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Records of Australian humpback dolphins (*Sousa sahulensis*) from an offshore island group in Western Australia

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Abstract

We report records of humpback dolphins at the Montebello Islands (20°26′S, 115°33′E) approximately 80 km from the mainland coast of Western Australia. This island group is a marine protected area (MPA), with approximately half of the area a sanctuary (no take) zone managed solely for nature conservation that excludes activities such as fishing and resource extraction, activities known to impact dolphins elsewhere. The habitat varies but includes fringing coral reef and shallow, sheltered sandy lagoons mostly < 10 m water depth and not exceeding 20 m. Several opportunistic sightings and one targeted five-day survey have resulted in 28 dolphins being catalogued in the MPA through photo-identification of natural marks on the dorsal fin and are considered to be recognisable through either distinctive or subtle marks. The species was initially reported in the MPA in June 2015 and was present in summer, autumn and winter of 2017. Six calves have been observed in the MPA, with one a neonate. Given the recent listing of the species as Vulnerable on the IUCN Redlist, and increasing pressure on near-shore coastal habitat, recognising the presence of this species at offshore islands such as these, and understanding their status and connectivity is a priority for the conservation and management of the species in Western Australia.

Keywords: Marine protected area, Montebello islands, Photo-identification, Tropical

Background

The Australian humpback dolphin (*Sousa sahulensis*) was recently recognised as a separate species to the Indo-Pacific humpback dolphin (*Sousa chinensis*). While the latter is found throughout Asian waters (Jefferson and Rosenbaum 2014), the Australian humpback dolphin (hereinafter referred to as 'humpback dolphin') is limited to the Sahul Shelf of northern Australia and the southern waters of Papua New Guinea (Beasley et al. 2016). In Australia, the species' range extends from Shark Bay in Western Australia north and east to southern Queensland (Parra and Cagnazzi 2016) (Fig. 1, inset). In Queensland, humpback dolphins are thought to be coastally obligate and found within 20 km from the mainland coast (Parra and Cagnazzi 2016). Although few surveys in Queensland have extended beyond this range, there are records of humpback dolphins occurring up to 55 km from the coast and in waters up to 50 m deep (Corkeron et al. 1997; Parra et al. 2004). Research in coastal waters of Queensland and the Northern Territory suggest they prefer water depths less than 20 m and are often close to river mouths (Parra et al. 2004, 2006a). However, as these dolphins are thought to be opportunistic-generalist feeders (Parra and Cagnazzi 2016), they may have a broad range of habitat preferences.

There have been few studies of the species' distribution and abundance in Western Australia, with the exception of some intensive surveys in the coastal waters of the Kimberley (Brown et al. 2016a, 2016b) and around the North West Cape in the Pilbara (Hunt et al. 2017) where sightings were recorded within a few kilometres of the mainland coast and nearshore islands. Opportunistic sightings have been reported elsewhere across their range (see Allen et al. 2012; Hanf et al. 2016). Of note, though, humpback dolphins have been sighted during dugong aerial surveys up to 60 km offshore near Barrow Island and the western Lowendal Islands in Western Australia (Hanf 2015) (Fig. 1).

