Advice to the Minister for Sustainability, Environment, Water, Population and Communities from the Threatened Species Scientific Committee (the Committee) on Amendment to the list of Threatened Species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

1. Name

Acanthophis hawkei

The species is commonly known as the plains death adder. It is in the Family Elapidae.

2. Reason for Conservation Assessment by the Committee

This advice follows assessment of information provided by a public nomination to list the plains death adder. The nominator suggested listing in the **vulnerable** category of the list.

This is the Committee's first consideration of the species under the EPBC Act.

3. Summary of Conclusion

The Committee judges that the species has been demonstrated to have met sufficient elements of Criterion 1 to make it eligible for listing as **vulnerable**.

4. Taxonomy

The plains death adder is conventionally accepted as a distinct species. The species has been formally described by Wells and Wellington (1985) and the subsequent genetic work by Wüster et al. (2005) allows the species to be defined by reference to a phylogenetic clade and accessioned sequences. A scientific institution has a specimen of the species (Northern Territory museum (R3677)) and the taxon is recognised as a distinct species by both the Northern Territory museum and the Queensland Museum.

5. Description

The plains death adder is a robust terrestrial snake which grows to a maximum length of approximately 1.2 m (Wells and Wellington, 1985). The species' dorsal side ranges in colour from shades of grey to a brownish-red, usually with wide, lighter bands across the body. The species' ventral side varies in colour from shades of grey to cream. The species has a somewhat flattened, triangular-shaped head (Webb et al., 2002). The end of its tail tapers rapidly, becoming thin and worm-like, and is used to lure prey within striking distance (Hagman et al., 2008).

6. National Context

The exact distribution of the species is unclear. Suitable habitat for the plains death adder consists of flat, treeless, cracking-soil riverine floodplains (Cogger, 2000). Based on the presence of suitable habitat, the potential geographic range of the plains death adder extends from Western Queensland, across the north of the Northern Territory to north-east Western Australia. Fragmented populations of the plains death adder are known to occur in the Mitchell Grass Downs of western Queensland, the Barkly Tableland on the Northern Territory / Queensland border and east of Darwin in the Northern Territory (see Figure 1). The species' extent of occurrence is estimated to be approximately 720,000 km^2 and its area of occupancy is estimated to be approximately 233,480 km^2 (Phillips, pers. comm., 2009).

Based upon field experience, and encounter rates across its range, the species can be locally common (in the absence of cane toads (*Rhinella marinus*)) on the highly productive floodplains of northern Australian rivers. On the Barkly Tableland and Mitchell Grass Downs, however, the species is less-commonly encountered, so can probably be considered scarce in this habitat. However, the total population size of the plains death adder is unknown.

Within its habitat the plains death adder is well camouflaged. It conceals itself in the substrate when in an ambush position and does not startle when approached. As such, the only reliable way of detecting individuals is to drive slowly on roads that cross or run close to suitable habitat for the species. Survey efforts need to be large, particularly in populations that have been invaded by cane toads, where detection rates can be as low as one individual per 30–60 hours of surveying (Phillips, pers. comm., 2009).

The species occurs within a variety of tenures including national parks, Indigenous land, military land and pastoral leases. A population exists in Kakadu National Park and in Mary River and Djukbinj National Parks in the Northern Territory. The major contiguous part of its range is the Barkly Tableland and Mitchell Grass Downs, where the predominant tenure is pastoral leases (Phillips, pers. comm., 2009).

The plains death adder is not listed under state or territory legislation. The species occurs within the Northern Territory Southern Gulf and the Desert Channels Natural Resource Management regions. It occurs within the Darwin Coastal, Pine Creek, Daly Basin, Mitchell Grass Downs, Gulf Fall and Upland, Mount Isa Inlier and Davenport Murchison Ranges IBRA bioregions.

7. Relevant Biology/Ecology

The species occurs on the flat, treeless, cracking-soil plains of northern Australia. Radiotracking suggests that individuals of this species are nomadic and do not have a definable home range. During the wet season, individuals move distances ranging from a few metres to a kilometre every 3–10 days in apparently random directions. Movement is less frequent during the dry season (Phillips, pers. comm., 2009).

