

## National aquatic weeds program – the journey

Andrew R. Petroeschevsky<sup>1</sup> and Philip L. Moran<sup>2</sup>

<sup>1</sup> Industry and Investment NSW, PMB 2, Grafton, NSW 2460, Australia

<sup>2</sup> Noosa and District Landcare Group, PO Box 278, Pomona, Qld 4568, Australia

Corresponding author: [andrew.petroeschevsky@industry.nsw.gov.au](mailto:andrew.petroeschevsky@industry.nsw.gov.au)

**Summary** Since 2003 the National Aquatic Weeds Program has focused on implementation of the national strategic plans for alligator weed (*Alternanthera philoxeroides* Martius), cabomba (*Cabomba caroliniana* Grey) and salvinia (*Salvinia molesta* D.S.Mitchell), each a Weed of National Significance (WoNS). Due to their aquatic nature there are considerable management challenges for stakeholders and there is an ongoing threat of further spread and impact. However, with guidance from a national management group and fulltime coordinator, the program has made significant progress towards implementation of each of the strategic plans by improving coordination, preventing spread, reducing impacts of existing infestations and increasing the knowledge base through research. This paper discusses many of the key initiatives from the national program that have successfully contributed to the implementation of the strategic plans.

**Keywords** Aquatic weeds, alligator weed, cabomba, salvinia, WoNS, biological control, herbicides, surveillance, early detection.

### INTRODUCTION

In 1999, three aquatic weeds: alligator weed, cabomba and salvinia, were listed as Weeds of National Significance (WoNS) due to their invasiveness and potential to spread. National strategic plans were developed for each species and although each differed in their detail they shared the following similar broad objectives:

- Provide national coordination.
- Prevent further spread – including through trade.
- Reduce impacts of current infestations.
- Research to develop improved control and understanding of ecology.

Other commonalities between the strategic plans included similar national distributions and stakeholder groups affected. As a result, in 1999 the National Weeds Strategy Executive Committee determined efficiencies could be gained through joint management of the three aquatic WoNS strategic plans and recommended they be managed together under one coordinator and management group (J. Thorp pers. comm.). Funds were secured in 2003 to initiate a national aquatic weeds program that would oversee the implementation of the aquatic WoNS strategic plans. This involved the employment of a fulltime national

aquatic weeds coordinator and the establishment of the National Aquatic Weeds Management Group (NAWMG).

With the support of both the NAWMG and national coordinator the national program has, over the last 6 years, planned, facilitated and/or monitored implementation of a range of key initiatives to address the above key priorities within the respective strategic plans. The contributions of these are discussed below.

### NATIONAL COORDINATION

The NAWMG, with support of the national coordinator, provides a coordinated and national approach to the management of the aquatic WoNS. The group is comprised of representatives from local and state government, research organisations, community groups and the aquarium industry, which brings a wide range of skills and expertise to the national program (Verbeek 2009). As well as overseeing the implementation of each of the strategic plans, the group has been pivotal in both improving communication and information exchange between all stakeholders affected by the aquatic WoNS, and reducing duplication in areas such as research and extension. Also, familiarity with three aquatic weeds strategies has provided the group with the insight to develop programs that benefits all aquatic weed management (Verbeek 2009), including the aquatic weed surveillance and identification training initiatives and the aquatic plants weed risk assessment, both of which are discussed later.

### PREVENTING FURTHER SPREAD

The aquatic WoNS only occupy a small percentage of their potential range and each strategic plan recognises the importance of reducing new incursions, preventing trade, early detection and rapid eradication response in preventing further spread. Hence key initiatives from the national program include: (1) increase aquatic WoNS surveillance and capacity for early detection and (2) remove cabomba and other weedy aquatic plants from the aquatic plant trade.

**Surveillance and early detection** At the commencement of the national program the NAWMG identified that due to low awareness of both alligator weed and cabomba within the weeds community there

was limited early detection of them. Additionally, there were concerns that, since only limited surveillance and mapping had been undertaken for both species, their real national distributions may have been much greater than what was known. In response, the national program sought to raise awareness of both of these weeds to the weeds community as well as develop initiatives to improve surveillance and detection efforts.