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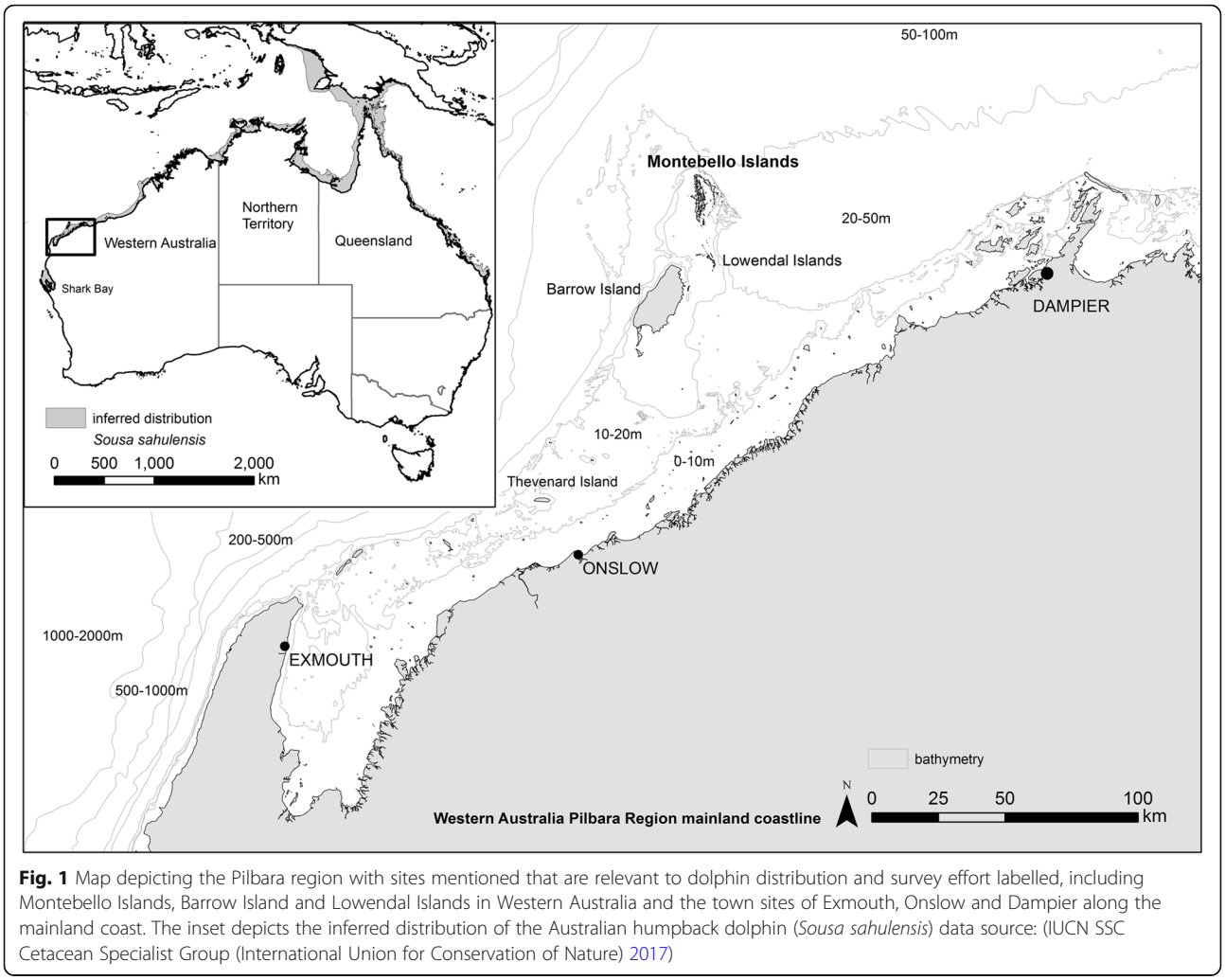

Fig. 1 Map depicting the Pilbara region with sites mentioned that are relevant to dolphin distribution and survey effort labelled, including Montebello Islands, Barrow Island and Lowendal Islands in Western Australia and the town sites of Exmouth, Onslow and Dampier along the mainland coast. The inset depicts the inferred distribution of the Australian humpback dolphin (*Sousa sahulensis*) data source: (IUCN SSC Cetacean Specialist Group (International Union for Conservation of Nature) 2017)

Here, we report on the occurrence of humpback dolphins at the Montebello Islands (20°26′S, 115°33′E), approximately 80 km from the mainland coast of Western Australia and approximately 20 km from Barrow Island (Fig. 1). The Montebello Island group consists of 274 low-lying limestone islands that form an almost continuous chain of sheltered lagoons (Department of Environment and Conservation 2007). The islands themselves are a conservation park under the *Conservation and Land Management Act 1984*, with the surrounding waters making up the Montebello Islands MPA, a 53,331 ha area, gazetted in 2004. Approximately half of the MPA is a sanctuary zone, managed solely for nature conservation, where low impact recreation and tourism are permitted, but extractive activities such as recreational and commercial fishing are prohibited (Department of Environment and Conservation 2007).

