

Threatened species nomination

For nominations/assessments under the Common Assessment Method (CAM).

Cover Page *(Office use only)*

Species name (scientific and common name):	<i>Ctenotus angusticeps</i> (Airlie Island Ctenotus/ Northwestern coastal Ctenotus)
Nomination for (addition, deletion, change):	Deletion
Nominated conservation category and criteria:	None

TSSC assessment of eligibility against the criteria:		
A.	Population size reduction	•
B.	Geographic range	•
C.	Small population size and decline	•
D.	Very small or restricted population	•
E.	Quantitative analysis	•

Outcome:			
TSSC Meeting date:	5 April 2017		
TSSC comments:	The committee had no queries, concerns or comments on the nomination.		
Recommendation:	Delist – remove from threatened fauna list.		
Ministerial approval:	22 December 2017	Government Gazette:	16 January 2018

Nomination summary *(to be completed by nominator)*

Current conservation status				
Scientific name:	<i>Ctenotus angusticeps</i>			
Common name:	Airlie Island Ctenotus (recommended change to : Northwestern coastal Ctenotus)			
Family name:	Scincidae	Fauna <input checked="" type="checkbox"/>	Flora <input type="checkbox"/>	
Nomination for:	Listing <input type="checkbox"/>	Change of status <input type="checkbox"/>	Delisting <input checked="" type="checkbox"/>	
Is the species currently on any conservation list, either in WA, Australia or Internationally?		Yes <input checked="" type="checkbox"/> If Yes; complete the following table	No <input type="checkbox"/> If No; go to the next question	
Jurisdiction	List or Act name	Date listed or assessed	Listing category i.e. critically endangered	Listing criteria i.e. B1ab(iii)+2ab(iii)
International	IUCN Red List			
National	EPBC Act	16/07/2000	Vulnerable	N/A
State of WA	WC Act	16/11/1990	Vulnerable	D2
		Assessed 05/04/2017	None	
Other States or Territories				
Consistent with Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding, it is confirmed that:				
<ul style="list-style-type: none"> this assessment meets the standard of evidence required by the Common Assessment Method to document the eligibility of the species under the IUCN criteria; 			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:				
<ul style="list-style-type: none"> surveys of the species were adequate to inform the assessment; 			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:	Refer to nomination. New mainland occurrences demonstrate that the species is not restricted to the single island, as originally thought, but occurs on the mainland at multiple sites extending 800 km (linear length) along the north-western coastline. Suitable habitat between these confirmed sites indicates an even greater potential distribution however these potential areas have not yet been surveyed.			
<ul style="list-style-type: none"> the conclusion of the assessment remains current and that any further information that may have become available since the assessment was completed supports or is consistent with the conclusion of the assessment. 			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:	New occurrences indicate the species is not at immediate risk.			
Nominated conservation status: category and criteria (including recommended categories for deleted species)				
Presumed extinct (EX) <input type="checkbox"/> Critically endangered (CR) <input type="checkbox"/> Endangered (EN) <input type="checkbox"/> Vulnerable (VU) <input type="checkbox"/>				

None (least concern) <input checked="" type="checkbox"/>			Data Deficient <input type="checkbox"/>	Conservation Dependent <input type="checkbox"/>
What criteria support the conservation status category above? <i>Refer to Appendix A table 'Summary of the five criteria (A-E)' and the check version that can be completed to indicate all criteria options</i>				
Eligibility against the criteria				
Provide justification for the nominated conservation status; is the species eligible or ineligible for listing against the five criteria. For delisting , provide details for why the species no longer meets the requirements of the current conservation status.				
A.	Population size reduction	<ul style="list-style-type: none"> The known species range, as an indicator of population size, has increased significantly in the last 10 years due to new knowledge of the species distribution on the mainland and suitable habitat type. Even though the population size is unknown, there is no known population size reduction and no evidence that a reduction has occurred or will occur in the future. It is possible that there has been or may be declines in AOO and habitat condition due to vegetation clearing for infrastructure development associated with mining and petroleum industries, residential and industrial development, pastoral and recreational activities within the region, particularly in areas surrounding Onslow, Karratha, Port Hedland and Broome. However, the species habitat (tidal mud flat and mangrove habitat) is not in areas where development usually occurs. Targeted surveys in 2012 (Maryan <i>et al.</i> 2013) captured the species at multiple sites within the Port Hedland area, demonstrating the species presence in suitable habitat after development in adjoining and nearby areas. Other threats associated with the industries (including recreational activities) and climate change (extreme weather events and rising sea levels) may possibly impact the species and its habitat, however the mangroves in north-western Australia are considered to be some of the least vulnerable to the potential impacts of sea level rise (Ward <i>et al.</i> 2016). (A3) A population reduction could be inferred to be met in the future based on the percentage of suitable habitat that is within mining and exploration tenements or areas likely to be developed near coastal towns. Using GIS shapefiles of tidal mud flat and mangrove habitat between Onslow and Broome, it is calculated that 42 % of this suitable habitat is within mining and exploration tenements. However, even though suitable habitat may occur within the tenements, it is unlikely that the habitat will be cleared or impacted, even if activities occurred on the tenements. The habitat is unlikely to be within a development footprint because the substrate and activities within tenements or development areas predominantly occur behind the coastal dunes in areas that are not suitable habitat for the species. It is possible for the exploration tenements to become live mining tenements, but it is unlikely that all of them will, and also unlikely that the potential habitat within an area/tenement would be impacted. If impact to habitat did occur, it is likely to be minor, at a small scale; it is unlikely to be at a scale to result in a population reduction of $\geq 30\%$ within a 10 year period. Does not meet criteria - not likely to meet Vulnerable A3c threshold 		

		within the time period (10 years).
B.	Geographic range	<ul style="list-style-type: none"> The species was originally only known from a single location, Airlie Island, when it was listed as Vulnerable D2 as a precautionary measure. It has more recently been found on the mainland at numerous sites along the coast, with additional potential habitat available that has not been surveyed. While some locations may be at risk of minor impact, many areas are not and are within conservation estate. The species does not meet the IUCN criteria, and further survey will likely further expand its distribution and occupancy. (B1) All records of the species are found along an 800 km linear length of coastline and Airlie and Finucane Island, and therefore it is not appropriate to calculate the EOO using Minimum Convex Polygon or α-hull (i.e. MCP over capture records is 51,228 km² but this area is predominantly ocean and omits coastal areas which are potential habitat). The extent of potential habitat (tidal mud flat and mangrove habitat) between Onslow and Broome is calculated to be 2,488 km² and 5,974 km² when the coastal grasslands are included. These habitat types actually extend from Exmouth to the Northern Territory border and the extent of potential habitat increases further to 9,575 km² (tidal mud flats and mangrove) and 13,227 km² (plus adjoining coastal grasslands). MCP over this entire extended area of potential habitat is > 300,000 km². Therefore, the EOO is estimated to be at least 2,488 km². (B2) AOO is 96 km² (2 km x 2 km grid) based on capture records, which is considered to be a significant under-representation of the actual AOO. The estimated AOO would be an under-estimate given the extent of potential habitat. Using 2 km x 2 km grid squares over the mapped vegetation types (as per EOO) the area of potential habitat is 4,528 km² of mangrove and tidal flat habitat between Onslow and Broome, increasing to 9,128 km² when the coastal grasslands between Onslow and Broome are included. As these habitat types occur from Exmouth to the NT border, these calculated areas increase to 17,776 km² and 22,524 km² respectively. (a) The species appears to be restricted to naturally fragmented habitat but is not considered to be severely fragmented. It is currently known from 15 subpopulations at 11 discrete geographical locations (with 16 different land tenure and purpose types, including conservation estate). However, the number of subpopulations/locations is expected to increase with further survey. (b) There is no known decline or evidence of decline in EOO, AOO, number of locations or subpopulations, area, extent or quality of habitat, or number of mature individuals. It is possible that there has been some minimal decline in the past and that there could be minimal decline in the present and future, due to vegetation clearing for development, however clearing is not likely to have occurred, nor is it likely to be occurring in the present or to occur in the future, within the species habitat (tidal mud flat and mangrove habitat). Does not meet criteria as there is no known continuing decline
C.	Small population size and decline	<ul style="list-style-type: none"> The known species range, and therefore population size, has increased significantly in the last 10 years due to new knowledge of the species distribution on the mainland and suitable habitat type. Even though the population size is unknown, there is no known decline and no

