

SHORT COMMUNICATION

Assessing the conservation status of the grass *Elymus multiflorus* subsp. *kingianus* on Lord Howe Island, NSW

Tony D. Auld¹, Sue Bower² and Ian Hutton³

¹Climate Change Science, Office of Environment and Heritage NSW, PO Box 1967 Hurstville NSW 2220, AUSTRALIA
email: tony.auld@environment.nsw.gov.au

²Lord Howe Island Board, Lord Howe Island, NSW 2898, AUSTRALIA.

³PO Box 157, Lord Howe Island, NSW 2898, AUSTRALIA

Abstract

The grass *Elymus multiflorus* subsp. *kingianus* (family Poaceae) is considered to be endemic to Lord Howe and Norfolk Islands. We assessed the conservation status of the taxon on Lord Howe Island, New South Wales, and undertook targeted field surveys across three years and several seasons in suitable habitat, based on the single previously recorded location. We found the species occurrence on Lord Howe Island was highly restricted, with only a few plants found at 2 locations in close proximity. A number of exotic grasses pose a threat to the long-term conservation of the taxon, which was assessed as being eligible for listing as critically endangered under the *NSW Threatened Species Conservation Act 1995*.

Cunninghamia (2011) 12(2): 137–142

Introduction

The assessment of the conservation status of plant and animal species is concerned with identifying those taxa that are considered to be most at risk of extinction. Recovery or threat management actions can then be undertaken to promote the long-term conservation of threatened species. The risk of extinction for plants and animals has been assessed using a variety of techniques ranging from specific decision rules (IUCN 1994, 2010, Keith 1998) to scoring systems based on attributes of species and threat (Millsap *et al.* 1990). Currently the most widely accepted scheme is the red list criteria developed by the World Conservation Union (IUCN 1994, IUCN 2010). This scheme underpins the criteria for listing species as threatened at the national level in Australia (*Environment Protection and Biodiversity Conservation Act (EPBC)* (see EPBC regulations 2000) and across several states (e.g. *NSW Threatened Species Conservation Act 1995 (TSC)* (see TSC Regulations 2010); *Tasmanian Threatened Species Protection Act 1995*).

The flora of Lord Howe Island (LHI) has a high level of endemism along with strong connections between mainland Australian, New Zealand and New Caledonian

flora (Green 1994). There are also strong floristic affinities with Norfolk Island and several species co-occur on these two islands. *Elymus multiflorus* is a grass that occurs in coastal southeastern Australia, Norfolk Island, Lord Howe Island and New Zealand (De Lange *et al.* 2005). One form within the species (var. *kingianus*) has been recognised as a distinct variety (Green 1994, Conner 1994), and was recently accepted as being a subspecies (de Lange *et al.* 2005). *Elymus multiflorus* subsp. *kingianus* is considered to be endemic to Lord Howe Island in NSW and the Norfolk Island Group (Rabbit and Norfolk Islands) (Green 1994, de Lange *et al.* 2005). Conner (1994) distinguishes the Norfolk Island endemic *Elymus multiflorus* subsp. *kingianus* (now known to also occur on Lord Howe Island) from New Zealand plants by the multiplicity of small prickle teeth on the lemmas and on the glume. *Elymus multiflorus* subsp. *kingianus* has recently been listed as Critically Endangered on the *EPBC Act* following a review of the conservation assessment of plants from Norfolk Island (TSSC 2003). However, its status on Lord Howe Island (LHI) was somewhat uncertain. The taxon has been recorded on the Main island, under synonyms *Agyropogon scabrum* var. *scabrum* (Rodd & Pickard 1983) and *Agyropogon scabrum* (Pickard 1983), at only one location (Old Settlement Beach). It was considered rare and

very uncommon by Pickard (1983). There have been no recorded sightings or collection records since that time. The ecology of the species on the island is also poorly known.

The IUCN Red List criteria (IUCN 2001) utilize three basic elements that may independently be used to assess the risk of extinction. These are: a) rates of decline; b) geographic range size; and c) population size and structure, including fluctuations and number of locations. In this paper, we undertook to assess the conservation status of *Elymus multiflorus* subsp. *kingianus* on LHI using IUCN red list criteria, along with NSW state TSC Act listing criteria and regulations. To do this we conducted survey work over several seasons across 3 years to verify the presence of *E. m. kingianus* on LHI, quantify its distribution and abundance and to identify any current threats to the taxon.

