Potential beneficial and adverse effects to be addressed in the EPA application to introduce the yellow flag iris flea beetle (*Aphthona nonstriata*) as a biocontrol agent for yellow flag iris (*Iris pseudacorus*)

Angela Bownes, Manaaki Whenua – Landcare Research,

bownesa@landcareresearch.co.nz; 321 9605

The potential risks, costs, and benefits of the introduction of biocontrol agents to New Zealand for invasive weeds have been identified through formal brainstorming and through consultation with the public and professionals. There is a suite of possible risks, costs and benefits that are common to most biocontrol agents proposed for release, and other effects that may be specific to each biocontrol agent. These are outlined below for the proposed introduction of *Aphthona nonstriata* as a biocontrol agent for yellow flag iris.

The effects of the introduction of exotic biocontrol agents can result from:

(1) the introduction of a new organism to the New Zealand environment; and

(2) a reduction in the target pest through successful biocontrol.

Those effects considered to be significant (in terms of the magnitude of the effect and the frequency of or likelihood of the effect) are highlighted in bold and discussed more extensively in the application.

Potential impacts on Māori values will be addressed in a separate consultation process and will be done accordingly for the yellow flag iris flea beetle application.

Please contact Angela Bownes if you have any comments about the approach used in the application, or to report additional potential effects.

POTENTIAL BENEFICIAL EFFECTS	
Source of potential benefit	**Comment**
<u>On the Environment</u>	
Reduced competition from YFI leads to increased survival and diversity of native and other desirable plants in affected habitats.	This is the major expected benefit from the contribution of flea beetle to the biocontrol programme. YFI invades natural, urban, and agricultural wetland ecosystems. It can alter habitats through the formation of dense rhizome mats, which accumulate sediment and cause wetland areas to become drier. These rhizome mats are also responsible for the displacement of native plant species and associated biota. The flea beetle will affect existing YFI plants, directly reducing plant biomass and growth, and indirectly reducing seed formation. Successful biological control will reduce adverse effects wherever the weed occurs, acting far beyond the reach of existing management efforts and providing ongoing control. Significant reductions of seed production by the flea beetle will slow the spread and increases in density of the weed.
Further spread and naturalisation in other areas avoided	Major benefit. Successful control will reduce seed production and the development of new serious infestations of YFI.
Reduced damage to other vegetation and sensitive ecosystems from spraying.	Major benefit. Spraying YFI with herbicides can damage non-target plant species and is highly undesirable in the ecosystems it typically invades including wetlands, slow-moving rivers and streams, and the margins of lakes. Spraying with herbicides can damage valued vegetation growing in close proximity to the weed, and the use of herbicides in aquatic environments is not advised. Successful biological control will significantly reduce the need for spraying YFI with herbicides
Successful biocontrol will reduce YFI infestations and decrease flooding risk as well as severity of a flooding event and the associated impact on native fauna and flora.	Major benefit. By reducing YFI monocultures, the volume of trapped water that could be released during a flooding event is reduced. This will mitigate the severity of flooding events and have less impact on native seedlings or shallow-rooted species.
Benefits to parasitoids, predator and disease relationships in trophic webs	Increased plant diversity as YFI monocultures break up will increase the diversity and complexity of trophic webs. Effects will vary locally, spatially and temporally.
Reduced contamination of air, soil and water from reduced YFI spraying.	Successful biocontrol of YFI will reduce the need for chemical control.
Reduced disturbance through mechanical/manual control methods that negatively impact native species and	Successful biocontrol of YFI will reduce the need for mechanical/manual control.