Methods

Humpback dolphins were first reported at the Montebello Islands by a State government officer in June 2015 conducting routine monitoring. Photographs were taken at the time confirming the species. Subsequently, several more opportunistic sightings have been made within the MPA during routine park management surveys (February, May, June and July 2017) and in March 2017 by a member of the public. A survey designed to locate humpback dolphins and to better understand the number of individuals present and potential for connectivity with the mainland or other islands was undertaken from 22 to 27 June 2017. Two vessels were used to conduct the survey; a 20 m mother vessel, and, when conditions were favourable for sighting dolphins (Beaufort sea state ≤3), a smaller 5 metre RHIB (rigid hull inflatable boat). Given the short timeframe for the survey and limited information on dolphin presence in the MPA, pre-determined transect lines were not followed, rather, the survey effort covered embayments where wind and tide conditions were favourable and followed a path roughly from north to south of the island group. The habitat surveyed varied but included fringing coral reef

and shallow, sheltered sandy lagoons mostly < 10 m water depth and not exceeding 20 m.

Photographs of all dolphin groups were taken during both opportunistic sightings and the dedicated survey. Photo-identification is routinely used to identify individual dolphins as they can be differentiated using natural marks on their dorsal fins (Würsig and Würsig 1977). For Australian humpback dolphins, a combination of nicks and notches on the dorsal fin edge and the loss of pigmentation on the dorsal fin are both unique identifiers (Brown et al. 2016a). Age class was assigned based on relative size and positioning in relation to an adult i.e. calves were in baby position with an adult assumed to be the mother (Mann and Smuts 1998), juveniles were larger than calves but smaller than adults and appeared to be independent of an adult (Parra et al. 2006c). Photographs from both opportunistic sightings and dedicated surveys were processed, entered into a State-wide database ('Dolfin'), and compared to the existing catalogue of humpback dolphins for Western Australia (Raudino et al., 2018).

Results

Twelve opportunistic sightings of 39 dolphins were recorded between June 2015 and July 2017 including photographs, details on group size, composition and location (Fig. 2). The dedicated survey targeting humpback dolphins conducted in June 2017 covered 244 km over 37 h, across 5 days, within the Montebello Islands MPA. This equated to an encounter rate of 0.08 humpback dolphins per kilometre of survey effort or 0.54 humpback dolphins per hour of survey effort. Four groups containing a cumulative total of 20 individuals were sighted (Fig. 2). The number of dolphins reported is therefore a minimum as more may have been present but missed due to environmental conditions. Most individuals were apparently mature (Hanf et al. 2016) based on size, while eight were considered immature (two juveniles, six calves). One calf was a neonate (estimated to be less than 3 months of age) based on its lighter colour, small size, uncoordinated surfacing, and visible foetal lines (Mann and Smuts 1999). Across all sightings ($n = 43$), a total of 28 individual dolphins, excluding calves, have been catalogued through photo-identification of natural marks on the dorsal fin and are considered to be recognisable through either distinctive or subtle marks. Of these, one distinctively marked individual was resighted between 19 May and 25 June 2017 indicating that individuals may use the area over months. Further, another individual sighted in June 2015 was resighted in May 2017 at a nearby location, suggesting some site fidelity to the Montebello Islands. No matches have been made with the > 500 other humpback dolphins in the database sighted in nearshore coastal waters of the Pilbara region (i.e. Onslow, Exmouth and Dampier study sites located 100–200 km from this study site) (Fig. 1) in Western Australia. Bottlenose dolphins (Tursiops sp.) and dugongs were also sighted during the survey but were in lower numbers than humpback dolphins.