We hoped that this would also help with the understanding of some basic life-history components of the ecology of the taxon.

Methods

Survey effort was concentrated on the one previously known location of Rodd & Pickard (1983), Old Settlement Beach, at the northern end of the island, along with all surrounding comparable habitat i.e., accessible basalt derived coastal margins in the northern half of the island (Fig. 1). Much of this habitat immediately adjacent to the settlement area is degraded by weeds (Hutton 2005). We conducted surveys over three years (2008, 2009, 2011) and three seasons

Table 1. Results of searches for *Elymus multiflorus* subsp. *kingianus* across likely habitat of Lord Howe Island (1971–2011). * = exotic plants. Collectors ANR= AN Rodd; TA= T Auld, AD= A Denham, IH= I Hutton, SB= S Bower, KM= K Macdonald, MS= M Stroud, CH= C Haselden, SN= S Nally, DM= D Milledge, HB= H Bower, IT= I Turnbull

Area	Coll.	Year	Season & date	Locations searched	<i>Elymus</i> abundance	Co-occurring taxa (* indicates exotics)	Threats
Dawsons Point coastline to Old Settlement Beach	ANR	1971	Autumn 21/03/1971	unknown	Occasional only	<i>Poa</i> , <i>Dianella</i> , <i>Melaleuca</i>	not recorded
	TA, AD, IH, SB	2008	Autumn 4/05/2008	Old Settlement Beach western end to point	3 plants	<i>Poa poiformis</i> , <i>Sporobolus virginianus</i> , <i>Melaleuca howeana</i> , <i>Cassinia tenuifolia</i> , <i>Dodonaea viscosa</i> , * <i>Paspalum</i> sp.	weeds
	TA, AD, IH, SB	2008	Autumn 4/05/2008	North Bay, eastern nil headland around to Dawsons Point	nil	<i>Sporobolus virginianus</i> , * <i>S. africanus</i> , * <i>Bromus cartharticus</i> , * <i>Bromus diandrus</i> , * <i>Paspalum</i> spp.	weeds, erosion
	TA, AD, IH	2008	Spring 5/11/2008	Old Settlement Beach to North Bay around headland	1 plant	<i>Poa poiformis</i> , <i>Sporobolus virginianus</i> , <i>Dichelachne crinita</i> , * <i>Sporobolus africanus</i> , * <i>Briza minor</i> , * <i>Sonchus oleraceus</i>	weeds
	SB, HB	2009	Autumn 4/5/2009	Old Settlement to Dawsons Point	27 plants (16 mature)	<i>Melaleuca howeana</i> , <i>Poa poiformis</i> , <i>Dodonaea viscosa</i> , <i>Cassinia tenuifolia</i> , <i>Rapanea platystigma</i> , <i>Dianella intermedia</i> , * <i>Bromus cartharticus</i> , * <i>Paspalum dilatatum</i> , * <i>Bromus</i> sp., * <i>Ipomoea cairica</i>	weeds
	SB	2011	Spring 4/11/2011	Old Settlement to Dawsons Point	48 plants (9 mature)	weeds	weeds
Dawsons Point ridge	KM, MS, SB	2009	Summer 12– 13/02/2009	Dawsons Point	2 (5 plants seen in 2010)	<i>Poa poiformis</i> , <i>Melanthera biflora</i> , <i>Leucopogon parviflorus</i> , <i>Melaleuca howeana</i> , * <i>Conyza bonariensis</i>	weeds, erosion
	TA, AD, IH, SB.	2008	Autumn 4/05/2008	Dawson ridge summit	nil	<i>Oplismenus hirtellus</i> under a 2–3m tree canopy.	none
	Northern Hills	KM, MS, SB	2009	Summer 12– 13/02/2009	Dawsons point to Kim's Lookout and Malabar track	nil	weeds
SB, DM		2009	Winter 7–8/08/2009	North Head to Mt Eliza. Old Gulch to Curio Point	nil	<i>Commelina cyanea</i> , <i>Poa poiformis</i> , <i>Achyranthes aspera</i> , <i>Melaleuca howeana</i> , * <i>Bromus</i> sp., * <i>Chloris gayana</i> , * <i>Asparagus asparagoides</i>	weeds
Roach Island	SB, CH, SN	2009	Summer 29/02/2009	Roach Island	nil	<i>Commelina cyanea</i> , <i>Achyranthes aspera</i> , <i>Poa poiformis</i> , * <i>Portulacca oleracea</i> , * <i>Bromus cartharticus</i> , * <i>Ipomoea cairica</i>	weeds
Rabbit Island	SB, HB, IT	2009	Autumn 15/04/2009	Rabbit Island	nil	<i>Commelina cyanea</i> , <i>Poa poiformis</i> , <i>Melaleuca howeana</i> , * <i>Chloris gayana</i> , * <i>Ipomoea cairica</i> , * <i>Bromus cartharticus</i>	weeds