The species does not actively hunt. Between moves, individuals bury themselves amongst substrate such as leaf litter or sand, and assume an ambush position and wait for prey. While waiting for prey only the head and tail are exposed, and both are well camouflaged. To attract prey to within striking distance, the plains death adder waves the tip of its tail to imitate prey, such as a worm or caterpillar. The species is highly venomous (Cogger, 2000). Frogs and lizards constitute 95% of the diet of young plains death adders, but individuals switch to small mammals, such as rats, when they reach a larger size (Webb et al., 2002, 2005). This larger size is generally often only attained by females (Webb et al., 2005). The plains death adder provides a food resource for predators including birds, goannas and other snake species (Phillips, pers. comm., 2009).

The life expectancy of the plains death adder is approximately 10 years. The species' generation length is between 3–5 years, with males reaching sexual maturity at 12 months and females at 18–24 months (Webb et al., 2002). The species generally breeds from October to November and produces live young from February to March. Males will attempt to breed every year, but females will only breed every one–two years depending on prey availability. The species typically has between 8–24 offspring in a litter (Phillips, pers. comm., 2009).

8. Description of Threats

The introduced cane toad presents the greatest threat to the plains death adder. The plains death adder is an ambush forager and has a specialised foraging tactic of luring prey by waving the tip of its tail. Native frogs make up a large proportion of the species' diet (Webb et al., 2005). The cane toad responds more strongly to this lure than native prey species and cane toads are more likely to elicit luring from plains death adders than native prey (Hagman et al., 2008). The species does not appear to have the ability to discriminate between cane toads and native frogs (Hagman et al., 2008, 2009). The toxins in cane toads' skin typically cause death in the plains death adder and individuals have been known to die in large numbers when cane toads arrive in an area (Hagman et al., 2008, 2009; Phillips et al., 2010).

Cane toads are spreading across northern Australia at a rate of approximately 40–100 km per year (Phillips et al., 2007, Urban et al., 2008) and are slowly encompassing the

geographic distribution of the plains death adder. It has been predicted that by 2030 cane toads will have encompassed almost all of the species' range (Phillips et al., 2003) (see Figure 1). It is possible that the range of the cane toad will not completely overlap that of the plains death adders in the south, as the drier conditions would potentially restrict the cane toads' spread. However, outlying cane toad records suggest that these southern populations already experience cane toads, at least sporadically (Phillips et al., 2008).