		evidence that a decline has occurred or will occur in the future.	
		<ul style="list-style-type: none"> • Does not meet criteria 	
D.	Very small or restricted population	<ul style="list-style-type: none"> • (D) The population size is unknown. However, the known species range, and therefore population size, has increased significantly in the last 10 years due to new knowledge of the species distribution on the mainland and suitable habitat type. A single-day survey conducted near Broome in April 2017 resulted in 20 individuals being captured (19 mature individuals and 1 sub-adult). • (D2) The species was originally thought to only be found on Airlie Island, meeting eligibility for a restricted population (AOO < 20 km² and number of location < 5). However, surveys have since found it at multiple locations on the mainland between Karratha and Broome. Currently known AOO is 96 km², the number of locations is at least 11 and there is no known plausible threat that may drive the taxon to CR or EX in a very short period of time. • Does not meet criteria 	
E.	Quantitative analysis	<ul style="list-style-type: none"> • Insufficient information to assess 	
Reasons for change of status			
Genuine change <input type="checkbox"/> New knowledge <input checked="" type="checkbox"/> Taxonomic change <input type="checkbox"/> Previous mistake <input type="checkbox"/> Other <input type="checkbox"/>			
<p>When the species was first listed as a threatened species, it was only known from Airlie Island. It was later found on the mainland at Roebuck Bay (Sadler 1993). In 2012, Biologic undertook a nine-day targeted survey on the coast between Onslow and Broome and found new mainland populations. Genetic work was also undertaken to confirm that the mainland specimens were the Airlie Island species (Maryan <i>et al.</i> 2013). The Commonwealth-facilitated IUCN Squamata Assessment workshop for the WA species was held in February 2017 and the preliminary assessment of this species was as 'Least Concern'. Further surveys are likely to demonstrate a larger extent of the species on the mainland.</p>			
Summary of assessment information (detailed information to be provided in the relevant sections of the form)			
EOO	<p>All records of the species are found along an 800 km linear length of coastline and Airlie and Finucane Islands, and therefore it is not appropriate to calculate the EOO using MCP or α-hull.</p> <p>MCP is 51,228 km² but is predominantly ocean and omits coastal areas which are potential habitat.</p> <p>The area of potential habitat (tidal mud flat and mangrove habitat) between Onslow and Broome is calculated to be 2,488 km² and up to 13,227 km² including all potential habitat between Exmouth and the NT border. MCP covering this extended area of potential habitat is > 3000,000 km².</p>	<p>AOO</p> <p>96 km² (2 km x 2 km grid) for recorded captures.</p> <p>Between 4,528 km² (Onslow to Broome) and 22,524 km² using 2 km x 2 km grid squares over potential habitat areas.</p>	<p>Generation length</p> <p>1-3 years</p>
No. locations	11 known discrete geographical locations (with 16 different land tenure and purpose types)	Severely fragmented	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
No. subpopulations	15 based on known locations and habitat	No. mature individuals	Unknown

	connectivity		
Percentage global population within WA		100 %	
Percentage global population within Australia		100 %	
Percentage population decline over 10 years or 3 generations		Unknown	

Summary of subpopulation information (detailed information to be provided in the relevant sections of the form)						
Location (in order NE to SW)	Land tenure (types within the 2 km x2 km grid squares)	Survey information: Date of survey and No. mature individuals	AOO (2 km x 2km grid square only, not area of potential habitat in vicinity)	Site / habitat Condition	Threats (note if past, present or future)	Specific management actions
Willies Creek, Waterbank N of Broome	Unallocated Crown Land (UCL) (potentially within adjoining Crown Reserves - Yawuru Birragun Conservation Park and Yawuru Northern Intertidal Area, for <i>Conservation, Recreation and Traditional and Customary Aboriginal Use and Enjoyment</i>)	2012	4 km ²	Unknown, presumably good or higher	There are no known threats to the species. Potential threats are provided below based on land tenure and use/purpose (comment applicable to all locations). Possibly: Recreational activities (<i>present and future</i>) Climate change (<i>future</i>)	No location or site specific management actions General actions that may be considered for any mainland locations/sites are as follows: Native Vegetation Clearing Permit conditions Improve public awareness Control recreational access routes Survey and monitor Exotic weed control
Dampier Creek (Kunin), Broome	UCL Crown Reserve – Yawuru Nagulagun / Roebuck Bay Marine Park and Yawuru Birragun Conservation Park (for <i>Conservation, Recreation and Traditional and Customary Aboriginal</i>	2017: 20 individuals (including 1 sub-adult)	16 km ²	Unknown, presumably good or higher	Possibly: Recreational activities (<i>present and future</i>) Climate change (<i>future</i>)	As above As per Management Plans for the marine park and conservation park

	<i>Use and Enjoyment)</i>					
Crab Creek, Roebuck Plains ESE of Broome	Crown Reserve - Yawuru Nagulagun / Roebuck Bay Marine Park (for <i>Conservation, Recreation and Traditional and Customary Aboriginal Use and Enjoyment</i>)	2012	4 km ²	Unknown, presumably good or higher	Possibly: Recreational activities (<i>present and future</i>) Climate change (<i>future</i>)	As above
Thangoo Station, Roebuck SSE of Broome	Crown Reserves - Yawuru Nagulagun / Roebuck Bay Marine Park and Yawuru Birragun Conservation Park (for <i>Conservation, Recreation and Traditional and Customary Aboriginal Use and Enjoyment</i>) Crown Lease Pastoral	1990: 7 individuals 2012	4 km ²	Degraded and modified in pastoral areas	Possibly: Recreational activities (<i>present and future</i>) Pastoral activities (<i>past, present and future</i>) Climate change (<i>future</i>)	As above
Port Smith, Frazier Downs Station, Lagrange NE of Bidyadanga Community	UCL Crown Lease Pastoral	2012	4 km ²	Unknown	Possibly: Recreational activities (<i>present and future</i>) Pastoral activities (<i>past, present and future</i>) Climate change (<i>future</i>)	As above (Willie Creek)
Cape Keraudren, Firewood Creek, Pardoo E of Port Hedland	Crown Reserve - Shire (for recreation) (potentially within adjoining/nearby	2012	8 km ²	Unknown	Possibly: Recreational activities (<i>present and future</i>)	As above

	Crown Reserves - Eighty Mile Beach Marine Park (which includes tidal flats) and Jarrkurnpang Nature Reserve)				Climate change (<i>future</i>)	
Beebingarra Creek, Pippingarra E of Port Hedland	UCL Crown Reserve (Harbour purposes) Crown Lease Pastoral Mining tenement (live mineral lease)	2012	4 km ²	Unknown	Possibly: Land development (<i>past, present and future</i>) Pastoral activities (<i>past, present and future</i>) Climate change (<i>future</i>)	As above
Cooke Point, Pretty Pool, Port Hedland	UCL Crown Reserve – Shire (for recreation) Crown Reserve (Harbour purposes) Crown Lease – Town of Port Hedland	2012	4 km ²	Unknown	Possibly: Recreational activities (<i>present and future</i>) Climate change (<i>future</i>)	As above
Redbank and Wedgfield, Port Hedland	UCL, Crown Reserve – Shire (recreation) Crown Reserve (Harbour purposes) Freehold Mining tenement (live mineral lease)	2010-2012	12 km ²	Unknown	Possibly: Land development (<i>past, present and future</i>) Recreational activities (<i>present and future</i>) Climate change (<i>future</i>)	As above
Finucane Island, Port Hedland	UCL Crown Reserve	2012	8 km ²	Unknown	Possibly: Land development (<i>past,</i>	As above

	(Harbour purposes) Crown Lease				<i>present and future</i> Recreational activities (<i>present and future</i>) Climate change (<i>future</i>)	
Salmon Creek, Boodarie W of Port Hedland	UCL Crown Reserve (Harbour purposes) Mining tenement (live general purpose lease)	2011-2012	8 km ²	Unknown	Possibly: Land development (<i>past</i> , <i>present and future</i>) Climate change (<i>future</i>)	As above
Turner River, Boodarie W of Port Hedland	UCL Crown Reserve (Harbour purposes) Crown Lease Pastoral	2012	4 km ²	Unknown	Possibly: Pastoral activities (<i>past</i> , <i>present and future</i>)	
Boodarie Creek, Boodarie W of Port Hedland	UCL Crown Reserve (Harbour purposes) Crown Lease Pastoral Mining tenement (live mining lease)	2012	8 km ²	Unknown	Possibly: Pastoral activities (<i>past</i> , <i>present and future</i>) Land development (<i>past</i> , <i>present and future</i>)	
Lulu Creek, Nickol River, Mount Anketell E of Karratha	UCL Crown Reserve (Harbour purposes) Crown Reserve (for industrial estate) Crown Lease Pastoral Mining tenement (live and pending	2012	4 km ²	Unknown	Possibly: Land development (<i>past</i> , <i>present and future</i>) Pastoral activities (<i>past</i> , <i>present and future</i>) Climate change (<i>future</i>)	As above

	exploration licence)					
Airlie Island NNE of Onslow	Crown Reserve (Airlie Island Nature Reserve Petroleum title (production licence)	1900: type specimen 1987: 4 individuals 1990: > 35 individuals 2001: 4 individuals 2014-15: 4 individuals	0.28 km ² (4 km ² as 1 grid square)	Very good to degraded near processing facilities	Possibly: Petroleum related development / oil and gas processing facilities (<i>past and future</i>) Climate change (<i>future</i>) Buffel grass (<i>Cenchrus ciliaris</i>) as although has been successfully controlled it is unknown if it has been eradicated (<i>past and future</i>)	As above