To improve surveillance and early detection capabilities for the aquatic WoNS, the national program oversaw development of both the Recognising Water Weeds (RWW) training package and aquatic weeds surveillance protocols. The RWW training package was designed as a series of one-day workshops to provide participants with the basic botanical skills necessary to distinguish between native aquatic plants and aquatic weeds. Since its development in 2005 it has been highly popular, with over 50 workshops held in ACT, NSW, Qld, SA and WA resulting in over 800 people trained, including weed officers, community members and Waterwatch volunteers. The surveillance protocols were intended as a means to implement active aquatic weed surveillance whereby weed control authorities could identify potential aquatic weed invasion points, or sentinel sites, within their jurisdictions and regularly inspect them. However, their adoption by weed control authorities was low, despite the efforts of a national early detection project to promote them (R. Luxton and D. Boorman pers. comm.).

The RWW training package has contributed to the significant increase in new detections of alligator weed and cabomba infestations since the commencement of the national program. Since 2003, 19 new alligator weed outlier infestations were discovered, raising the total number of outlier sites to 31, whilst 37 cabomba infestations were discovered, raising the total number of infestations to 91. The national databases for these species show that approximately 20% of these detections were attributed to either identification training or identification material produced by the national program. Of significant importance is that over 90% all new detections recorded were a result of passive detection by weed professionals, which highlights the importance of aquatic weed identification skills for this audience.

**Preventing the trade of cabomba and other high risk aquatic plants** The popularity of cabomba and salvinia as aquarium and pond plants throughout much of Australia is thought to have contributed significantly to their spread. Hence their respective strategic plans both recognise that effective strategies for preventing further spread involve prevention of further trade through uniform national legislation

in addition to awareness raising activities with the aquatic plant trade.

The Victorian Government's decision in 2005 to declare all WoNS, including cabomba, as prohibited plants means there is now uniform national legislation outlawing the trade of all aquatic WoNS, which has significantly reduced the risk of the trade contributing to further introductions and spread. The bans appear to have been successful for cabomba as, since 2005, there have been no reports from Victoria or other states of a retail outlet trading this plant. For salvinia, despite a national sales ban for over 20 years, illegal trading at some nurseries and weekend markets continues, which poses an ongoing risk of creating new infestations.

The national program has also sought to ensure that both cabomba and salvinia are not replaced in the aquatic plant trade by other aquatic plants with similar weed potential. The national weed risk assessment of tradable aquatic plant species project identified a further 33 aquarium or pond plants that pose a weed risk and should be subject to a national sales ban (Petroschevsky and Champion 2008). Providing the project's recommendations are adopted, the aquatic plant trade will be less likely to contribute to future aquatic weed introductions. Other key aquatic plant initiatives from the national program include articles in publications of both the pet and nursery trade, and the production by the Pet Industry Association of Australia of the responsible handling of aquatic plants DVD, which was distributed to all PIAA affiliated aquarium shops.

#### REDUCING IMPACTS

On-ground management of the aquatic WoNS has involved eradication or containment of outlier infestations and reducing impact and preventing spread of core infestation areas. Key initiatives of the national program to improve core area management include: (1) prioritising alligator weed infestations within the core areas to contain spread and reduce impact, and (2) improved access to salvinia biocontrol agents.

**Prioritising core alligator weed infestations** A strategic planning process initiated by the national program has identified the alligator weed infestations within the core areas that pose the greatest risk of further spread and impact. The alligator weed core infestations are considered to be not eradicable and cover approximately 4000 hectares of waterways and low lying land in the Sydney and Hunter Basins, representing over 99% of all alligator weed in Australia. Instead, the strategic plan identifies a need to contain core infestations to prevent both further spread nationally and impacts to key assets (ARMCANZ 2000).

However, at the commencement of the program little information was available as to which infestations posed the greatest risks.

Through the national program, in 2007 a consultant identified infestations within both regions that posed high risks of further spread. However, the results applied to individual infestations and were difficult to apply at a regional scale (Somerville 2009). At the same time, information on significant biodiversity assets within both regions became available. Hence it was decided a second planning phase was required to merge the results of both projects and identify priority areas for future on-ground effort to prevent further spread and impact.

With support from the national program and under the guidance of an expert panel, a second phase of the planning process was initiated. Infestations within each region were grouped into 30–40 homogenous management units based primarily on hydrology. For each management unit, data were compiled on extent of alligator weed and the presence of vectors and key biodiversity assets. Then a risk matrix was applied to score each management unit on its potential for both further spread and impact on biodiversity assets, as well as management feasibility. This provided a priority score for each management unit, which after review of the expert panel, formed the basis for their final rankings.

It is expected that future investment for on-ground management of core infestations will be directed towards these higher priority management units, which it is hoped will reduce the national and regional threat posed by the core infestations.