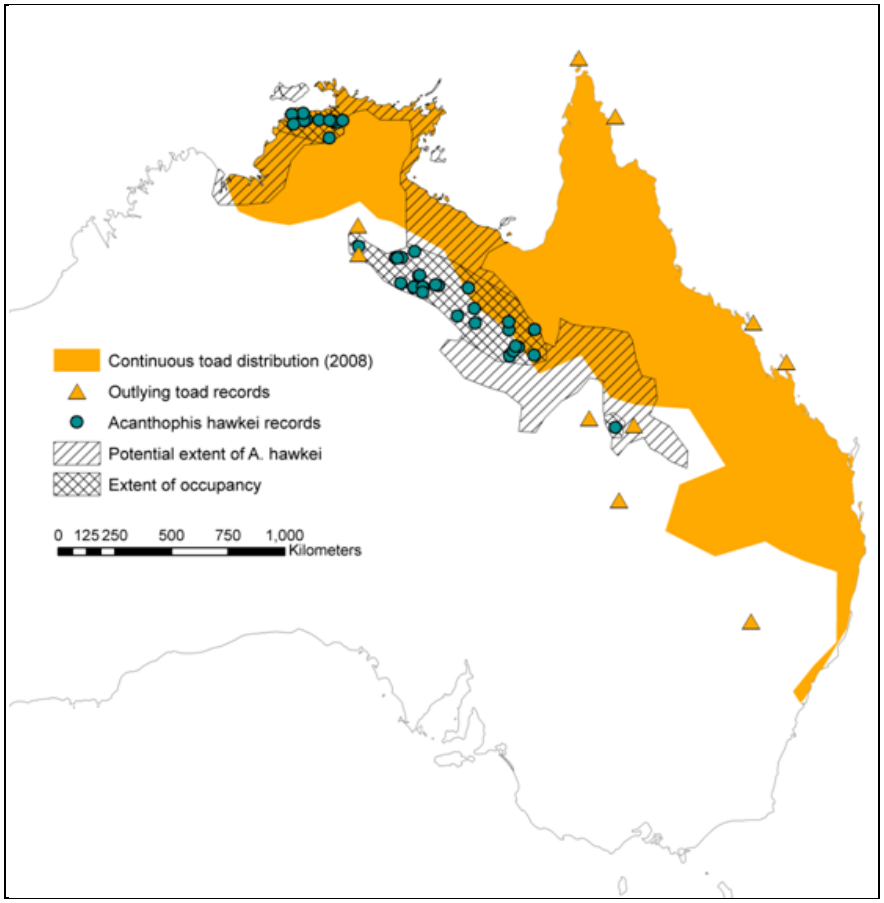

Figure 1. Map of extent of occurrence and area of occupancy of the plains death adder, as well as the distribution of cane toads (as at 2008 based on an alpha-hull analysis of >15,000 toad records, see Phillips et al., 2008).

Habitat modification due to over-grazing by cattle and inappropriate fire regimes is a potential threat to the plains death adder. Both over-grazing and fire regimes that result in large-scale wildfires reduce ground cover and prey availability for the species. Large, unseasonal flood events may impact the plains death adders' food supply of native rats and frogs, but such events are rare and usually relatively localised (Webb et al., 2002).

The widespread practice in northern Australia of spreading waterpoints is used to help reduce grazing pressure on some country by encouraging cattle to use all the country more evenly. In practice, the number of cattle grazed usually increases, resulting in greater total grazing pressure. This practice is a potential threat to the plains death adder as it reduces groundcover, and areas that could act as refugia, for the plains death adder. The practice also has a detrimental impact on the plains death adder as it favours the survival and spread of cane toads (Johnson, pers. comm., 2010).

9. Public Consultation

The nomination was made available for public exhibition and comment for 30 business days. The Committee has had regard to all comments that were relevant to the survival of the species.

10. How judged by the Committee in relation to the criteria of the EPBC Act and Regulations

The Committee judges that the species is **eligible** for listing as **vulnerable** under the EPBC Act. The assessment against the criteria is as follows:

Criterion 1: It has undergone, is suspected to have undergone or is likely to undergo in the immediate future a very severe, severe or substantial reduction in numbers

As outlined under the threats section, the introduced cane toad presents a threat to the plains death adder. With cane toads spreading across northern Australia at a rate of approximately 40–100 km per year (Phillips et al., 2007, Urban et al., 2008), it has been predicted that by 2030 cane toads will have encompassed almost all of the species' range (Phillips et al., 2003).

There are currently no effective broad-scale measures to control cane toads (DEWHA, 2010). While some plains death adder populations occur within National Parks, these reserves are not actively managed for the species, and contain large populations of cane toads (Watson and Woinarski, 2003). The Committee considers it likely that there will be a reduction in the number of plains death adders in the future, as its range continues to be invaded by cane toads.

Surveys have found that encounter rates of the plains death adder on the Arnhem Highway, in the Northern Territories' Adelaide River floodplain, were relatively constant in the seven years preceding the arrival of cane toads in the area (Webb et al., 2002; Phillips et al., 2010). However, following the arrival of the cane toad, the encounter rate decreased. Extensive monitoring was undertaken along an 11 km stretch of the Arnhem Highway, just east of Darwin, over a five year period (from 2004–2009) following the arrival of cane toads. This study considered that the 89% reduction in plains death adder numbers over this period of time was due to the impact of the consumption of cane toads (Phillips et al., 2010).