facilitate establishment of other weed species.	
Increase in food sources for many fish and bird species.	Successful biocontrol will help to restore affected habitats to their natural state, supporting a greater variety of native and valued fauna.
Loss of endangered species is slowed.	Not a significant effect. No species are known to be at risk primarly because of YFI. Given its ability to dominate wetland habitats, it is highly likely that YFI poses a threat to rare or regionally uncommon wetland species, especially those with narrow ecological niches or limited distributions. Lack of detailed case studies may reflect a gap in targeted research rather than absence of impact. Cases where YFI is threatening endangered species in other countries in its invaded range have been reported.
<u>On Human Health and Safety</u>	
Reduction in YFI infestations reduces exposure to YFI plant sap that are toxic to mammals and can cause skin irritation in humans.	It is expected that flea beetle attack will reduce plant biomass and reduce the size of infestations. This will reduce the probability of human exposure to plant sap (for example, during management efforts through hand-pulling).
Reducing YFI infestations reduces human anxiety about weedy nature of YFI in water courses, canals and other waterbodies.	This is likely to be a real effect to landowners, communities, and volunteers involved in management of the weed.
Successful biocontrol reduces the flooding risks posed by YFI infestations in water courses, canals and other waterbodies.	This is likely to be a real benefit to landowners, and communities living in areas close to waterbodies infested with YFI or at risk of being infested by YFI.
<u>On society and communities</u>	
Successful biocontrol would benefit society and communities by restoring the amenity values and cultural and conservation significance of lakefronts and riparian zones.	A significant benefit.
Successful biological control reduces costs of YFI management to regional and territorial authorities and private landowners	A significant benefit. YFI is actively managed in many regions to eradicate or contain this invasive weed species. YFI is also a problem plant in wet pastures requiring control. Successful biocontrol will reduce costs of management efforts at current as well as new invasion sites.
Reduced need to manage YFI leads to better allocation of community and volunteer resources for weed management.	A significant benefit.

Reduced need to manage YFI leads to improved morale in DOC, RC staff, communities and volunteers.	Successful biological control would be well received. Benefits accrue to few people.
Improved look and feel of native wetland habitats and riparian zones.	A significant effect. Successful control reduces the occurrence of unsightly and detrimental monocultures of YFI and limits the establishment of new infestations, making wetlands, lakes and rivers more accessible for recreational activities and improving their aesthetic value.
Reduced need for spraying in and near aquatic and wetland ecosystems.	A significant benefit. The use of herbicides in waterways and wetlands is deeply objectionable to the New Zealand public, especially Māori. Successful biocontrol of YFI will significantly reduce the demand for chemical control to manage the weed and prevent its spread.
Reduced flooding and rafting impacts.	YFI 'rafts' reduce the surface areas of shallow lakes and cause potential flooding as the water is displaced. Blockages downstream from rafts can also lead to localised flooding.
<u>On the market economy</u>	
Successful biological control reduces the current costs of YFI management, allowing more sustainable control options for existing infestations.	A significant benefit. YFI is currently managed in several regions across NZ, with control efforts relying solely on repeated hrbicide applications to eradicate or contain this invasive weed species.
Successful biocontrol reduces the flooding risks posed by YFI infestations in water courses, canals and other waterbodies.	This is likely to be a real effect to landowners, and communities living in areas close to waterbodies infested with YFI or at risk of being infested by YFI.
Reduced seed production to eliminate future invasion risk.	A significant benefit. YFI seeds spread predominantly by water, making invasion of new sites and reinvasion of cleared sites a major risk.
More natural environment for tourism	A significant benefit. Reduction in monocultures of YFI along edges of waterbodies and restoration of native species.
POTENTIAL ADVERSE EFFECTS	
Source of potential adverse effects	**Comment**
<u>On the Environment</u>	
Non-target feeding by YFI flea beetle significantly reduces native plant populations.	Not a significant risk. Host range testing indicates that no native plants support development of the YFI flea beetle and would therefore not be at risk.
Non-target feeding by YFI flea beetle significantly reduces the usefulness of ornamental plants (iris species/ varieties)	A possible effect. Host range testing indicates that the YFI flea beetle development is supported by selected some subgenera within the genus *Iris*. Effects will be localized and potential damage and development on ornamental irises