### **Improving access to salvinia biocontrol agents**

Through the establishment of biological control rearing facilities the national program has overseen an increase in adoption of the highly effective salvinia biological control agent, the salvinia weevil (*Cyrtobagous salviniae* Calder and Sands), across much of the core salvinia infestation in Australia.

The weevil provides substantial benefit-cost ratios when compared to other control methods, which has been estimated as high as 53:1 by some studies (Doelman 1989). It is an essential tool for managing the majority of salvinia infestations within the core infestation area, which covers much of Australia's east coast, from Cairns to Sydney, and parts of the Northern Territory. However, prior to the national program its use across much of this area was low due to the lack of agent supply.

The national program championed both the construction of additional rearing facilities in strategic locations and the establishment of user pays systems

in NSW and South East Queensland to ensure such facilities remain in operation long after the initial funding periods have ceased. These facilities provide a reliable and hygienic supply of weevils to control authorities and, once operational, they significantly increased demand for the weevils, particularly in the regions the facilities were located. Six additional rearing facilities were constructed across Australia taking the total number of rearing facilities to eight, a 400% increase in capacity.

However, a lack of adoption in the temperate climates of the Greater Sydney and Hunter regions of NSW remains, despite recent research findings that demonstrate the salvinia weevil is far more effective in temperate climates than previously thought. It is hoped that future efforts in the form of salvinia biological control training courses scheduled for 2010 and 2011 will help address this underutilisation of weevils in temperate climates.

### **RESEARCH INITIATIVES**

Due to the inherent difficulties of managing weeds in aquatic environments and a limited knowledge base on both alligator weed and cabomba control techniques, much of the aquatic WoNS research effort has been directed towards improving the control methods. Research initiatives supported by the national program are leading to significant improvements in the fields of control and ecology. However, it is beyond the scope of this paper to cover all research so only the strategic needs that underpinned some priority research and the implications of some key findings are discussed.

**Biological control research** A major research focus of the national program has been to identify biological control agents for both alligator weed and cabomba, which will hopefully provide low cost self-sustaining management solutions. For alligator weed, biocontrol agents in addition to the flea beetle *Agasicles hygrophila* Selman and Vogt) may provide more effective control in core areas, particularly terrestrial forms. However, a host-specific agent is yet to be found, which is possibly due to the presence of native *Alternanthera* species, closely related to alligator weed, in Australia.

An effective cabomba biological control agent would provide substantial benefits to the national program as many cabomba infestations are large scale or located in water storage facilities, which in many cases makes control using either herbicide or mechanical removal impractical. Current research by CSIRO Entomology has identified a small weevil (*Hydrotimetes natans* Kolbe) that appears host-specific in the field but due to the difficulty of rearing the weevil under

quarantine conditions its host specificity has yet to be fully tested. If this weevil is host-specific, the difficulty in growing cabomba in non-field conditions is likely to present the national program some challenges in rearing and release.

Salvinia biological control research has mostly focused on testing the efficacy of the salvinia weevil in temperate climates, as prior to the commencement of the national program there was little understanding of its performance in the temperate climates of NSW. Results demonstrated that weevils can still provide an effective control tool for salvinia, particularly for river sites, and the low adoption of the weevil may be due more to a lack of perseverance by managers (Sullivan *et al.* 2008).

**Herbicide research initiatives** The suspension of registration of 2,4-D n-butyl ester herbicide by the Australian Pesticides and Veterinary Medicines Authority in late 2005 left the national program without an effective registered herbicide for cabomba control, thus leaving few options for managing cabomba, particularly for outlier populations. As a result, through the national program, state primary industries departments in both Queensland and NSW have conducted a range of herbicide efficacy trials, which identified carfentrazone-ethyl as an effective herbicide and potential replacement for 2,4-D n-butyl ester. Currently an application for its registration by its manufacturer, FMC International, is under consideration by the APVMA.

For alligator weed, herbicide research by partners of the national program have focused on fragmentation rates of aquatic infestations and effects of herbicide programs on below ground biomass of terrestrial infestations. Both of these topics are key barriers to its eradication and research findings are expected to improve best practice approaches. Results of the former are presented in this volume (Dugdale *et al.* 2010).

#### ACKNOWLEDGMENTS

The authors would like to thank Dr Tony Dugdale and Dr Shon Schooler for their useful critique of this paper. The authors and the NAWMG would like to thank the Caring for our Country funding program for the continuation of the national aquatic weeds program.

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