A study by Brown et al. (2011) at Fogg Dam in the Northern Territory found that the population size of the plains death adder actually marginally increased rather than declined over a four year period following cane toad invasion. Brown et al. (2011) suggest that in some areas the direct negative effects of cane toad invasion could be out-weighed by indirect positive effects. Brown et al. (2011) suggest one possible explanation for this increase is the reduction in population size of varanid lizards, predators of the plains death adder, as a result of the impact of cane toads. It should be noted however, that the site where the plains death adder increased (Fogg Dam) had a small population size when monitoring commenced and saw only a slight increase in those numbers following cane toad arrival. The site where adders decreased (Arnhem Highway) had a very large population size when monitoring commenced, and declined substantially. Therefore, the total observed effect over the two populations is still one of large decline (Phillips, pers comm., 2011).

The Committee considers that, although there may be spatial variation in the degree of decline, monitoring has revealed that the effect of cane toads across all populations monitored is of a large decline. The Committee considers it is likely that a similar magnitude of decline that monitoring studies have revealed will occur in other populations of the plains death adder following the introduction of cane toads. Given that cane toads are expected to have almost entirely encompassed the geographic distribution of the plains death adder by 2030, the Committee considers it likely that the plains death adder will decline substantially over the next three generations (approximately 10–15 years).

As the Committee considers that the plains death adder is likely to undergo a substantial reduction in numbers, the species has been demonstrated to have met the relevant elements of Criterion 1 to make it **eligible** for listing as **vulnerable**.

Criterion 2: Its geographic distribution is precarious for the survival of the species and is very restricted, restricted or limited

The plains death adder is known to occur within the riverine floodplains of the Northern Territory, the Barkly Tableland and the Mitchell Grass Downs of western Queensland. The Committee does not consider the species' geographic distribution to be very restricted, restricted or limited.

As outlined under the threats section and Criterion 1, the introduced cane toad presents a threat to the plains death adder and is likely to encompass almost all of the plains death adder's range in the future. Numbers of plains death adders have been observed to decline following the introduction of cane toads (Phillips et al., 2010). However, as the Committee does not consider the species' geographic distribution to be very restricted, restricted or limited, the species has not been demonstrated to have met the required elements of Criterion 2, it is **ineligible** for listing in any category under this criterion.

Criterion 3: The estimated total number of mature individuals is limited to a particular degree; and either

(a) evidence suggests that the number will continue to decline at a particular rate; or

(b) the number is likely to continue to decline and its geographic distribution is precarious for its survival

As described under the national context section, the total population size of the plains death adder is unknown due to the difficulty of detecting individuals of this species.

As outlined under Criterion 1 and 2, the plains death adder has been observed to decline following the arrival of toxic cane toads to an area and this decline is likely to continue in the future as the cane toad continues to invade populations across Northern Australia.

Although the Committee considers the species is likely to experience a continued decline across its geographic distribution, there are insufficient data available to estimate whether the total number of mature individuals is very low, low, limited, or not limited. Therefore, as the species has not been demonstrated to have met this required element of Criterion 3, it is **ineligible** for listing in any category under this criterion.

Criterion 4: The estimated total number of mature individuals is extremely low, very low or low

As outlined under the national context section, the plains death adder is difficult to survey due to the difficulty of detecting individuals. The only reliable way to detect individuals of this species is to drive slowly in the early evening on roads that cross or run close to suitable habitat and watch for them crossing the road, and as such the survey efforts needs to be large (Phillips, pers. comm., 2009). Given the above, the total population size of the plains death adder is unknown.

As there are insufficient data available to estimate whether or not the total number of mature individuals is extremely low, very low, or low, the species has not been demonstrated to have met this required element of Criterion 4 and is **ineligible** for listing in any category under this criterion.

Criterion 5: Probability of extinction in the wild that is at least

(a) 50% in the immediate future; or

(b) 20% in the near future; or

(c) 10% in the medium-term future

There are insufficient data available to estimate a probability of extinction of the species in the wild over a relevant timeframe. Therefore, as the species has not been demonstrated to have met the required elements of Criterion 5, it is **ineligible** for listing in any category under this criterion.

11. Conclusion

Conservation Status

Acanthophis hawkei (plains death adder) was nominated for inclusion in the list of threatened species referred to in section 178 of the EPBC Act. The nominator suggested listing in the **vulnerable** category of the list.