Fig. 1. Known locations of *Elymus multiflorus* subsp. *kingianus* (red x, near Dawson's Point and Old Settlement Beach) along with habitat searched (blue lines). Roach Island is at the top and Rabbit Island at the bottom of the Figure. The habitat on the east and southeastern side of Old Settlement Beach and from The Clear Place to Blinky Point is highly degraded by weeds (yellow line). The northern basalt cliffs are near vertical and inaccessible.



Fig. 2 Habitat for *Elymus multiflorus* subsp. *kingianus* at Dawsons point. Photo Sue Bower

Table 2. Assessment of conservation status of *Elymus multiflorus* subsp. *kingianus* on Lord Howe Island using IUCN red list criteria and NSW Threatened Species Conservation Act Regulation.

For each assessment five criteria or clauses determine if the taxon is threatened, and the degree of the threat, by placing it in a threat category (IUCN 2001, 2010, TSC 2010, NSW Scientific Committee 2010). The category used for the taxon once all five criteria/clauses have been considered, is the highest threat category reached by any one of the five criteria. Codes are DD– data deficient; CR –Critically Endangered; VU– Vulnerable.

Issue	IUCN Rule	IUCN	TSC Clause	TSC
Population Reduction ¹	A	DD	6	DD
Geographic Range ²	B	CR via B1ab, B2ab	7	CR
Population Size ³	C	CR via C2a ⁱⁱ	8	CR
Small Population ⁴	D	CR	9	CR
Extinction Probability ⁵	E	DD	not applicable	
Very Restricted ⁶	included in D		10	VU

1. There is insufficient information on the reduction of the size of the population. The one location identified by Rodd and Pickard (1983) remains extant.
2. The species is currently restricted to two small, but nearby, patches at the western end of Old Settlement Beach and at Dawsons Point. EOO and AOO are estimated to be 4 km², based on 2 x 2 km grid cells; the scale of assessment recommended by IUCN (2010). This is below the threshold for critically endangered. The habitat of the known locations and other potential habitat are occupied by a number of common natives *Poa*, *Sporobolus*, but also a number of weedy exotic grasses that may out compete *Elymus multiflorus* subsp. *kingianus*. Continuing decline is inferred as the habitat of the species is occupied by a number of weedy exotic grasses. For the species to be considered critically endangered under IUCN Criterion B, it must only occur in one location. The close proximity of the two known sites (a few hundred metres apart) would suggest that they are part of the one population and that the threats (weeds) will affect both sites.
3. The population is estimated to be less than 50 mature individuals. Continuing decline is inferred as the habitat of the species is occupied by a number of weedy exotic grasses that may out compete *Elymus multiflorus* subsp. *kingianus*. As no subpopulation is estimated to contain more than 50 mature individuals, the species would be assessed as Critically Endangered under IUCN.
4. The population size is extremely small and estimated to be less than 50 mature individuals (which is equivalent to extremely low under TSC Regulation 2010, NSW Scientific Committee 2010).
5. There is insufficient data for quantitative analysis. Criterion E is data deficient.
6. The restricted nature of the distribution combined with threats and stochastic events would allow the taxon to be assessed as vulnerable under this clause.

(autumn and summer 2008, summer, autumn and winter 2009, spring 2011). All observers were initially shown plants at a known location to standardise identification. We searched along the base of littoral rainforest just above bare rocks on the coastal shore, where exposure has led to a slightly more open habitat, as it is in this zone that there is available habitat for the species. This included erosion scarps providing areas of potential habitat for recruitment. We also searched the nearby summit of Dawson ridge where we examined areas of exposed rocky habitats with grass or sedge cover, along with other exposed areas on walking tracks nearby. Where plants were located we counted the number of individuals, recorded vegetation composition, including weedy species and recorded any threats to the species. Additional sites along the sea cliffs on the eastern side of the island above the Clear Place to Blinky Point were also searched.

