

## Conservation Advice

### *Phlegmariurus squarrosus*

rock tassel-fern

#### Taxonomy

Conventionally accepted as *Phlegmariurus squarrosus* (G.Forst.) Á.Löve & D.Löve.

The species is currently listed under the EPBC Act as *Huperzia squarrosa* (G.Forst.) Trevis. Following recently published research (Field and Bostock, 2013) the genus *Huperzia* is synonymised with *Phlegmariurus*. The name of this species is now conventionally accepted as *Phlegmariurus squarrosus*.

#### Conservation status

Critically endangered: Criterion 2 B2 (a) + (b)(iv)(v).

Species can also be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see

<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

#### Reason for conservation assessment by the Threatened Species Scientific Committee

The species (as *Huperzia squarrosa*) was listed as endangered under the predecessor to the *Environmental Protection and Biodiversity Conservation Act (1999)* (EPBC Act) the *Environment Protection Act* and transferred to the EPBC Act in June 2000.

This advice follows assessment of new information provided to the Department/Committee to change the listing status of the species.

#### Description

A fern ally with attractive hanging 'tassels'. Branches are tufted, arched towards the apex, 30–75 cm long. Leaves are sub-whorled or spirally arranged, thin, firm, angled at 60–90° to the axis, entire, 10–30 mm long, pale green to yellowish-green, twisted near the base. Spore-bearing leaves are abruptly contracting above the base into a long, attenuate upper portion 5–7 mm long, with spore bodies occupying one-sixth of the length (information from Jones and Clemesha, 1976; Chinnock, 1998).

#### Distribution

In Australia, *Phlegmariurus squarrosus* is restricted to north-east Queensland, where it has been recorded from Mcllwraith Range, Cape Tribulation region, the Mossman region, around Mt Bellenden Ker and 'near Cairns' (Australian National Herbarium, 2009; Queensland Herbarium, 2009). Anecdotal evidence suggests that this species is naturally rare, at least in the southern part of its range (Australian National Herbarium, 2009; Queensland Herbarium, 2009).

This species has been recorded from Kulla (Mcllwraith Range) and Daintree National Parks and Monkhouse Timber Reserve (Queensland Herbarium, 2009).

Globally, *Phlegmariurus squarrosus* occurs in tropical Africa, Asia and the Pacific (Chinnock, 1998). The whole-of-range estimate of distribution (including non-Australian sites) based on herbarium records is probably inaccurate, because *P. squarrosus* (*H. squarrosa* in Chinnock, 1998) is polyphyletic (Field, 2011), and Australian herbarium records for this species include numerous misidentifications of exotic species (Field, pers. comm., 2012).

#### Cultural Significance

Not known.

## Relevant Biology/Ecology

*Phlegmariurus squarrosus* occurs on rocks, particularly around waterfalls, or on tree trunks in lowland swamps and low to mid-altitude rainforest (Jones and Clemesha, 1976; Queensland Herbarium 2009).

Details of the ages of sexual maturity, life expectancy and natural mortality are unknown.

Tropical cyclones and drought are known causes of mortality of *Phlegmariurus squarrosus* cyclones (Field, pers. comm., 2012).

## Threats

Illegal collection is a known threats to this species (Landsberg and Clarkson, 2004; Queensland Herbarium, 2009). The species has been subject to historic decline in range and population size from poaching for the ornamental plant trade (Field, 2011). Recent surveys indicate ongoing decline (Field, 2011).

This species is potentially threatened by localised settlement and visitor pressures (Landsberg and Clarkson, 2004).

## How judged by the Committee in relation to the EPBC Act Criteria and Regulations

### Criterion 1: Reduction in numbers (based on any of A1 – A4)

- A1. An observed, estimated, inferred or suspected population very severe  $\geq 90\%$ , severe  $\geq 70\%$  substantial  $\geq 50\%$  size reduction over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
- (a) direct observation
  - (b) an index of abundance appropriate to the taxon
  - (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
  - (d) actual or potential levels of exploitation
  - (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.
- A2. An observed, estimated, inferred or suspected population very severe  $\geq 80\%$ , severe  $\geq 50\%$  substantial  $\geq 30\%$  size reduction over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
- A3. A population size reduction very severe  $\geq 80\%$ , severe  $\geq 50\%$  substantial  $\geq 30\%$ , projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
- A4. An observed, estimated, inferred, projected or suspected population size reduction very severe  $\geq 80\%$ , severe  $\geq 50\%$  substantial  $\geq 30\%$  over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

**Evidence**

Field (pers. comm., 2012) reported that this species has been subject to significant poaching and is continuing to decline due to climatic disturbance such as drought and cyclones.

The number of mature individuals in the larger of the two known wild populations (Daintree National Park) declined by approximately 70 percent from 2004-2011 (Field, pers. comm., 2012).