Discussion/conclusion

Repeated sightings of humpback dolphins in the nearshore waters of the Montebello Islands at different times throughout the year suggest that dolphins are present year round in the area. The limited survey effort that has been undertaken in this area restricts our current understanding of population abundance and potential range including connectivity with the population present in Pilbara coastal waters. We have identified a relatively high number of individual humpback dolphins with minimal survey effort compared to other sites where there has been repeated survey effort in the Pilbara (Raudino et al. 2018) and Kimberley (Brown et al. 2016b). It is highly probable that more humpback dolphins will be identified using these offshore islands with future survey effort in favourable environmental conditions.

While we have confirmed that there are humpback dolphins present at offshore islands they may have little interaction with humpback dolphins using mainland coastal waters. To date, we have had no matches of dolphins sighted at the Montebello Islands with those identified from mainland coastal waters or nearshore coastal islands contained in the Western Australian humpback dolphin catalogue from Exmouth, Onslow or Dampier, all study sites in the Pilbara (Fig. 1). While nearshore habitat is clearly important to this species, it is unknown whether the open expanse of water between these offshore islands and the mainland, albeit shallow and within their preferred depth range < 20 m, poses a barrier to movement of this species. The habitats used by the species in the Kimberley region of Western Australia (Brown et al. 2016b, 2017) are more similar to known preferred habitats in Eastern Australia i.e. close to river mouths with high tidal exchange (Parra 2006b). Whereas in the Pilbara region coral reefs, sandy embayments (Hunt et al. 2017), coastal islands with fringing reefs (Raudino et al., 2018), sheltered lagoons and offshore islands with associated reefs (this paper) all appear to be important habitat to the species.

Our understanding of the genetic connectivity of humpback dolphins in Western Australia is similarly limited by the small amount of data available. Gene flow is apparently low in the adjacent mainland coastal waters i.e. between Exmouth and Dampier of the Pilbara region, about 400 km apart, however there is evidence of some movement of individuals between sites (Brown et al. 2014), a distance far greater than the Montebello Islands to the mainland coast. At a broader spatial scale , the two sites in the Pilbara region are more genetically similar than those further east in the Kimberley region with very little gene flow evident between these regions (approx 1000 km) (Brown et al. 2017). Findings in

