Impact Assessment Record

Scientific Name: *Sagittaria* spp.* Common name: arrowhead

QUESTION	COMMENTS	RATING	CONFIDENCE
Social			
1. Restrict human access?	An emergent aquatic perennial herb. Inhabits shallowly flooded (to 45cm) or marshy areas associated with rivers and streams. In south eastern Australia it is commonly found in drainage ditches and permanent swamps associated with irrigation and drainage systems (Parson & Cuthberston, 1992). Would not impede human access to waterways.	**L**	**MH**
2. Reduce tourism?	Although most commonly found in drainage ditches and irrigation canals, it has also been found in a number of creeks in Victoria including Nine Mile Creek, Wunghnu and Bullock Creek near the junction of the Oven and Murray Rivers. In drain and irrigation channels it can form dense infestations that block the flow of water (Parson & Cuthberston, 1992). Its presence may affect water-based activities such as fishing or swimming.	**MH**	**MH**
3. Injurious to people?	No prickles, spines or burrs described (Aston, 1973). *Sagittaria* species are eaten by ducks and sometimes humans, suggesting that they are not toxic either (Parson & Cuthberston, 1992).	**L**	**MH**
4. Damage to cultural sites?	An aquatic species (Parson & Cuthberston, 1992). Not likely to impact on sites of cultural significance.	**L**	**MH**
Abiotic			
5. Impact flow?	"Sagittaria forms extensive infestations in shallow waterways, seriously restricting water flow and increasing sedimentation, thus aggravating flooding." (BPRC, 2004). An emergent aquatic, firmly rooted. "Dense infestations block channels and drainage ditches" (Parsons & Cuthbertson, 1992). "Arrowhead can severely retard and completely choke water flow in irrigation channels" (Gunasekera & Krake, 2001). Serious impacts to both surface and subsurface water flow.	**H**	**MH**
6. Impact water quality?	"Decaying plant material contributes to water pollution and sedimentation and may also increase the risk of algal bloom and microbial activity" (Sagliocco & Bruzesse, 2005). Likely to cause noticeable but minor effects on dissolved O_2.	**ML**	**MH**
7. Increase soil erosion?	In New Zealand it, "forms extensive infestations in shallow waterways, seriously restricting water flow and increasing sedimentation, thus aggravating flooding" (BPRC, 2004). Increased chance of flooding would create the potential for large-scale soil movement with minor off-site implications.	**MH**	**MH**
8. Reduce biomass?	Where it occurs in drainage channels and irrigation canals (Parson & Cuthberston, 1992) little other vegetation would normally exist. Infestations of arrowhead would increase biomass.	**ML**	**MH**
9. Change fire regime?	Aquatic species (Flower et al, 1999). Fire not applicable in this ecosystem.	**L**	**H**
Community Habitat			
10. Impact on composition (a) high value EVC	Basin=East Gippsland- Cann River (ISC=Excellent); CMA=East Gippsland; CLIMATE=VH. "*S. calycina* [syn. *S. montevidensis* ssp. *calycina*] is very abundant in suitable years, sometimes forming vast beds" (Kaul, 1985). Can displace native water plants which occupy the same habitat (ESC, 2005). Able to form monocultures displacing all species within a layer.	**H**	**MH**

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QUESTION	COMMENTS	RATING	CONFIDENCE
(b) medium value EVC	Aquatic species. All Victorian water bodies considered to comprise high value EVCs only (Weiss pers. coms.)i.	**L**	**H**
(c) low value EVC	Aquatic species. All Victorian water bodies considered to comprise high value EVCs only (Weiss pers. coms.)ii.	**L**	**H**
11. Impact on structure?	"*S. calycina* [syn. *S. montevidensis* ssp. *calycina*] is very abundant in suitable years, sometimes forming vast beds" (Kaul, 1985). Can displace native water plants which occupy the same habitat (ESC, 2005). Able to form monocultures.	**H**	**MH**
12. Effect on threatened flora?	No information found.	**MH**	**L**
Fauna			
13. Effect on threatened fauna?	No information found.	**MH**	**L**
14. Effect on non-threatened fauna?	"Has a negative impact on native species and on the integrity of natural waterways, such as the waterways of the Barmah-Millewa forest, where it has been recorded" (GMW). Large populations obstruct the movement of wildlife and fish (Sagliocco & Bruzzese, 2005). May reduce habitat and have a minor effect on native fauna.	**ML**	**MH**
15. Benefits fauna?	Spoonbills have been observed feeding on the plant (Parson & Cuthberston, 1992). The plant may provide an alternate source of food.	**MH**	**MH**
16. Injurious to fauna?	No prickles, spines or burrs described (Aston, 1973). Spoonbills and carp have been observed feeding on the plant (Parson & Cuthberston, 1992). Not harmful to fauna.	**L**	**MH**
Pest Animal			
17. Food source to pests?	Carp (considered a serious aquatic pest) have been observed feeding on the plant (Parson & Cuthberston, 1992).	**MH**	**MH**
18. Provides harbor?	Carp (considered a serious aquatic pest) have been observed feeding on the plant Parson & Cuthberston (1992) and dense infestations (Parsons & Cuthbertson, 1992) may also provide harbor for them.	**MH**	**MH**
Agriculture			
19. Impact yield?	"Grain yields were not affected by Californian arrowhead densities up to 200 plants/m^2 (Gibson et al, 2001). "Arrowhead reduced the yield of rice by up to 75% if completely unchecked" (Flower, Pratley & Slater, 1999). The ability of rice to outcompete arrowhead depends on when it is sown after flooding (Flower et al, 2002). This species has the capacity to have a serious impact on rice yield.	**H**	**H**
20. Impact quality?	"Weed senesced well before rice maturity" (Gibson et al, 2001). Unlikely to impact on the quality of the produce.	**L**	**H**
21. Affect land value?	Whilst this species can "severely retard and completely choke water flow in irrigation channels" (Gunasekera & Krake, 2001), it is the responsibility of the water service provider to control the weed (GMW) so is unlikely to have an impact on land value.	**L**	**MH**