The other, smaller of the two known populations (Wooroonooran National Park) was not monitored from 2005-2011, due to inaccessibility following a tropical cyclone, after which time none of the original plants could be located (Field, 2011; pers. comm., 2012).

This corresponds to an estimated, inferred or suspected population reduce of at least 'severe', and meets the threshold for listing as 'Endangered' (level of decline  $\geq 50\%$ ).

**A2: Eligible for listing as endangered****Criterion 2:**

Geographic distribution (based on either of B1 or B2)

B1. Extent of occurrence estimated to be very restricted  $< 100 \text{ km}^2$ , restricted  $< 5000 \text{ km}^2$  or limited  $< 20\,000 \text{ km}^2$

B2. Area of occupancy estimated to be very restricted  $< 10 \text{ km}^2$ , restricted  $< 500 \text{ km}^2$  or limited  $< 2000 \text{ km}^2$

AND

Geographic distribution is precarious for the survival of the species, (based on at least two of a–c)

- a. Severely fragmented or known to exist at a limited location.
- b. Continuing decline, observed, inferred or projected, in any of the following:
  - (i) extent of occurrence
  - (ii) area of occupancy
  - (iii) area, extent and/or quality of habitat
  - (iv) number of locations or subpopulations
  - (v) number of mature individuals.
- c. Extreme fluctuations in any of the following:
  - (i) extent of occurrence
  - (ii) area of occupancy
  - (iii) number of locations or subpopulations
  - (iv) number of mature individuals

**Evidence**

The extent of occurrence (B1) of *P. squarrosus* in Australia is  $5681 \text{ km}^2$ , and the area of occupancy (B2) is extrapolated to be  $5 \text{ km}^2$  over point populations of less than  $1 \text{ km}^2$  (Field, pers. comm., 2012).

The estimated area of occupancy is below the threshold for a 'very restricted' distribution ( $10 \text{ km}^2$  or less – the threshold for 'Critically Endangered').

The species is presently restricted to two wild populations, plus several scattered individuals (Field, 2012) which is considered to be limited. The species is also subject to continuing decline in number of locations and number of mature individuals due to climatic disturbance (Field, 2012).

Therefore, the geographic distribution is precarious for the species' survival.

B2, a+b (iv)(v): **Eligible for listing as critically endangered**

**Criterion 3:** The estimated total number of mature individuals is very low <250, low <2500 or limited <10 000; **and** either of (A) or (B) is true

- (A) evidence suggests that the number will continue to decline at a very high (25% in 3 years or 1 generation (up to 100 years), whichever is longer), high (20% in 5 years or 2 generations (up to 100 years), whichever is longer) or substantial (10% in 10 years or 3 generations years), whichever is longer (up to 100) rate; or
- (B) the number is likely to continue to decline and its geographic distribution is precarious for its survival (based on at least two of a – c):
- a. Severely fragmented or known to exist at a limited location.
  - b. Continuing decline, observed, inferred or projected, in any of the following:
    - (i) extent of occurrence
    - (ii) area of occupancy
    - (iii) area, extent and/or quality of habitat
    - (iv) number of locations or subpopulations
    - (v) number of mature individuals.
  - c. Extreme fluctuations in any of the following:
    - (i) extent of occurrence
    - (ii) area of occupancy
    - (iii) number of locations or subpopulations
    - (iv) number of mature individuals

#### **Evidence**

This species was reported to be uncommon at the location in the Daintree National Park (Queensland Herbarium, 2009). Jones and Clemesha (1976) reported the species to be 'quite rare in its native habitat'.

An annual survey of 215 sites (each covering an area of 1km<sup>2</sup>) located only 14 mature individuals (Field, pers. comm., 2012). This is the only quantitative information available, and although an estimate of the population size is not available, the size is likely to be at least 'Low' (less than 1000 – the threshold for 'Endangered' for this criterion).

Field (pers. comm., 2012) reported that the species is still declining, and at a high rate. Historical decline of mature individuals of approximately 70 percent occurred at the Daintree National Park population from 2004-2011, as a result of drought and poaching. These threats are predicted to continue (Field, pers. comm., 2012).

Field (pers. comm., 2012) states that the probability of extinction in the wild is approximately 20 percent in the near future (the threshold for 'Endangered'), based on the high rate of decline in the number of mature individuals observed in annual surveys from 2004-2011. This rate of decline is considered to be very high.

Continued decline due to poaching and climatic perturbations is likely (Field, 2012). The geographic distribution is precarious for the species' survival. – See Criterion 2.

**Eligible for listing as endangered:** estimated population is low <2 500 mature individuals, observed high rate of continuing decline. Geographic distribution is precarious as it is fragmented and known to exist at a limited location with a net decline in the number of mature individuals.