The Committee considers the geographic distribution of the plains death adder is precarious and the species is likely to decline as a result of the introduction of cane toads to Northern Australia. Given that the cane toad is expected to encompass almost all of the species' range in the future, the Committee considers that the plains death adder is likely to undergo a substantial reduction in numbers. Therefore, the species has been demonstrated to have met the relevant elements of Criterion 1 to make it **eligible** for listing as **vulnerable**.

The highest category for which the species is eligible to be listed is **vulnerable**.

Recovery Plan

There should not be a recovery plan for the plains death adder as the main threat to this species is the introduced cane toad and a threat abatement plan is currently being developed for this threat.

12. Recommendations

(i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the **vulnerable** category:

Acanthophis hawkei

(ii) The Committee recommends that there should not be a recovery plan for this species.

Threatened Species Scientific Committee
29 August 2011

References cited in the advice

Brown GP, Phillips BL and Shine R (2011). The ecological impact of invasive cane toads on tropical snakes: Field data do not support laboratory-based predictions. Ecology 92 (2): 422–431.

Cogger HG (2000). Reptiles and Amphibians of Australia: 6th edition. Reed Books. Melbourne.

Department of Environment, Water, Heritage and the Arts (DEWHA) (2010). Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (Draft).
Available on the Internet at:
http://www.environment.gov.au/biodiversity/invasive/ferals/cane-toads/index.html

Hagman M, Phillips BL and Shine R (2008). Tails of enticement: caudal luring by an ambush-foraging snake (Acanthophis praelongus, Elapidae). Functional Ecology 22:1134–1139.

Hagman M, Phillips BL and Shine R (2009). Fatal attraction: adaptations to prey on native frogs imperil snakes after invasion of toxic prey. Proceedings of the Royal Society B-Biological Sciences 276: 2813–2818.

Johnson A (2010). Personal communication by email 16 November 2010. CSIRO Group Executive, Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Phillips B (2009). Personal communication, 25 November 2009. Senior research fellow. James Cook University.

Phillips B (2011). Personal communication by email 16 May 2011. Senior research fellow. James Cook University.

Phillips BL, Brown GP and Shine R (2003). Assessing the potential impact of cane toads on Australian snakes. Conservation Biology 17: 1738–1747.

Phillips BL, Brown GP, Greenlees M, Webb JK and Shine R (2007). Rapid expansion of the cane toad (*Bufo marinus*) invasion front in tropical Australia. Austral Ecology 32: 169–176.

Phillips BL, Chipperfield JD and Kearney MR (2008). The toad ahead: challenges of modelling the range and spread of an invasive species. Wildlife Research 35: 222–234.

Phillips BL, Greenlees MJ, Brown GP and Shine R (2010). Predator behaviour and morphology mediates the impact of an invasive species: cane toads and death adders in Australia. Animal Conservation 13: 53–59.

Urban MC, Phillips BL, Skelly DK and Shine R (2008). A toad more travelled: the heterogeneous invasion dynamics of cane toads in Australia. The American Naturalist 171: E134–E148.

Watson M and Woinarski J (2003). A preliminary assessment of impacts of cane toads on terrestrial Vertebrate fauna in Kakadu National Park. Unpublished Report February 2003. Jabiru: Kakadu Research Advisory Committee.

Webb JK, Christian KA, Fisher P (2002). Fast growth and early maturation in a viviparous ambush foraging elapid snake from tropical Australia. Journal of Herpetology 36: 505–509.

Webb JK, Shine R and Christian KA (2005). Does intraspecific niche partitioning in a native predator influence its response to an invasion by a toxic prey species? Austral Ecology 30: 201–209.

Wells RW and Wellington CR (1985). A Classification of the Amphibia and Reptilia of Australia. Australian Journal of Herpetology, Supplementary Series 1: 1–61.

Wüster W, Dumbrell AJ, Hay C, Pook CE, Williams DJ and Fry BG (2005). Snakes across the Strait: trans-Torresian phylogeographic relationships in three genera of Australasian snakes (Serpentes : Elapidae : *Acanthophis*, *Oxyuranus*, and *Pseudechis*). Molecular Phylogenetics and Evolution 34: 1–14.