Nomination detail

Please refer to the Departments guidelines on nominating species for amendment of the Western Australian threatened species lists at http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Threatened_Species_Nomination_Guidelines_2014.pdf

For technical information on terminology used in this form, and the intent of information requirements, as they relate to an assessment of this nomination against the IUCN Red List criteria, refer to the 2001 *IUCN Red List Categories and Criteria. Version 3.1*

http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf

and *Guidelines for Using the IUCN Red List Categories and Criteria Version 11* (February 2014)


<http://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf>

Section 1: Taxonomy

1.1 Current taxonomy			
Species name and Author:		<i>Ctenotus angusticeps</i> Storr, 1988	
Subspecies name(s) and Author:		N/A	
Is the species/subspecies conventionally accepted?		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Is there any controversy about the taxonomy?		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
If not conventionally accepted and/or if there is any controversy; provide details:		N/A	
Has the species/subspecies been formally named?		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Has the species/subspecies been recently described?		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
If the species has not been formally named or described; is it in the process of being described? Is there an anticipated date for the publication of the description? Has a type specimen been deposited? And if so provide the registration number and where deposited.		N/A	
If there are any closely related taxa provide details and include key distinguishing features:		Many species of the <i>Ctenotus</i> genus are morphologically similar and can be difficult to identify. <i>C. angusticeps</i> has an overlapping distribution with and is morphologically similar to <i>C. grandis</i> (Maryan <i>et al.</i> 2013). <i>C. angusticeps</i> may be confused with <i>C. saxatilis</i> which also occurs on Airlie and Finucane Islands and on the mainland in in generally the same locations, and has similar patterning and is a similar size (Ford and Turpin 2011). Distinguishing features between the species can be found in Cogger (2014).	
1.2 Taxonomic history			
Are there recent synonyms for the species?		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
If Yes; provide details of synonyms:		N/A	
Have there been recent changes in the taxonomy or nomenclature?		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

If Yes; provide details of changes:	N/A
1.3 Hybridisation	
Is there any known hybridism with other species in the wild?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes; Where does this occur and how frequently?	N/A

Section 2: Species information

2.1 Morphology / physical description	
Insert photograph(s) of species or provide as an attachment:	
	
(Photo: Maryan <i>et al.</i> , 2013)	
Species description:	<p>Extract from Cogger (2014):</p> <p>"Olive grey above, mottled and variegated with black and dirty-white or cream; a series of longitudinally aligned whitish, dark-edged spots or short bars, especially on the upper and lower flanks, more obscure on the back; usually some indication of a dark mid-dorsal stripe, whitish below. 28-30 mid-body scale rows, Nasals in contact or narrowly separated. Prefrontals narrowly separated. Foyr supraoculars. 7-8 supralabials. Ear lobules 3-4. Lamellae under fourth toe 19-22, each with "a moderately wide callus". 70 mm (snout-vent)."</p>
2.2 Biology (provide details)	
Species belonging to the <i>Ctenopus</i> genus are terrestrial and oviparous (Cogger, 2014). Little is known about the biology of this species.	
2.3 Ecology (provide details)	
<p><i>C. angusticeps</i> is primarily found in coastal areas. On Airlie Island, the species occupies most habitat types including tussock grasslands and <i>Acacia</i> shrubland with coastal spinifex. On the mainland, the species appears "to be highly restricted to specific habitat, primarily salt marsh communities adjacent to mangroves where lizards shelter down crab holes". The mainland habitat descriptions recorded during surveys is "samphire shrubland along mangrove</p>	

margin” and “the landward fringe of salt marsh communities, vegetated with samphire and marine couch grass immediately adjacent to mangroves or some distance away, through still within close association” (Maryan *et al.*, 2013). These habitats area closely associated with mangroves, which experience extreme heat, wind, glare and tides. The species presence within these harsh environments, and its typically daytime-based activity, indicate that it is fairly heat tolerant (Maryan *et al.*, 2013).

Mangrove environments are highly dynamic, expanding and contracting in response to water levels and erosion. As they are closely associated with the salt marsh communities, it is possible that the habitat for *C. angusticeps* would also expand and contract over short periods of time. It is therefore assumed that subpopulations of *C. angusticeps* regularly undergo periods of time where they are connected and isolated (Maryan *et al.*, 2013).

Crab holes have been present at all locations where the species has been found. They are used by the species, along with dense tussocks of marine couch grass, to take shelter overnight and evade capture. Juveniles have also been observed retreating up to 30 cm above ground into samphire vegetation. Like other reptile species that live in tidal or seasonally inundated wetlands, *C. angusticeps* may survive complete submergence under water by utilising air pockets within the crab holes (Maryan *et al.*, 2013).

Ctenotus angusticeps has been observed foraging throughout the day on raised sandy patches and amongst the mangroves at low tide (Maryan *et al.*, 2013). Opportunistic feeders on a wide-variety of invertebrates (Cogger, 2014).

Section 3: Habitat

3.1 Habitat (provide details in response to the question below)

Describe the habitat suitable for the species (biological and non-biological). Include descriptions of specific purpose habitat (e.g. foraging, breeding, roosting, seasonal migration, different life stages).

C. angusticeps is primarily found in coastal areas. On Airlie Island, the species occupies most habitat types including tussock grasslands and *Acacia* shrubland with coastal spinifex. On the mainland, the species appears “to be highly restricted to specific habitat, primarily salt marsh communities adjacent to mangroves where lizards shelter down crab holes”. The mainland habitat descriptions recorded during surveys are “samphire shrubland along mangrove margin” and “the landward fringe of salt marsh communities, vegetated with samphire and marine couch grass immediately adjacent to mangroves or some distance away, through still within close association. The dominant vegetation being the succulent samphires *Tecticornia halocnemoides* subsp. *tenuis* and *Suaeda arbusculoides* on clayey soils with a mixed herd and grass cover of *Muellerolimon salicorniaceum* and *Sporobolus virginicus* on sandy soils. ... observed at some localities within the mangrove-lined creek edges but displayed a marked preference for the low open shrubland area that is subject to tidal influences with numerous crab hole on a heavy, greyish sandy clay substrate.” (Maryan *et al.*, 2013). These habitats area closely associated with mangroves, which experience extreme heat, wind, glare and tides. Crab holes appear to be a habitat requirement.

If the species occurs in a variety of habitats, is there a preferred habitat?

As above

Does the species use refugia?
(include what is it and when is it used)

Crab holes are used by the species, along with dense tussocks of marine couch grass, to take shelter overnight and evade capture. Juveniles have also been observed retreating up to 30 cm above ground into samphire vegetation.

Is the habitat restricted in extent or number of locations?

Yes ☐ No ☒ Unknown ☐

If Yes, provide details:	Previously thought to be only on Airlie Island, recent surveys have found it at 10 other locations on the mainland. Further targeted surveys will likely find it in other areas along the coast where suitable habitat is known to occur.	
Is this species reliant on a threatened or priority species or ecological community?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>	
If Yes, provide details:	There is no evidence that it is reliant on a threatened or priority species or ecological community. However, the species appears to be restricted to coastal salt march communities associated with mangroves. In the Roebuck Bay area, the species has been found on the Vulnerable Threatened Ecological Community (TEC): Roebuck Bay mudflats (species-rich faunal community of the intertidal mudflats of Roebuck Bay) and the Priority Ecological Community (PEC): Kimberley Vegetation Association 73 (as defined by John Beard's vegetation mapping for the Kimberley (Beard 1979); grasslands, short bunch grass savanna, grass; salt water grassland (<i>Sporobolus virginicus</i>); threats: extensive threatening processes acting at landscape scales, namely altered fire regimes, over grazing, and weed invasion).	
Are there any other species (sympatric species) that may affect the conservation status of the nominated species?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>	
If Yes, provide details:	The species frequently uses crab holes and has only been found in mangrove-associated salt march communities that have crab holes. Crabs holes therefore appear to be an essential requirement (Maryan <i>et al.</i> , 2013). The mangrove crab species that most likely dig the holes where <i>C. angusticeps</i> has been found are fiddler crabs (<i>Uca</i> spp.) and bubbler crabs (<i>Scopimera</i> spp.).	
What is the area, extent, abundance of habitat?	<p>The area and extent of potential habitat (mangrove and tidal flats) is calculated to be 2,488 km² between Onslow and Broome (the targeted survey area by Maryan <i>et al.</i> 2013). The area and extent of potential habitat increase to 5,974 km² when the coastal grasslands are included (as per associated vegetation in Morgan <i>et al.</i> 2013).</p> <p>The potential habitat is naturally fragmented and restricted to coastal areas with mangroves and these vegetation types (mangrove and tidal flats, and coastal grasslands) actually extend from Exmouth along the coast to the Northern Territory border. The calculation for this total area of potential mangrove and tidal flat habitat within WA is 9,575 km² and if the adjoining grassland (annual grasses (<i>Enneapogon</i> spp., <i>Aristida</i> spp., etc.) on dry plains and salt-water grasses (<i>Sporobolus virginicus</i>) on the coast) is also included based on the vegetation description by Maryan <i>et al.</i> 2013, then the potential total habitat area (mapped vegetation type) is 13,227 km² and 22,524 km² using 2 km x 2 km grid squares over the mapped vegetation types.</p> <p>It is likely that the species may be found near Exmouth given the relatively close proximity to Onslow, which is the mainland area adjacent to Airlie Island. However, it is unknown how likely the species is to occur within the other areas of mangrove and tidal flat habitat within the Kimberley Region.</p> <p>The specific available habitat for the species may naturally fluctuate in area based on the availability of crab holes. Maryan <i>et al.</i> 2013 states that, due to the species apparent reliance on crab holes, "it is feasible to assume that the environment for <i>C. angusticeps</i> would expand and contract over relatively short periods of time connecting and isolating lizard populations</p>	