**Criterion 4:** Estimated total number of mature individuals:

- (a) Extremely low < 50
- (b) Very low < 250
- (c) Low < 1000

**Evidence**

An annual survey of 215 sites (each covering an area of 1 km<sup>2</sup>), located only 14 mature individuals (Field, pers. comm., 2012). This is the only quantitative information available, and although an estimate of the population size was not provided, the size is likely to be at least 'Low' (less than 1000 – the threshold for 'Vulnerable').

**Eligible for listing as vulnerable**

**Criterion 5:** Probability of extinction in the wild based on quantitative analysis is at least:

- (a) 50% in the immediate future, 10 years or three generations (whichever is longer); or
- (b) 20% in the near future, 20 year or five generations (whichever is longer); or
- (c) 10% in the medium-term future, within 100 years.

**Evidence**

Field (pers. comm., 2012) states that the probability of extinction in the wild is approximately 20 percent in the near future (the threshold for 'Endangered'), based on the high rate of decline in the number of mature individuals observed in annual surveys from 2004-2011. However, there has not been a quantitative analysis demonstrating this probability.

**Not applicable:** population viability analysis has not been undertaken

**Public Consultation**

Notice of the proposed amendment was made available for public comment for at least 30 business days. Any comments received that are relevant to the survival of the species have been considered by the Committee.

**Recovery Plan**

There should not be a recovery plan for *Phlegmariurus squarrosus* as the approved conservation advice for the species provides sufficient direction to implement priority actions and mitigate against key threats.

Threats to the species are illegal collecting, habitat damage from cyclones and drought (Field, 2011). This species is potentially threatened by localised settlement and visitor pressures (Landsberg and Clarkson, 2004). The two wild populations occur in the Daintree National Park and Wooroonooran National Park, both part of the Wet Tropics World Heritage Area and are therefore offered formal protection. A recovery plan is not likely to provide further protection from illegal collecting or mortality caused by climatic events of cyclones or drought. The population at Wooroonooran National Park occurs in a difficult to access site.

**Conservation and Impact avoidance guidance**

**Primary Conservation Objectives**

A stable population of at least 1000 individuals in at least 5 separate, but interconnected, locations dispersed along several gorge systems in the wet tropics.

1. Increase the number and size of wild populations
2. Maintain and where possible enhance important habitat
3. Monitor and understand the conservation status of the species
4. Effectively manage protection and recovery effort

## Important populations

*Phlegmariurus squarrosus* is currently limited to two wild populations and several scattered individuals (Field, 2011). The two wild populations occur in the Daintree National Park and Wooroonooran National Park, both part of the Wet Tropics World Heritage Area. Both populations and all individuals are considered important.

## Important habitat to the survival of the species

*Phlegmariurus squarrosus* is restricted to areas of high-rainfall rainforest where it grows on boulders and rheophytic trees in the riparian fringe of gorges (Field, 2011). These habitats are considered to be important habitat for the survival of the species.

## Information required and research priorities

Research priorities that would inform future regional and local priority actions include:

- Design and implement a monitoring program.
- More precisely assess population size, distribution, and ecological requirements.
- Assess the extent of population/individual isolation and the species' requirements for maintenance of genetic diversity
- Assess the current extent of illegal collecting and its impact on populations.
- Undertake survey work in suitable habitat and potential habitat to locate any additional populations/occurrences/remnants.
- Undertake spore germination and/or vegetative propagation trials to determine the requirements for successful establishment. Ensure that cultivation of *P. squarrosa* for conservation purposes are from Australian provenanced plants [and not non-Australian, as these specimens may be phylogenetically different i.e. *P. squarrosa* may be polyphyletic and is yet to be taxonomically resolved].

## Management actions required

- Monitor populations and known occurrences.
- Manage anthropomorphic threats including visitor pressure to minimise any adverse impact on individuals and reduce the potential incidence of unauthorised collection.
- Where appropriate and possible, control access routes to suitably constrain public access to known sites.
- Manage sites to identify, control and reduce the incidence of illegal collection.
- Undertake survey work in suitable habitat and potential habitat to locate any additional populations/occurrences/remnants
- Manage populations to maintain genetic diversity.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary
- Undertake appropriate spore collection, storage and propagation in association with research trials and undertake re-establishment as appropriate following results of research of requirements
- Investigate options for linking, enhancing or establishing additional populations.
- Consider and, if appropriate, implement national translocation protocols if establishing additional populations is considered necessary and feasible.

## Recommendations

- (i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **transferring** from the endangered category to the critically endangered category:

*Phlegmariurus squarrosus*

- (ii) The Committee recommends for approval this document as the conservation advice for this species
- (iii) The Committee recommends that there should not be a recovery plan for this species.

Threatened Species Scientific Committee

3 September 2013

## References cited in the advice

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Viewed: 12 November 2009

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