504 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "A submerged aquatic plant with rhizomes and glaucous or grey-green stems up to 2 m long. Leaves are borne in whorls of 4-6, 15-35 mm long, and deeply dissected into 8-30 fine segments." |
| 601 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Evidence of substantial reproductive failure in native habitat? No] No evidence |
| 602 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Produces viable seed? Not in Australia] "Reproduction, in Australia, is wholly vegetative…Fruit: Not known in Australia. Seed: Not known in Australia] |
| 602 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Produces viable seed? Not outside native range] "Myriophyllum aquaticum is a dioecious species; however, only pistillate plants are found outside of its native range. In fact, staminate plants are rare even in native populations of South America (Orchard 1981). For this reason, seed production is not known to occur (Aiken 1981), and reproduction is exclusively vegetative (Orchard 1981). Vegetative reproduction occurs solely by fragmentation of emergent and submersed shoots." |
| 603 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Hybridizes naturally? Unknown] "...little is known regarding the appearance of staminate flowers, fruit, or seed; and no information is available on factors affecting pollination, fruit development, and seed germination since staminate flowers are rare (Sutton 1985)." |
| 604 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Self-compatible or apomictic? No] "The plant is dioecious." |
| 605 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Requires specialist pollinators? Unknown] "During a comprehensive study of Myriophyllum species, Orchard (1981) found only a few staminate flowers, and two plants with immature fruits, on specimens collected from South America. Therefore, little is known regarding the appearance of staminate flowers, fruit, or seed; and no information is available on factors affecting pollination, fruit development, and seed germination since staminate flowers are rare (Sutton 1985)." |
| 606 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Reproduction by vegetative fragmentation? Yes] "The plant spreads vegetatively by stem fragmentation. Only female plants are present in Britain, California, and southern Africa. The plant has aerial stems floating on the water surface but grows also as a submerged plant." |
| 607 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Minimum generative time (years)? 1] "Survival and spread of M. aquaticum depends solely on vegetative reproduction via fragmentation, as this species does not produce any specialized reproductive structures such as seeds, tubers, or turions (Sutton 1985)." [therefore, any fragment has immediate reproductive potential within the first year of growth] |
| 701 | 2009. Hussner, A.. Growth and photosynthesis of four invasive aquatic plant species in Europe. Weed Research. 49: 506–515. | [Propagules likely to be dispersed unintentionally? Yes] "One obstacle to success has been the regeneration capacity of the species, which as indicated by results in this study is rapid and efficient for C. helmsii, H. ranunculoides, M. aquaticum and L. grandiflora. Therefore, mechanical control of these species could be inefficient due to the fast recolonisation of controlled waters. Additionally, the ongoing spread of these species could be promoted by plant fragments drifting to downstream waters and small stem fragments may also be readily spread from actual sites of occurrences to new waters via waterfowl and other vertebrates (Figuerola & Green, 2002), or as a result of human sport activities (e.g. boating, diving, fishing) and professional navigation (Leung et al., 2006)." |
| 701 | 2011. Weedbusters. Myriophyllum aquaticum. http://weedbusters.co.nz/weed_info/detail.asp?WeedID=16 | [Propagules likely to be dispersed unintentionally? Yes] "Within catchments it is spread by flowing water, and new catchments are infested by fragments spread by boats and trailers, eel nets, diggers, and people 'liberating' fish." |
| 702 | 2001. Kay, S.H./Hoyle, S.T.. Mail Order, the Internet, and Invasive Aquatic Weeds. Journal of Aquatic Plant Management. 39: 88-91. | [Propagules dispersed intentionally by people? Yes] "Invasive, exotic weeds have been serious problems in freshwater systems in the United States for more than a century. Highly invasive species, including water hyacinth (Eichhornia crassipes (Mart.) Solms), Eurasian water milfoil (Myriophyllum spicatum L.), purple loosestrife (Lythrum salicaria L.), parrot feather (Myriophyllum aquaticum (Vell.) Verdc.), Brazilian elodea (Egeria densa Planch.), and hydrilla ( Hydrilla verticillata (L.f.) Royle), largely have been the result either of intentional introductions for ornamental use or subsequent use as ornamentals after the initial introduction (Countryman 1970, Couch and Nelson 1985, Nelson and Couch 1985, Penfound and Earle 1948, Schmitz 1990, Sutton 1985)." |

| | | |
|---|---|---|