	on a regular basis and correspondingly, if <i>C. angusticeps</i> were reliant on crab holes for shelter, then the creation of these holes would fluctuate seasonal and possibly change from year to year".
What is the quality of habitat?	Unknown across the species range, but assumed to vary between small areas of degraded/modified to large areas of good-quality habitat.
Is there a decline in habitat area, extent or quality?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If there is a decline, is the decline continuing?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
Provide details:	There is no known decline in habitat for the species. Some areas of coastal vegetation in the Kimberley and Pilbara is being modified or otherwise degraded at discrete sites due to infrastructure development (mining, oil production, transport, etc.) and recreational activities. However, the species habitat does not occur in areas where development usually occurs: development areas are predominantly behind the coastal dunes in areas that are not suitable habitat for the species. It is possible that habitat loss and degradation will continue into the future at some sites due to the ongoing development, expansion of the mining industry and an increase in tourism to the regions, but these areas are not known to correspond with the skink's habitat.
What is the critical habitat or habitat important for the survival of the species?	Coastal salt marsh, mud flats and coastal grassland associated with mangroves and the presence of crab holes.

Section 4: Survey

4.1 Survey methods (Provide details)	
What survey methods are applicable to the species?	Dry pit falls and hand collection
Are there preferred or recommended survey methods that yield better results for the species?	Identify suitable habitat (and ground truth) and observe lizards by flushing before digging in pit falls or collecting by hand. Surveys are best carried out during the early morning and late afternoon when the species is most active.
Are there special requirements, techniques, expertise or other considerations that are necessary when surveying for this species?	Experienced personnel familiar with the collection and identification of reptiles, preferably with knowledge of <i>Ctenotus</i> species.
Are there reasons why the species may not be detected during surveys?	<p>Many <i>Ctenotus</i> species are morphologically similar and therefore may be misidentified in the field. <i>C. angusticeps</i> may be confused with <i>C. saxatilis</i> which also occurs on Airlie and Finucane Islands and on the mainland in generally the same locations, and has similar patterning and is a similar size (Ford and Turpin 2011).</p> <p><i>Ctenotus</i> species often have extremely localised distributions, associated with a specific habitat-type, and therefore may go undetected if suitable habitat is not thoroughly foraged or systematically trapped.</p> <p><i>Ctenotus angusticeps</i> has a colouring and patterning that enables them to very effectively camouflage themselves on sandy clay substrates amongst vegetation.</p> <p><i>Ctenotus</i> are generally notoriously difficult to observe due to their cryptic nature and their tendency and ability to use a range of refuge types (Maryan</p>

		et al. 2013).	
Can the species be identified in the field?		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Provide details:	Experienced personnel familiar with identifying <i>Ctenotus</i> species are likely to be able to identify it within the field using a suitable field guide. Colouration and pattern morphology appears to be relatively consistent across the species' range, further aiding identification. Photographic evidence and collection of tissue samples is recommended.		
Can the species be easily confused within similar species in the field?		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/> Unknown <input type="checkbox"/>
Provide details:	Many species of the <i>Ctenotus</i> genus are morphologically similar and can be difficult to identify. <i>C. angusticeps</i> has an overlapping distribution with and is morphologically similar to <i>C. grandis</i> (Maryan et al. 2013). <i>C. angusticeps</i> may be confused with <i>C. saxatilis</i> which also occurs on Airlie and Finucane Islands and on the mainland in in generally the same locations, and has similar patterning and is a similar size (Ford and Turpin 2011). Distinguishing features between the species can be found in Cogger (2014).		
<p>List any published survey guidelines, guidance statements, protocols, standard operating procedures or other documents that are relevant to conducting surveys for this species.</p> <p>Maryan, B., Somaweera, R., Lloyd, R., Bunce, M. & O'Connell, M. (2013). Status of the Airlie Island Ctenotus <i>Ctenotus angusticeps</i> (Lacertilia: Scinidae), with notes on distribution, habitat and genetic variation. <i>The Western Australian Naturalist</i> 29(2):103-118.</p> <p>Department of Sustainability, Environment, Water, Population and Communities (2011). <i>Survey guidelines for Australia's threatened reptiles</i>. Available from: http://www.environment.gov.au/resource/survey-guidelines-australias-threatened-reptiles-guidelines-detecting-reptiles-listed</p> <p>Department of Environment and Conservation (2009). <i>Designing a monitoring project for significant native fauna species</i>. Available from: https://www.dpaw.wa.gov.au/plants-and-animals/96-monitoring/standards/139-monitoring-protocols</p> <p>Department of Parks and Wildlife (2013). <i>Standard Operation Procedure No. 9.3: Dry pitfall trapping for vertebrates and invertebrates</i>. Available from: https://www.dpaw.wa.gov.au/plants-and-animals/96-monitoring/standards/99-standard-operating-procedures</p> <p>Department of Biodiversity, Conservation and Attractions (2017). <i>Standard Operation Procedure: Hand capture of wildlife</i>. Available from: https://www.dpaw.wa.gov.au/plants-and-animals/96-monitoring/standards/99-standard-operating-procedures</p> <p>Department of Biodiversity, Conservation and Attractions (2017). <i>Standard Operation Procedure: Temporary marking of mammals, reptiles and birds</i>. Available from: https://www.dpaw.wa.gov.au/plants-and-animals/96-monitoring/standards/99-standard-operating-procedures</p>			
4.2 Survey effort			
Has the species been well surveyed?		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Have targeted surveys been conducted for the species?		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Provide details of the successful and unsuccessful surveys undertaken for the species:	<p>The species was monitored on Airlie Island using dry pit falls in 1989, 1990 and 2001. Observations of the species on the island were made over several days in 1990.</p> <p>A 2010 survey at Port Hedland resulted in the opportunistic sighting and collection of a specimen which lead to targeted surveys being conducted in the following years.</p> <p>A reconnaissance survey was undertaken in 2011 in Port Hedland to determine the species local distribution, relative abundance and habitat preferences.</p>		

	<p>A Level 2 fauna survey conducted for environmental impact assessment (EIA) at South Hedland in 2012 opportunistically captured the species.</p> <p>A Level 2 fauna survey conducted for (EIA) at Port Hedland in 2012 opportunistically captured the species.</p> <p>A 9-day targeted survey was undertaken in May 2012 in suitable coastal habitat between Onslow and Broome. 21 individuals were captured by hand.</p> <p>Fauna surveys conducted on Airlie Island for compliance monitoring in 2014 and 2015 captured the species at four of the dry pit fall trapping sites.</p> <p>A targeted survey was conducted near Broome in April 2017 resulting in 20 individuals being captured along one creekline.</p>
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4.3 Research *(Provide details)*

Has the species been well researched?	Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
What research has been or is being conducted?	Taxonomic and ecological observations. Analysis of tissue samples collected from captured individuals to determine taxonomy of the species on the mainland. Maryan et al. (2013) investigated the use of crab holes as retreat sites by the species. Hand captured skinks were tracked using a non-toxic fluorescent powder during a day and a night to show their natural movements. This study revealed that the skinks were using crab holes by choice and not just as an opportunistic retreat site when being pursued.
What are the knowledge gaps for the species?	Life history characteristics (biology) and response to potential threats
Research recommendations:	As above