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QUESTION	COMMENTS	RATING	CONFIDENCE
22. Change land use?	Land use may need to change from rice growing to another crop (see Q. 19), however, this is unlikely to cause a reduction in income.	**L**	**MH**
23. Increase harvest costs?	One study showed that draining rice bays for up to two weeks killed very young arrowhead seedlings, but didn't kill more mature seed-grown plants (Flower et al, 1999). Controlling arrowhead this way may cause a minor increase to the costs of harvest.	**M**	**H**
24. Disease host/vector?	Harbors several important plant viruses (Parsons & Cuthbertson, 1992).	**H**	**MH**

* Sagittaria species include (those naturalised in Australia): *S. montevidensis* ssp. *montevidensis*, *S. montevidensis* ssp. *calycina*, *S. platyphylla* & *S. graminea*.

References cited:

Angelo R & Bouffard DE 2005 *Atlas of the Flora of New England*, Harvard University Herbaria, USA, viewed:15/12/2005, http://neatlas.huh.harvard.edu/Neatlas2/MonoFam-A-C.html.

Aston HI 1973, Aquatic plants of Australia : a guide to the identification of the aquatic ferns and flowering plants of Australia, both native and naturalized, Melbourne University Press, Carlton, Vic.

Bay of Plenty Regional Council (BPRC) 2004, *Sagittaria graminea*, http://www.envbop.govt.nz/weeds/weed6.asp viewed 15/11/04

Eurobodalla Shire Council 2005, (ESC) *Sagittaria*, Eurobodalla Shire Council, NSW, viewed:17/10/2005, http://www.esc.nsw.gov.au/weeds/Sheets/aquatic/A%20Sagittaria.htm

Flower GE, Pratley JE & Silvapalan S 2002, 'Arrowhead- are the results of research relevant in the field?,' *Farmers Newsletter*, p. 44-45.

Flower GE, Pratley JE & Slater PD 1998, 'What makes arrowhead germinate?' *Farmers Newsletter*, p. 58-59.

Flower GE, Pratley JE & Slater PD 1999, 'Early desiccation as a tool for arrowhead control,' *12th Australian Weeds Conference*, Hobart Tasmania p. 543-546.

Gibson KE, Breen JL, Hill JE, Caton BP & Foin TC 2001, 'California arrowhead is a weak competitor in water-seeded rice' *Weed Science*, v. 49 (3) p. 381 – 384.

Goulburn-Murray Water (GMW) (draft) Sagittaria *spp.*

Gunasekera L & Krake K 2001, 'Arrowhead- a serious aquatic weed in northern Victoria', *Victorian Landcare and Catchment Management*, vol. 19. p. 7.

Kaul RB, 1985 'Reproductive phenology and biology in annual and perennial Alismataceae' *Aquatic Botany*, 22, p. 153 – 164.

Mühlenberg H 1980, *The complete guide to water plants*, EP Publishing Ltd, Germany.

Parsons WT & Cuthbertson EG 1992, *Noxious Weeds of Australia* (2nd ed.) CSIRO Publishing, Australia.

RIRDC (Rural Industries Research & Development Corporation) 1999, *Australian Government RIRDC*, RIRDC, Australian Government, Canberra, viewed: 13/12/2005, http://www.rirdc.gov.au/comp00/rice2.html#UCS-16A.

Sagliocco JL & Bruzzese E, 2005 *Nomination of a target weed for biological control* Victorian Department of Primary Industries & Victorian Department of Sustainability and Environment, Australia.

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Sainty, G.R. & Jacobs, S.W.L., 1981, *Waterplants of New South Wales*, Water Resources Commission, NSW.

Revisions

Date	Revised by	Revision

i Weiss, J. Project Leader, Pest Plant Impact Assessment. DPI, Frankston. Tel 9785 0111. (11/07/03)
ii Weiss, J. Project Leader, Pest Plant Impact Assessment. DPI, Frankston. Tel 9785 0111. (11/07/03)