Results

We successfully re-located *Elymus multiflorus* subsp. *kingianus* at the western end of Old Settlement Beach, the previously known location of Rodd & Pickard (1983), and at one nearby additional location at Dawsons Point (Fig. 1, Table 1). Both locations were in comparable habitat i.e. the zone between exposed basalt-derived cliffs and boulders near the water's edge, and the closed canopy of littoral rainforest upslope. This zone was dominated by shrubs, grasses and herbs, and was a mixture of closed shrub and open areas, either with some vegetation cover or exposed soil with little vegetation cover. At one site, *Elymus* plants occurred on the edges of an erosion scarp (10m ASL) and at the base of the erosion slip (>2m ASL). The width of the suitable habitat varied from <1 to a few metres, but was more or less continuous

around the shoreline on the lagoon side of the northern part of the Main island. Most of the habitat of coastal rocky shoreline that was searched was not occupied by *Elymus* and no plants were found in any exposed rocky patches on Dawsons Ridge. The habitat on the east and southeastern side of Old Settlement Beach is highly degraded by weeds and past clearing of the littoral rainforest (Fig. 1). No plants were found in the habitat along the extent of the sea cliffs above the Clear Place to Blinky Point; this habitat is severely degraded by *Asparagus aethiopicus* (Ground asparagus). Remnant native *Poa poiformis* grass communities are also compromised by severe weed competition in this area.

In all searches, from 1 up to 48 plants of *Elymus multiflorus* subsp. *kingianus* were seen, abundance depending on seasonal and annual variations (Table 1); it is inferred there are fewer than 50 mature plants in total. The main threat to *Elymus multiflorus* subsp. *kingianus* plants are exotic weeds that can occupy the habitat of the species and are likely to compete for space. There is also localised erosion that may result in the loss of individuals, but may in the long term also allow future recruitment into open patches. Excessive dry periods may threaten plants that occur in small crevices on cliffs. Storm surge may threaten low-lying plants. Other possible threats are previous damage from goats (now eradicated) and seed and seedling predation by exotic rodents.

The conservation status of *Elymus multiflorus* var. *kingianus* on LHI was assessed as critically endangered under both IUCN and the NSW threatened Species Conservation Act Regulations (Table 2).

Both estimates of range size (extent of occurrence EOO, and area of occupancy AOO) are estimated to be 4 km², based on 2 x 2 km grid cells; the scale of assessment recommended by IUCN (2010).

Discussion

Elymus multiflorus subsp. *kingianus* was assessed as critically endangered in NSW under both IUCN red list criteria and TSC Act regulations (2010). Its very restricted habitat, low numbers and ongoing threats from weeds were the main determinants of this threats status. At a global scale, incorporating the locations in the Norfolk Island group, low population numbers, ongoing weed threats (NI and LHI) and grazing (NI, Director of National Parks 2010) would also likely lead to an assessment of critically endangered.

We found that *Elymus multiflorus* subsp. *kingianus* had persisted on Lord Howe Island in one known location for over 25 years, even though the number of plants we detected was very low (1–48, depending on season and year). We could only locate one other nearby location (Fig. 1) with 2 plants in 2009 (up to 5 in 2010). The habitat for the species extends beyond these two sites and *Elymus* may potentially occupy some of this habitat in other years. There was some variation in abundance across years and seasons at the original known

site which likely reflects seasonal dieback and variation in seasonal conditions controlling recruitment and growth. Further searching in favourable seasons is recommended. Much of the habitat is in good condition, but there are a number of weedy species that pose a threat to *Elymus* and other co-occurring native species (Table 1). These are exotic grasses, herbs and creepers that are disturbance opportunists, particularly *Sporobolus africanus*, *Bromus cartharticus*, *Bromus diandrus* and *Paspalum* spp. that have the potential to successfully occupy the *Elymus* habitat (see Fig. 2) and exclude native taxa.

Our data suggest that individual plants are short-lived and there may be a rapid turnover in plant numbers at any one location (Table 1). This short-lived pattern corresponds with other reports on the ecology of *Elymus* spp. suggesting it is a short-lived perennial (Benson & McDougall 2005). McIntyre *et al.* (1995) suggest that there is no vegetative spread in the closely related *Elymus scaber* and this also appears likely in *Elymus multiflorus* subsp. *kingianus*. McIntyre *et al.* (1995) also suggest that the dispersal unit in *Elymus scaber* is adhesive, most likely through large awns. Adhesive characteristics are likely to promote dispersal on mammals. Awns in *Elymus multiflorus* subsp. *kingianus* on Norfolk Island are up to 17mm long (Conner 1994) and combined with the small prickle teeth on the lemmas and on the glumes may aid adhesion. As mammals are absent on Lord Howe Island (except for a bat) the ability of *Elymus multiflorus* subsp. *kingianus* to move to different patches of potential habitat around its current location is unknown. The species would need to maintain a persistent soil seed bank to take advantage of gaps in its habitat and to recruit each year. Currently factors controlling the timing and magnitude of germination are unknown, but seed dormancy has been observed in *Elymus scaber* (Maze *et al.* 1999), along with water and temperature impacts on germination.