| 704 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Propagules adapted to wind dispersal? No] "Reproduction in Australia is wholly by vegetative means. Stem fragments, broken off by wave action, boats or mechanical harvesting, move readily in streamflow and regenerate whenever they settle on sediments." |
| 705 | 2001. Parsons, W.T./Cuthbertson, E.G.. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia | [Propagules water dispersed? Yes] "Reproduction in Australia is wholly by vegetative means. Stem fragments, broken off by wave action, boats or mechanical harvesting, move readily in streamflow and regenerate whenever they settle on sediments." |
| 705 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Propagules water dispersed? Yes] "The plant spreads vegetatively by stem fragmentation. Only female plants are present in Britain, California, and southern Africa. The plant has aerial stems floating on the water surface but grows also as a submerged plant." |
| 706 | 2009. Hussner, A.. Growth and photosynthesis of four invasive aquatic plant species in Europe. Weed Research. 49: 506–515. | [Propagules bird dispersed? Possibly] "One obstacle to success has been the regeneration capacity of the species, which as indicated by results in this study is rapid and efficient for C. helmsii, H. ranunculoides, M. aquaticum and L. grandiflora. Therefore, mechanical control of these species could be inefficient due to the fast recolonisation of controlled waters. Additionally, the ongoing spread of these species could be promoted by plant fragments drifting to downstream waters and small stem fragments may also be readily spread from actual sites of occurrences to new waters via waterfowl and other vertebrates (Figuerola & Green, 2002), or as a result of human sport activities (e.g. boating, diving, fishing) and professional navigation (Leung et al., 2006)." |
| 706 | 2011. Weedbusters. Myriophyllum aquaticum. http://weedbusters.co.nz/weed_info/detail.asp?WeedID=16 | [Propagules bird dispersed? Possibly] "Birds are unlikely to spread it." |
| 707 | 2009. Hussner, A.. Growth and photosynthesis of four invasive aquatic plant species in Europe. Weed Research. 49: 506–515. | [Propagules dispersed by other animals (externally)? Yes] "…the ongoing spread of these species could be promoted by plant fragments drifting to downstream waters and small stem fragments may also be readily spread from actual sites of occurrences to new waters via waterfowl and other vertebrates (Figuerola & Green, 2002)…" |
| 708 | 2011. WRA Specialist. Personal Communication. | [Propagules survive passage through the gut? Unknown] Not known if fragments can be dispersed or survive internally |
| 801 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Prolific seed production (>1000/m2)? No] "Myriophyllum aquaticum is a dioecious species; however, only pistillate plants are found outside of its native range. In fact, staminate plants are rare even in native populations of South America (Orchard 1981). For this reason, seed production is not known to occur (Aiken 1981), and reproduction is exclusively vegetative (Orchard 1981). Vegetative reproduction occurs solely by fragmentation of emergent and submersed shoots." |
| 802 | 2010. Wersal, R.M.. The Conceptual Ecology and Management of Parrotfeather [Myriophyllum aquaticum (Vell.) Verdc.]. PhD Dissertation. Mississippi State University, MS | [Evidence that a persistent propagule bank is formed (>1 yr)? No] "Survival and spread of M. aquaticum depends solely on vegetative reproduction via fragmentation, as this species does not produce any specialized reproductive structures such as seeds, tubers, or turions (Sutton 1985)." |
| 803 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Well controlled by herbicides? Yes] "Effective herbicides are 2,4-D, diquat, or fluridone approved for use in aquatic environments." |
| 803 | 2007. Gray, C.J./Madsen, J.D./Wersal, R.M./Getsinger, K.D.. Eurasian Watermilfoil and Parrotfeather Control Using Carfentrazone-ethyl. Journal of Aquatic Plant Management. 45: 43-46. | [Well controlled by herbicides? Yes] "Two invasive weed species, Eurasian watermilfoil ( Myriophyllum spicatum L.) and parrotfeather [ Myriophyllum aquaticum (Vell.) Verdc.], were grown in outdoor mesocosms to determine the efficacy of carfentrazone ethyl (a,2-dichloro-5- [4-(difluoromethyl)-4,5-dihydro-3-methyl 5 oxo-1H-1,2,4-triazol- 1-yl]-4-fluorobenzenepropanoic acid, ethyl ester), alone and in combination with 2,4-D, a herbicide routinely used for watermilfoil control. Eurasian watermilfoil control was ≥ 98% when carfentrazone rates were applied alone at ≥ 150 µg ai L -1 . Carfentrazone alone initially controlled parrotfeather; however, tissue viability 3 weeks after treatment suggested plant recovery was likely. Both Eurasian watermilfoil and parrotfeather control was 100% when 2,4-D was applied at 1000 µg ae. L -1 ; however, when 2,4-D rate was reduced to 100 µg ae L -1 control declined to <50%. Herbicide applications containing carfentrazone with low rates of 2,4-D resulted in 100% death of both plant species. These results indicate that Eurasian watermilfoil control can be obtained using carfentrazone alone; but the addition of low levels of 2,4-D may be needed to achieve desired parrotfeather control." |