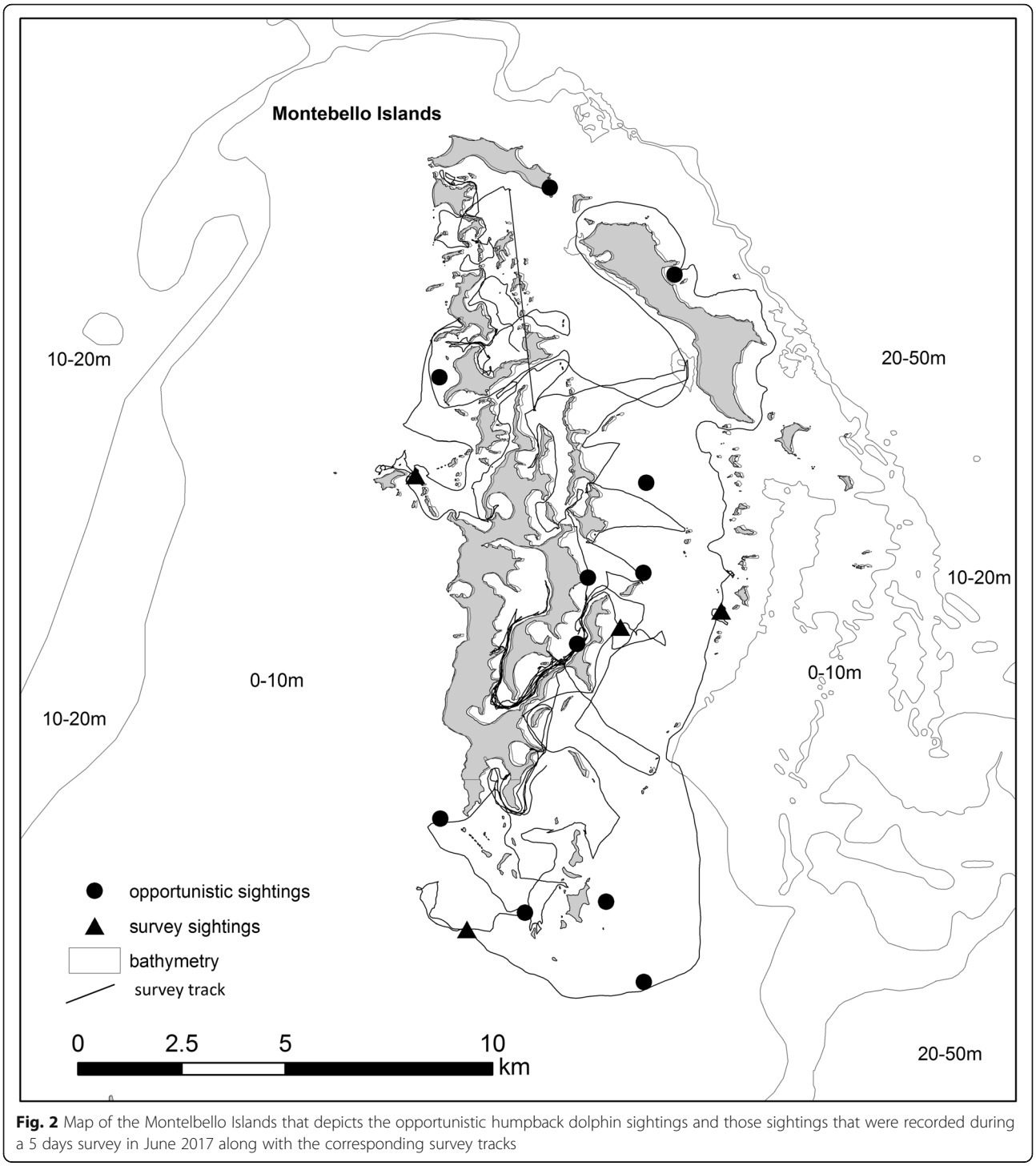

Fig. 2 Map of the Montelbello Islands that depicts the opportunistic humpback dolphin sightings and those sightings that were recorded during a 5 days survey in June 2017 along with the corresponding survey tracks

eastern Australia also show low genetic diversity, small effective population sizes and limited gene flow of this species over spatial scales of 300–500 km, likely due to historical population bottlenecks (Parra et al. 2018). In this context, it is important to understand whether dolphins move between the Montebello Islands and the near-shore waters of the mainland coast. Weather conditions during our targeted survey in June did not permit collection of tissue samples from humpback dolphins for genetic analyses. It is however a priority to collect samples from this site to understand the genetic connectivity of humpback dolphins at the Montebello Islands with those elsewhere. Given the recent listing of the species as Vulnerable on the IUCN Redlist due to a

projected continuing decline in the number of mature individuals driven by loss and fragementation of suitable habitat (Parra et al. 2017), and increasing pressure on near-shore coastal habitat where the species occurs (Bejder et al. 2012), understanding whether there is an offshore island population is a priority (Waples and Raudino In Press). This will assist in determining an appropriate scale for management and may be an important consideration in their conservation in Western Australia. Additionally, understanding the distribution and ranging patterns of the dolphins using the Montebello Island waters will assist in identifying the importance of the MPA to the population, given the differences in habitat and pressures relative to the Pilbara coast, and inform management objectives within the MPA as well as more broadly across the range of the species. The area may serve as a refuge for this species in future, given activities such as fishing and resource extraction are excluded, the risk of entanglement may be lower and fish prey may be more available than unmanaged areas in mainland coastal waters.

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Authors' contributions
HR and TH conducted the survey and collected data. HR analysed the photo-identification and sighting data. HR, TH and KW wrote the manuscript. All authors read and approved the final manuscript.

Ethics approval
The survey was conducted under the Department of Biodiversity, Conservation and Attractions Animal Ethics Committee licence U10/2015–2018.

Competing interests
The authors declare that they have no competing interests.

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