A permanent monitoring plot and rodent bait station was established by the Lord Howe Island Board, and some individual plants were tagged in 2011.

Ongoing management of *Elymus multiflorus* subsp. *kingianus* should focus on monitoring the existing locations and where possible, other nearby available habitat to detect season and magnitude of germination in any one year. Some weed control may be necessary where any aggressive invasion of habitat occurs. Maintenance of bait stations should also be ongoing.

Acknowledgements

We thank Hank Bower, Dianne Brown, Andrew Denham, Chris Haselden, Kye McDonald, David Milledge, Simon Nally, Matt Stroud and Ian Turnbull and for help with field sampling. The Lord Howe Island Board supported this work and the use of a research facility for TA.

References

- Benson D, McDougall L (2005) Ecology of Sydney plant species: Part 10 Monocotyledon families Lemnaceae to Zosteraceae. *Cunninghamia* 9, 16–212.
- Connor HE (1994) Indigenous New Zealand Triticeae: Gramineae. *New Zealand Journal of Botany* 32, 125–154.
- de Lange PJ, Gardner RO, Sykes WR, Crowcroft GM, Cameron EK, Stalker F, Christian ML, Braggins JE (2005) Vascular flora of Norfolk Island: some additions and taxonomic notes. *New Zealand Journal of Botany* 43, 563–596.
- Director of National Parks 2010. *Norfolk Island Region Threatened Species Recovery Plan*. Department of the Environment, Water, Heritage and the Arts, Canberra.
- EPBC Regulations (2000) Environment Protection and Biodiversity Conservation Regulations 2000. Statutory Rules 2000 No. 181 as amended made under the *Environment Protection and Biodiversity Conservation Act 1999*.
- Green PS (1994) Norfolk Island & Lord Howe Island. In: *Flora of Australia*. 49, 1–681. Canberra: AGPS.
- Hutton I (2005) *Rare plants survey 2– Lord Howe Island*. Report to Dept of Environment and Conservation NSW.
- IUCN (World Conservation Union) (1994) *IUCN Red List Categories*. IUCN Species Survival Commission, Gland.
- IUCN (2001) *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- IUCN (2010) *Guidelines for Using the IUCN Red List Categories and Criteria Version 8.0*. Prepared by the Standards and Petitions Working Group. Species Survival Commission Biodiversity Assessments Sub-Committee, Gland.
- Keith DA (1998) An evaluation and modification of World Conservation Union Red List criteria for classification of extinction risk in vascular plants. *Conservation Biology* 12, 1076–1090.
- Maze KM, Koen TB, Watt LA (1999) Factors influencing the germination of six perennial grasses of Central New South Wales. *Australian Journal of Botany* 41, 79–90.
- McIntyre S, Lavorel S, Tremont RM (1995) Plant life-history attributes: their relationship to disturbance response in herbaceous vegetation. *Journal of Ecology* 83, 31–44
- Millsap BA, Gore JA, Runde DE, Cerulean SI 1990. Setting priorities for the conservation of fish and wildlife species in Florida. *Wildlife Monographs* 111, 1–57.
- NSW Scientific Committee (2009) *Guidelines for interpreting listing criteria for species, populations and ecological communities under the NSW Threatened Species Conservation Act*. Version 1.0a.
- Pickard J (1983) Rare or threatened vascular plants of Lord Howe Island. *Biological Conservation* 27, 125–139.
- Rodd AN, Pickard J (1983) Census of vascular flora of Lord Howe Island. *Cunninghamia* 1, 267–280.
- TSC Regulations (2010) Threatened Species Conservation Regulation 2010 under the Threatened Species Conservation Act 1995. NSW Government Gazette No. 495.
- Threatened Species Scientific Committee (TSSC) (2003). Commonwealth Listing Advice for Norfolk Island Flora – 11 Critically Endangered Species. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/norfolk-island-flora-critically.html>.