	can be mitigated or avoided through implementation of conventional control methods, such as insecticides
YFI flea beetle compete with native herbivore species.	Not a significant risk. Development of the YFI flea beetle is restricted to selected species in the genus *Iris* and in NZ will be found mainly on YFI infestations. None of the herbivore species naturally occurring on YFI in NZ were specialist species and reliant of YFI for their survival (Probst et al. 2022). Therefore, significant competition between resident herbivores and introduced biocontrol agent species is highly unlikely.
YFI is replaced by another (worse) weed	Which weeds grow in similar habitat (riparian zones) and are already widely present? To follow up with stakeholders.
Reduced habitat quality for some native fauna.	Not a significant risk. Replacement vegetation will also support invertebrate fauna. No fauna of special significance found on YFI in NZ (Probst et al. 2022).
Swift evolutionary change in insect leads to unexpected non-target damage to valued plants and/or alterations to food webs	Not a significant risk. There is little evidence of adaptive host range expansion to non-target species in weed biocontrol agents.
Food web interactions are adversely affected by the introduction of new prey species	Adverse effects are conceivable but not expected. Increased plant diversity as YFI monocultures break up will increase the diversity and complexity of trophic webs, but effects will vary locally, spatially and temporally.
The YFI flea beetle hybridises with native beetle species.	Not a significant risk. No beetle species in New Zealand are closely related to enable hybridisation.
Indirect competition causes extinction of native insects.	Not a significant risk. No indication that vulnerable or endangered species are associated with YFI infestations (Probst et al. 2022), and any measurable indirect competition would be restricted to the immediate vicinity of the host plant.
Rapid biocontrol leads to erosion, followed by reduced water quality from sediments	Not a significant risk. The impact of biocontrol is generally expected to occur and build over a longer time period, which reduces the risk of erosion and reduced water quality
<u>On Human Health and Safety</u>	
Public phobia of the new flea beetle	Possible due to concerns the flea beetle will damage valued ornamental plants and/or of native and/or commercial crops.
Flea beetles need spraying with adverse effects to humans.	Not a significant risk. Significant populations of YFI flea beetle will primarily be associated with YFI infestations. Populations could potentially be sustained on mass plantings of cultivated iris species, such occurrences are likely to be limited

	and localized and could be controlled through insecticides. The need for spraying is expected to be infrequent and restricted to specific settings, thereby minimizing potential exposure and associated risks to humans.
On Society and Communities	
Fear and distrust of exotic species and their possible non-target effects	Firmly held opinion in a proportion of the New Zealand population.
Biocontrol reduces aesthetic values of YFI.	A possible effect. YFI may still be valued as an ornamental or as a showy wetland plant species.
Non-target feeding by the YFI flea beetle reduces the usefulness of some Iris cultivars susceptible to flea beetle damage.	A possible risk. While the YFI flea beetle could potentially sustain populations on mass plantings of cultivated iris species, these could be controlled through application of insecticides.
On the Market economy	
Successful biological control reduces revenue for contractors and suppliers.	Not a significant effect. Revenues directly related to YFI management are not a key revenue source for many or any contractors or suppliers. *Is this true?*
Flea beetle feeding and development negatively impact growth and aesthetic value of ornamental iris species, making cultivation for and sales in nurseries unprofitable.	A possible risk. While the YFI flea beetle could potentially sustain populations on mass plantings of cultivated iris species, these could be controlled through application of insecticides.
Suppression of flowering significantly affects the bee-keeping industry.	Not a significant risk. YFI flower structure more suited to *Bombus* species and long-tongued fly species (Sutherland 1990).

References:

Probst C, McGrannachan C, Morton S, McGrath Z, White R, Cartier A 2022. Invertebrates and fungi associated with yellow flag iris, *Iris pseudacorus* L., in New Zealand. Contract Report LC4111. 28 p.

Sutherland WJ 1990. *Iris Pseudacorus* L. Journal of Ecology 78(3): 833-848.