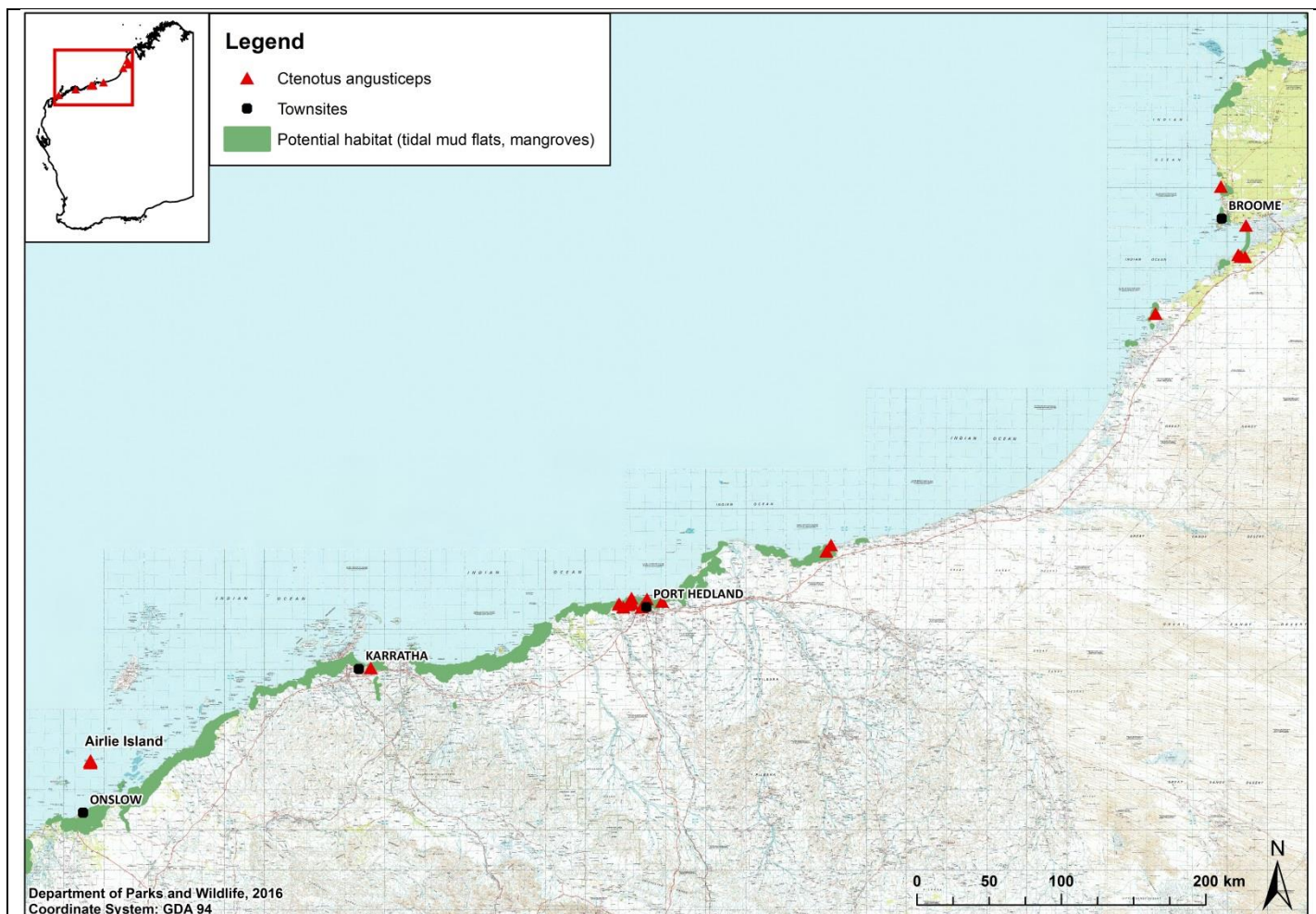
4.4 Monitoring *(Provide details)*

Is the species being monitored, either directly (targeted) or indirectly (general monitoring)?	No.
What methods are used for monitoring?	See above (4.1 Survey Methods)
Monitoring recommendations:	Monitor the species in areas that are undergoing development.

Section 5: Geographic range

5.1 Distribution

Insert map(s) of the species distribution, or provide as an attachment:



What is the current distribution of the species within Western Australia?	Found on Airlie Island and known on the mainland between Karratha and Broome, including Finucane Island.		
What percentage of the species distribution is within WA?	100 %		
What is the current distribution of the species within the other Australian States and Territories?	Not known to occur in any other State or Territory.		
Does the species occur outside of Australia?		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
If Yes, what percentage of the species distribution is within Australia, or what is the significance of the occurrence in Australia?	N/A		
What is the current international trend for the species? (if known)	N/A		
5.2 Migration (fauna only)			
Is the species migratory?		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
Is the migration within WA or within Australia or international?	N/A		
5.3 Extent of Occurrence (EOO) within Australia			

What is the current EOO?	<p>51,228 km² (MCP) but this area is predominantly ocean and omits coastal areas which are potential habitat.</p> <p>2,488 km² is the extent of potential habitat (mangrove and tidal flat habitat) between Onslow and Broome.</p> <p>5,974 km² when the coastal grasslands between Onslow and Broome are included (annual grasses (<i>Enneapogon</i> spp., <i>Aristida</i> spp., etc.) on dry plains and salt-water grasses (<i>Sporobolus virginicus</i>) on the coast) as per the survey area and associated vegetation in Morgan <i>et al.</i> 2013).</p> <p>These vegetation types (mangrove and tidal flats, and coastal grasslands) actually extend from Exmouth along the coast to the Northern Territory border.</p> <p>9,575 km² for this total extent of potential mangrove and tidal flat habitat within WA (Exmouth to NT border).</p> <p>13,227 km² when the total extent of the adjoining grassland within WA is also included.</p> <p>> 300,000 km² (MCP) of greatest extent of potential habitat within WA, but also contains large area of ocean.</p>		
How has this been calculated?	<p>MCP. However, all records of the species are known from an 800 km linear length of coastline and Airlie and Finucane Island, and therefore it is not appropriate to calculate the EOO using MCP or α-hull (i.e. MCP over capture records is 51,228 km² but this area is predominantly ocean and omits coastal areas which are potential habitat). The extent of potential habitat has been calculated using GIS shapefiles of mapped vegetation types (tidal mud flats and mangrove habitats, and adjoining coastal grasslands) between Onslow and Broome, and between Exmouth and the NT border.</p>		
What is the historical EOO?	0.28 km ² as previously only known to occur on Airlie Island		
What is the current EOO trend?	Decreasing <input type="checkbox"/> Increasing <input checked="" type="checkbox"/> Stable <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>		
Provide details on the current trend – quantify if possible	There has been an increase in the calculated EOO due to the species being found at mainland locations, when previously only known from Airlie Island. However, this increase is due to survey effort and new knowledge on the species distribution. It is unknown if there has been an actual change in species distribution.		
If there has been a change in EOO when did this change occur?	<p>1990: found on Thangoo Station, southern end of Roebuck Bay near Broome within the Western Kimberley District (Sadler 1993).</p> <p>2010: observed near Port Hedland and a specimen collected for identification by the WA Museum (Turpin and Ford 2011).</p> <p>2011-2012: found at 8 locations additional locations along the coast between Broome and Onslow (Maryan <i>et al.</i> 2013).</p>		
Was the change observed, estimated, inferred or projected?	Observed		
If the EOO is decreasing / declining, is it continuing?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/>		
Is the continuing decline observed, estimated, inferred or projected?	N/A. There is no known decline in EOO.		
Is there extreme fluctuation in EOO?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>		

If Yes, provide details:	N/A
5.4 Area of Occupancy (AOO) within Australia	
What is the current AOO?	<p>96 km²</p> <p>Based on potential habitat suitable for the species:</p> <p>4,528 km² is the area of potential habitat (mangrove and tidal flat habitat) between Onslow and Broome.</p> <p>9,128 km² when the coastal grasslands between Onslow and Broome are included.</p> <p>17,776 km² for the total area of potential mangrove and tidal flat habitat within WA (Exmouth to NT border).</p> <p>22,524 km² when the total area of the adjoining grassland within WA is also included.</p>
How has this been calculated?	<p>Calculated using 2 km x 2 km grid of all known capture records.</p> <p>AOO of potential habitat calculated using 2 km x 2 km grid squares over the mapped vegetation types (refer to EOO).</p>
What is the historical AOO?	0.28 km ² as previously only known to occur on Airlie Island
What is the current AOO trend?	Decreasing <input type="checkbox"/> Increasing <input checked="" type="checkbox"/> Stable <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
<i>Provide details on the current trend – quantify if possible</i>	<p>There has been an increase in the calculated AOO due to the species being found at mainland locations, when previously only known from Airlie Island. However, this increase is due to survey effort and new knowledge on the species distribution. It is unknown if there has been an actual change in species distribution.</p> <p>It is possible the actual AOO has decreased in some areas due to native vegetation clearing for amenities, infrastructure and mining/petroleum extraction purposes. However, the species habitat (tidal mud flat and mangrove habitat) is not areas where development usually occurs. Activities within tenements and other development areas predominantly occur behind the coastal dunes in areas that do not contain suitable habitat for the species.</p>
If there has been a change in AOO when did this change occur?	<p>1990: found on Thangoo Station, southern end of Roebuck Bay near Broome within the Western Kimberley District (Sadler 1993).</p> <p>2010: observed near Port Hedland and a specimen collected for identification by the WA Museum (Turpin and Ford 2011).</p> <p>2011-2012: found at 8 locations additional locations along the coast between Broome and Onslow (Maryan <i>et al.</i> 2013).</p> <p>2017: found at an additional location near Broome.</p> <p>It possible that there has been a minor decrease in actual AOO based particularly on the extensive infrastructure development related to the mining industry in Karratha, which may have already impacted on the species' habitat, and also on permits granted for clearing vegetation for the purpose of mining and/or mineral extraction and building associated amenities/infrastructure in areas of Onslow, Karratha, Port Hedland and Broome. However, the species habitat (tidal mud flat and mangrove habitat) is not areas where development usually occurs. Even though suitable habitat may occur within the mining tenements and clearing permit areas, it is</p>