| | | |
|---|---|---|
| 803 | 2010. Wersal, R.M./Madsen, J.D.. Comparison of Subsurface and Foliar Herbicide Applications for Control of Parrotfeather (Myriophyllum aquaticum). Invasive Plant Science and Management. 3(3): 262-267. | [Well controlled by herbicides? No. But others report success] "Parrotfeather is an invasive, aquatic plant in the United States that is native to South America. It has impaired the use of water bodies throughout the United States and is difficult to control, despite using a variety of management techniques. Our objectives were to examine the efficacy of subsurface applications of seven herbicides labeled for aquatic use and to compare those applications to herbicides that can also be applied to emergent foliage. A replicated mesocosm study was conducted in 378-L (100 gal) tanks beginning in August 2007 and repeated during the same period in 2008. The maximum and half-maximum labeled rates of copper chelate, diquat, endothall, fluridone, triclopyr, and carfentrazone-ethyl were applied to the water column in designated mesocosms. The maximum labeled rate for foliar applications of diquat, triclopyr, and 2,4-D were used to compare treatment methods. Six weeks after treatment (WAT), copper, endothall, fluridone, and carfentrazone-ethyl did not achieve 90% control; in fact, control was less than 50% for each herbicide, and therefore, the herbicides were not considered efficacious for controlling parrotfeather. Diquat at all rates and application methods resulted in 70 to 90% biomass reduction. Triclopyr, with both the highest aqueous concentration and foliar application, resulted in an 84 and 86%, respectively, reduction in biomass at 6 WAT. The foliar application of 2,4-D was the only herbicide and application method that resulted in ≥ 90% biomass reduction of parrotfeather. In these studies, regrowth occurred in all tanks regardless of herbicide or treatment method, indicating multiple applications would be necessary to provide longer-term plant control. Future research should identify possible herbicide combinations or timing of applications to maximize treatment efficacy." |
| 803 | 2011. Weedbusters. Myriophyllum aquaticum. http://weedbusters.co.nz/weed_info/detail.asp?WeedID=16 | [Well controlled by herbicides? Yes] "Before you carry out any control work, make sure the plant you are targeting is not a valued native species. 1. Rake up (November-January): Leave on site to rot down. away from water, and then follow up from February to April by spraying any regrowth. 2. Weedmat: Lay carefully to ensure fragments are not released, start at top of infestation, leave 3-4 months. 3. Spray terrestrial sites (spring-autumn): glyphosate (20ml/L + penetrant) sprayed 4 times over a 10 or more week programme. 4. Lower water level, mechanically remove, use weedmat to cover the area or dry out thoroughly for 2-3 weeks. " |
| 804 | 2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK | [Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "The plant can be removed by mechanical harvesters, although mechanical removal may enhance stem fragmentation." |
| 805 | 2011. California Invasive Plant Council. Invasive Plants of California's Wildland - Myriophyllum aquaticum. http://www.cal-ipc.org/ip/management/ipcw/pages/detailreport.cfm@usernumber=64&surveynumber=182.php | [Effective natural enemies present locally? Unknown] "Parrot's feather has a high tannin content, so most grazers, including grass carp (Ctenopharyngodon idella), find it unpalatable. Grass carp also prefer soft plants, such as Elodea canadensis, and the tough, woody parrot's feather stems are avoided. USDA approved biological control agents are not currently available. Potential agents do exist, but they have yet be tested for host specificity. A complex of insects feed on parrot's feather in its native habitat. Lysathia flavipes, a flea beetle found on parrot's feather in Argentina, causes moderate damage under field conditions. Also found in Argentina is a weevil, Listronotus marginicollis, that apparently feeds only on parrot's feather in its native range. Other insects have been found on parrot's feather in Florida. Lysathia ludoviciana, a flea beetle native to the southern United States and the Caribbean, uses parrot's feather as a host plant for larvae under laboratory conditions. However, the flea beetle is not often found on parrot's feather in the field. Two members of the Tortricidae family, Argyrotaenia ivana and Choristoneura parallela, have also been found on parrot's feather in Florida, but their effect on the plant is unknown. In addition, larvae of the caterpillar, Parapoynx allionealis, mine parrot's feather leaves, but the impact of these larvae is unknown. Fungal control options exist as well. An isolate of Pythium carolinianum collected in California has shown some promise as a potential biocontrol agent. parrot's feather stems experimentally inoculated with this fungus produced significantly less growth than control plants (Washington Water Quality Program 1998)." |