	unlikely that the habitat would have been or will be cleared or impacted, even if activities occurred on the tenements. The habitat is unlikely to be within a development footprint because the substrate and activities within tenements or development areas predominantly occur behind the coastal dunes in areas that are not suitable habitat for the species. If habitat has been affected, it is likely to have been minor and at such a scale that is likely to be too small to represent an observable decrease in AOO.		
Was the change observed, estimated, inferred or projected? Give details.	Observed increase due to targeted surveys and new knowledge. Inferred possible decrease in actual AOO based on vegetation clearing permits and mining tenements, however this is unlikely (as above).		
If the AOO is decreasing / declining, is it continuing?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/>
Is the continuing decline observed, estimated, inferred or projected? Give details.	There is no known decline in AOO. However, it is inferred that the AOO may possibly decline in the future as further habitat is cleared for future mining-related development, particularly within and surrounding the towns of Onslow, Karratha, Port Hedland and Broome. However, developments usually occur behind the coastal dunes in areas that are not suitable habitat for the species (as above).		
Is there extreme fluctuation in AOO?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Unknown <input checked="" type="checkbox"/>
<i>If Yes, provide details:</i>	Mangrove environments are highly dynamic, expanding and contracting in response to water levels and erosion. As the species is closely associated with salt marsh communities, it is possible that the habitat for <i>C. angusticeps</i> would also expand and contract over short periods of time. It is therefore assumed that subpopulations of <i>C. angusticeps</i> regularly undergo periods of connectivity and isolation. The presence or creation of crab holes fluctuate seasonally and possibly change from year to year (Maryan <i>et al.</i> 2013).		
5.5 Number of Locations			
'Locations' are defined as a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat. (IUCN 2001).			
At how many locations does the species occur?	At least 11 locations: found on Airlie Island and 10 mainland locations between Karratha and Broome, including Finucane Island. There are at least 16 different land tenures and land use purpose types, including conservation estate.		
Has there been a change in the number of locations?	Decrease <input type="checkbox"/>	Increase <input checked="" type="checkbox"/>	No change <input type="checkbox"/> Unknown <input type="checkbox"/>
If there has been a change, when did this change occur?	There has been an increase in the number of known locations due to new knowledge on species distribution.		
Was the change observed, estimated, inferred or projected? Give details.	Observed increase in the number of known locations.		
If the number of locations is decreasing / declining, is it continuing?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/>
Is the continuing decline observed, estimated, inferred or projected?			

Give details.		
Is there extreme fluctuation in the number of locations?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:	There may be natural fluctuations of available habitat, however these are not considered to be 'extreme', and not likely to be at a scale that would change the number of locations. Mangrove environments are highly dynamic, expanding and contracting in response to water levels and erosion. As the species is closely associated with salt marsh communities, it is possible that the habitat for <i>C. angusticeps</i> would also expand and contract over short periods of time. It is therefore assumed that subpopulations of <i>C. angusticeps</i> regularly undergo periods of connectivity and isolation. The presence or creation of crab holes fluctuate seasonally and possibly change from year to year (Maryan <i>et al.</i> , 2013).	
Does this species occur on any off-shore islands?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes, provide details:	Airlie Island and Finucane Island	
5.6 Fragmentation		
Is the distribution fragmented?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>
The phrase ' severely fragmented ' refers to the situation in which increased extinction risks to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonization.		
Is the distribution severely fragmented?		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>
If Yes, provide details:	The species distribution is fragmented due to natural fragmentation of the habitat (mangrove and tidal mud flats), but it is not 'severely fragmented' (refer to fluctuations above).	
5.7 Land tenure		
Is the species known to occur on lands managed primarily for nature conservation? i.e. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes; provide details:	<p>Airlie Island is a Nature Reserve.</p> <p>The records and suitable habitat for the species near Broome are within the <i>Yawuru Birragun Conservation Park</i>, <i>Yawuru Nagulagun / Roebuck Bay Marine Park</i> and <i>Yawuru Northern Intertidal Area</i> (tidal flats and mangroves).</p> <p>The species records at Pardoo are in areas adjoining/near the <i>Eighty Mile Beach Marine Park</i> (which includes tidal flats) and <i>Jarrkurnpang Nature Reserve</i>. There is potential habitat within these Crown Reserves.</p>	
Is the species known to occur on lands that are under threat? i.e. mining tenement, zoned for development		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes; provide details:	Airlie Island is under an active petroleum title and some areas within and surrounding Onslow, Karratha, Port Hedland and Broome are under mining tenements (exploration, mining, mineral and general purpose leases), and Crown reserves for harbour purposes, industry, recreation.	
Provide details of other land tenures	Pastoral leases, Native Title lands and freehold/private property.	

where the species occurs as this relates to the species conservation status	
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Section 6: Population

‘Population’ is used in a specific sense in the Red List Criteria that is different to its common biological usage. Population is here defined as the total number of mature individuals of the taxon. In the case of taxa obligately dependent on other taxa for all or part of their life cycles, biologically appropriate values for the host taxon should be used. (IUCN 2001)

‘Subpopulations’ are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less).

6.1 Subpopulations

Location (in order NE to SW)	Land tenure (within 2 km x 2 km grid square)	Survey information: Date of survey and No. mature individuals	AOO (2 km x 2km grid square only, not area of potential habitat in vicinity)	Site / habitat Condition
Willies Creek, Waterbank N of Broome	Unallocated Crown Land (UCL) (potentially within adjoining Crown Reserves - Yawuru Birragun Conservation Park and Yawuru Northern Intertidal Area, for <i>Conservation, Recreation and Traditional and Customary Aboriginal Use and Enjoyment</i>)	2012	4 km ²	Unknown
Dampier Creek (Kunin), Broome	UCL Crown Reserve – Yawuru Nagulagun / Roebuck Bay Marine Park and Yawuru Birragun Conservation Park (for <i>Conservation, Recreation and Traditional and Customary Aboriginal Use and Enjoyment</i>)	2017: 20 individuals (including 1 sub-adult)	16 km ²	Unknown
Crab Creek, Roebuck Plains ESE of Broome	Crown Reserve - Yawuru Nagulagun / Roebuck Bay Marine Park (for <i>Conservation, Recreation and</i>	2012	4 km ²	Unknown

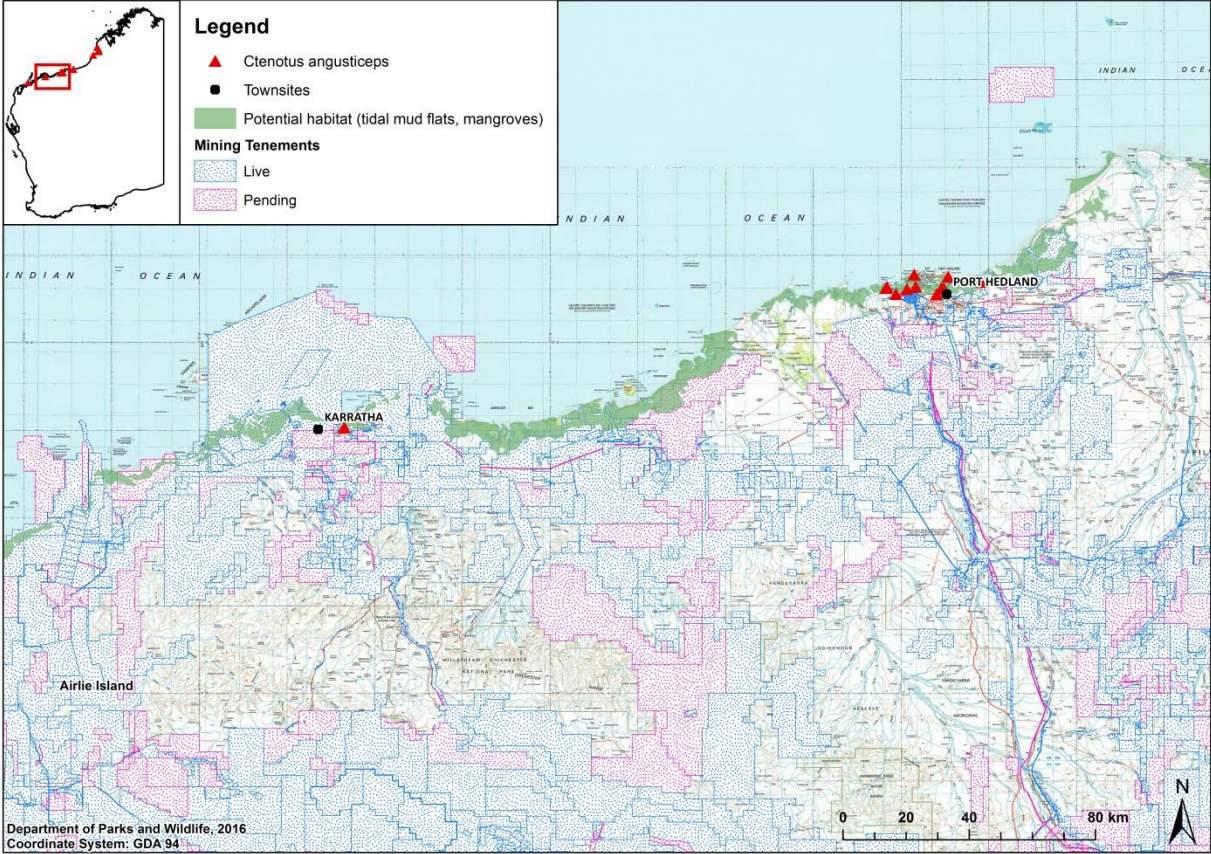
	<i>Traditional and Customary Aboriginal Use and Enjoyment)</i>			
Thangoo Station, Roebuck SSE of Broome	Crown Reserves - Yawuru Nagulagun / Roebuck Bay Marine Park and Yawuru Birragun Conservation Park (for <i>Conservation, Recreation and Traditional and Customary Aboriginal Use and Enjoyment</i>) Crown Lease Pastoral	1990: 7 individuals 2012	4 km ²	Degraded/modified in areas
Port Smith, Frazier Downs Station, Lagrange NE of Bidyadanga Community	UCL Crown Lease Pastoral	2012	4 km ²	Unknown
Cape Keraudren, Firewood Creek, Pardoo E of Port Hedland	Crown Reserve - Shire (for recreation) (potentially within adjoining/nearby Crown Reserves - Eighty Mile Beach Marine Park (which includes tidal flats) and Jarrkurnpang Nature Reserve)	2012	8 km ²	Unknown
Beebingarra Creek, Pippingarra E of Port Hedland	UCL Crown Reserve (Harbour purposes) Crown Lease Pastoral Mining tenement (live mineral lease)	2012	4 km ²	Unknown
Cooke Point, Pretty Pool, Port Hedland	UCL Crown Reserve – Shire (for recreation) Crown Reserve (Harbour purposes) Crown Lease – Town of Port Hedland	2012	4 km ²	
Redbank and Wedgefield, Port Hedland	UCL Crown Reserve – Shire (recreation) Crown Reserve	2010-2012	12 km ²	Unknown

	(Harbour purposes) Freehold Mining tenement (live mineral lease)			
Finucane Island, Port Hedland	UCL Crown Reserve (Harbour purposes) Crown Lease	2012	8 km ²	Unknown
Salmon Creek, Boodarie W of Port Hedland	UCL Crown Reserve (Harbour purposes) Mining tenement (live general purpose lease)	2011-2012	8 km ²	Unknown
Turner River, Boodarie W of Port Hedland	UCL Crown Reserve (Harbour purposes) Crown Lease Pastoral	2012	4 km ²	
Boodarie Creek, Boodarie W of Port Hedland	UCL Crown Reserve (Harbour purposes) Crown Lease Pastoral Mining tenement (live mining lease)	2012	8 km ²	
Lulu Creek, Nickol River, Mount Anketell E of Karratha	UCL Crown Reserve (Harbour purposes) Crown Reserve (for industrial estate) Crown Lease Pastoral Mining tenements (live and pending exploration licence)	2012	4 km ²	Unknown
Airlie Island NNE of Onslow	Crown Reserve (Airlie Island Nature Reserve) Petroleum Title (production licence)	1900: type specimen 1987: 4 individuals 1990: > 35 individuals 2001: 4 individuals 2014-15: 4 individuals	0.28 km ² (4 km ² as 1 grid square)	Very good to degraded near processing facilities

6.2 Population size (Australian context) (include how numbers were determined/calculated)

What is the total population size?	Unknown
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What is the number of subpopulations?	15 based on the number of known record sites and habitat connectivity
What percentage of the population is within WA?	100 %
What percentage of the population is within Australia?	100 %
6.3 Population dynamics (Australian context) (include how numbers were determined/calculated)	
What is the number of mature individuals?	Unknown. However, 20 individuals were captured (19 adults and 1 sub-adult) during a one day survey at Dampier Creek near Broome in April 2017.
What is the number of immature individuals?	Unknown
What is the number of senescing/past reproductive individuals?	Unknown
What is the maximum number of mature individuals per subpopulation?	Unknown
What is the percentage of mature individuals in the largest subpopulation?	Unknown
What percentage of mature individuals is within WA?	100 %
What percentage of global mature individuals is within Australia?	100 %
What is the age of sexual maturity?	Unknown. Based on observations of <i>Ctenotus pantherinus</i> and <i>C. piankai</i> , sexual maturity was reached between 10-11 months of age (James, 1991a). Most species belonging to the genus <i>Ctenotus</i> reproduce by at least two years of age (James, 1991b).
What is the life expectancy?	Species belonging to the <i>Ctenotus</i> genus live approximately 3 or more years (James, 1991b)
What is the generation length?	Unknown. Based on average age of sexual maturity, generation length is assumed to be between 1-3 years.
What is the reproductive capacity? (i.e. litter size or number of seeds)	Unknown. Assumed to be between 1-7 eggs per clutch based on reproductive biological information of other <i>Ctenotus</i> species.
What is the reproductive success?	Unknown
6.4 Population trend	
What is the current population trend (mature individuals)?	Decreasing <input type="checkbox"/> Increasing <input checked="" type="checkbox"/> Stable <input type="checkbox"/> Unknown <input checked="" type="checkbox"/>
What is the percentage of the	Unknown. The known species range, as an indicator of population size and

<p>population change and over what time period?</p>	<p>trend, has apparently increased significantly in the last 10 years due to new knowledge of the species distribution on the mainland and suitable habitat type. Even though the population size and trend is unknown, there is no known population change and no evidence that a change has occurred or will occur in the future.</p> <p>A population reduction in the future could be inferred from the percentage of suitable habitat that is within mining and exploration tenements, but if impact to this habitat were likely to occur, it is likely to be minor and at such a scale that is likely to be too small to represent a population reduction of $\geq 30\%$ within 10 years.</p>
<p>How has this been calculated?</p>	<p>Using GIS shapefiles of tidal mud flat and mangrove habitat between Onslow and Broome, it is calculated that 42 % of this suitable habitat is within mining and exploration tenements. However, even though suitable habitat may occur within the tenements, it is unlikely that the habitat will be cleared or impacted, even if activities occurred on the tenements. The habitat is unlikely to be within a development footprint because the substrate and activities within tenements or development areas predominantly occur behind the coastal dunes in areas that do not contain suitable habitat for the species. It is possible for the exploration tenements to become live mining tenements, but it is unlikely that all of them will, and also unlikely that the potential habitat within an area/tenement would be impacted within a 10 year period. If impact to habitat were likely to occur, it is likely to be minor and at such a scale that is likely to be too small to represent a decreasing population trend.</p>  <p>Legend</p> <ul style="list-style-type: none"> ▲ <i>Ctenotus angusticeps</i> ● Townsites ■ Potential habitat (tidal mud flats, mangroves) Mining Tenements <ul style="list-style-type: none"> ■ Live ■ Pending <p>Department of Parks and Wildlife, 2016 Coordinate System: GDA 94</p>
<p>If the trend is decreasing; are the causes of the reduction understood?</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/></p>
<p>Have the causes of the reduction ceased?</p>	<p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/></p>
<p>Are the causes of the reduction reversible?</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/></p>
<p>Is the reduction continuing (continuing decline)?</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/></p>
<p>Has the change been observed,</p>	<p>Unknown. No information on population trends and no monitoring has been</p>

estimated, inferred or is it suspected (direct observation, index of abundance appropriate to the species)?		conducted in order to infer trend. The known species range, as an indicator of population size and trend, has seemingly increased significantly in the last 10 years due to new knowledge of the species distribution on the mainland and suitable habitat type. Even though the actual population size and trend is unknown, there is no known reduction and no evidence that a reduction has occurred or will occur in the future.			
When was the reduction or is it anticipated to occur?		Past <input type="checkbox"/>	Present <input type="checkbox"/>	Future <input type="checkbox"/>	NA <input checked="" type="checkbox"/>
What is the period of time for the reduction (in years and generations)?					
Has there been a reduction in the number of subpopulations?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/>
If Yes, provide details:	There is no known reduction in the number of subpopulations.				
Are there extreme fluctuations in population size?			Yes <input type="checkbox"/>	No <input type="checkbox"/>	Unknown <input checked="" type="checkbox"/>
If Yes, provide details:	There is no known extreme fluctuation in population size. There may be natural fluctuations in the population size based on available habitat, however this is not considered to be 'extreme', and not likely to be at a scale to significantly change the population size. Mangrove environments are highly dynamic, expanding and contracting in response to water levels and erosion. As they are closely associated with the salt marsh communities, it is possible that the habitat for <i>C. angusticeps</i> would also expand and contract over short periods of time. It is therefore assumed that subpopulations of <i>C. angusticeps</i> regularly undergo periods of connectivity and isolation (Maryan <i>et al.</i> , 2013).				
6.5 Translocations and captive/enclosed subpopulations					
Have there been translocations (introduction or re-introduction)?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/>
Are there proposed translocations (introduction or re-introduction)?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/>
Are there captive/enclosed/cultivated subpopulations?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/>
Are there proposed captive/enclosed/cultivated subpopulations?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/>
Are there self-sustaining translocated subpopulations?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/>
If Yes, provide details:	N/A				
Are there translocated subpopulations that are not self-sustaining?			Yes <input type="checkbox"/>	No <input type="checkbox"/>	Unknown <input type="checkbox"/> NA <input checked="" type="checkbox"/>
If Yes, provide details:	N/A				
Are there self-sustaining captive/enclosed subpopulations?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/>
If Yes, provide details:	N/A				
Are there captive/enclosed subpopulations that are not self-sustaining?			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Unknown <input type="checkbox"/>
If Yes, provide details:	N/A				

details:	
Other information on translocations and captive/enclosed subpopulations for the species (including failures):	N/A
6.6 Important subpopulations	
<p><i>Identify any subpopulations that are important or necessary for the long-term survival of the species and provide details for why they are considered as such (i.e. key breeding, edge or range, maintenance of genetic diversity):</i></p> <p>Airlie Island is the most important subpopulation because the species is within secure tenure (i.e. Nature Reserve) and potential threats may be managed more easily than on the mainlands. However, all subpopulations may be important for the long-term survival as they appear to be naturally fragmented due to habitat type. Therefore, a loss of one subpopulation could reduce the species AOO and EOO.</p>	

Section 7: Threats

7.1 Threats (detail how the species is being impacted, i.e. how severe, the extent, evidence of the impact)				
Threat (describe how the threat impacts on the species. Include abiotic and biotic causes, human related e.g. exploitation, and biological characteristics of the species e.g. low genetic diversity)	Extent (give details of impact on whole species or specific subpopulations)	Impact (what is the level of threat to the conservation of the species)	Evidence	Time period (past, present, future)
Habitat degradation due to weed invasion (particularly Buffel Grass <i>Cenchrus ciliaris</i>)	Airlie island	Nil to Minor	Buffel Grass is successfully controlled on Airlie Island, although it is unlikely that it has been fully eradicated and therefore could be a potential future threat. It could change conditions of the ecosystem and therefore eliminate food sources.	Past and future
Habitat loss and degradation due to infrastructure development (Airlie Island)	Airlie Island	Minor	A total of 3 ha (12 %) of vegetation on Airlie Island was cleared for the development of oil and gas processing facilities. These facilities have been offline since 2002, but there is the potential for the facilities to be utilised in the future. Human activity associated with the facilities would have led to degradation of other habitat on the island.	Past and future
Habitat loss and degradation due to infrastructure development (mainland)	Mainland, particularly near Karratha, Port Hedland and Broome	Low	Much of the known habitat of the species is in or near areas where land has been or may be developed in response to growth in the mining industry. This infrastructure development has or may lead to vegetation clearing and habitat degradation. However, the species habitat (tidal mud flat and mangrove habitat) is not areas where development usually occurs. The habitat is unlikely to be within a development footprint because the substrate and activities within tenements or development areas predominantly occur behind the coastal dunes in areas that do not contain suitable habitat for the species.	Past, present and future
Habitat degradation due to recreational activities	Mainland, particularly near Karratha, Port	Low	Due to an increase in the human population in the region in response to growth in the mining industry, there has been an increase in beach-related recreational activities, particularly	Past, present and future

	Hedland and Broome		4WDs and motorbikes.	
Habitat degradation due to pastoral activities	Port Smith/Frazier Downs	Low	In general, pastoral activities have or may lead to habitat degradation. Unknown if impacting on the species and its habitat.	Past, present and future
Climate change leading to rising sea levels and extreme weather events	Mainland	Low to medium	Projections show that water levels will continue to rise with the warming climate. The species' habitat is unique, fragmented and may be subjected to extreme weather and rising sea levels, however the mangroves in north-western Australia are considered to be some of the least vulnerable to the potential impacts of sea level rise and may even expand in area, migrating further landward if barriers do not exist (Ward <i>et al.</i> 2016). Climate change could therefore positively impact the species' habitat, by causing an increase in tidal flats and mangrove habitat area. It is also possible that climate change may have a negative impact on the species; increased temperatures and extreme weather due to the species temperature tolerance, the effect on crabs (as crab holes appear to be an important habitat feature) and the availability of food resources.	Future

Section 8: Management

8.1 Current management		
Is the species managed?	Yes, directly <input type="checkbox"/>	Yes, indirectly <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes; provide details of current or past management actions:	Indirectly based on habitat within management plan areas for the conservation and marine parks.	
Does the species benefit from the management of another species or ecological community?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>	
If Yes; provide details:	Management and protection of the TEC and PEC near Broome.	
8.2 Recovery planning		
Is there an approved Recovery Plan (RP) or Interim Recovery Plan (IRP) for the species?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
List all relevant recovery plans or interim recovery plans (including draft, in-preparation, out-of-date, national and other State/Territory plans, and plans for other species or ecological communities that may benefit or be relevant to the nominated species)		
N/A		
List other documents that may be relevant to the management of the species or the lands on which it occurs (i.e. area management plans, conservation advices, referral guidelines)		
<ul style="list-style-type: none"> Department of the Environment, Water, Heritage and the Arts (2008). <i>Approved Conservation Advice on Ctenotus angusticeps (Airlie Island Ctenotus)</i>. Canberra, ACT: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/25937-conservation-advice.pdf. While this advice is now out of date due to further subpopulations of the species found on the mainland, some of the suggestions for recovery are still applicable. Threatened Species Scientific Committee (TSSC) (2012). <i>Commonwealth Listing Advice on Ctenotus angusticeps (Airlie Island Ctenotus)</i>. Department of Sustainability, Environment, Water, Population and Communities. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/25937-listing-advice.pdf Department of Parks and Wildlife (2016). <i>Yawuru Birragun Conservation Park Joint Management Plan 2016</i>, Department of Parks and Wildlife, Perth. https://www.dpaw.wa.gov.au/images/documents/parks/management-plans/ybcp_mangement_plan_web.pdf Department of Parks and Wildlife (2016). <i>Yawuru Nagulagun / Roebuck Bay Marine Park Joint Management Plan 2016</i>, Department of Parks and Wildlife, Perth. https://www.dpaw.wa.gov.au/images/documents/parks/management-plans/ynrbmp_mangement_plan_web.pdf Department of Parks and Wildlife (2014). <i>Eighty Mile Beach Marine Park Management Plan 2014 – 2024</i>. Department of Parks and Wildlife Perth. https://www.dpaw.wa.gov.au/images/documents/parks/management-plans/dearchive/eighty-mile-beach-management-plan.pdf 		
8.3 Management recommendations		
Conditions could be attached to Native Vegetation Clearing Permits for known locations and other suitable habitat to prevent the loss of habitat and consequently a reduction in the number of individuals, locations and subpopulations.		

Improve public awareness of the species with the aim of reducing the impact of recreational activities on the species' habitat.

Control access routes to suitably constrain public access/recreational activities in areas where the species is known to occur.

Survey suitable/potential habitat and monitor known subpopulations to determine population size and trends and identify impact of threats.

Ongoing control of Buffel Grass on Airlie Island and determine whether control measures should be undertaken in other areas where the species is known to occur.

Section 9: Nominator details

Nominator name(s):	
Contact details:	
Date submitted:	05/10/2016
<i>If the nomination has been refereed or reviewed by experts, please provide their names and contact details:</i>	

Section 10: References

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