

# Tropical inshore dolphins of north-western Australia: Unknown populations in a rapidly changing region

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Australian Snubfin *Orcaella heinsohni*, Indo-Pacific Humpback *Sousa chinensis* and Indo-Pacific Bottlenose Dolphins *Tursiops aduncus* inhabit Australia's tropical north-western coastline, a region undergoing extensive port development associated with the massive expansion of the oil, gas and mining industries. The current lack of data on dolphin population sizes or trends precludes impact assessments of developments on these protected species. Furthermore, the Western Australian and Commonwealth Government conservation listings of tropical inshore dolphins do not reflect their international listings. From April to July, 2010, we conducted *ad hoc* boat-based surveys (n=55) of inshore delphinids at seven sites across north-western Australia from Coral Bay in the south (23.1°S: 113.8°E) to Cable Beach in the north (17.9°S: 122.2°E). We documented the locations of these three species from which we obtained photo-identification and biopsy data, as well as reports of Australian Snubfin Dolphin sightings from researchers and community groups. The data from this limited field effort confirm that Indo-Pacific Humpback and Indo-Pacific Bottlenose Dolphins occur in the waters adjacent to each north-western Australian urban centre and show that the range of the Australian Snubfin Dolphin extends considerably further south-west than previously reported. Given the scale of coastal developments and the vulnerability of isolated cetacean populations to fragmentation or extirpation, assessments of the viability of dolphin populations are required. Our data suggest that the Australian Snubfin, Indo-Pacific Humpback and Indo-Pacific Bottlenose Dolphins need to be considered as likely to be impacted by coastal developments across north-western Australia.

Keywords: Coastal development, delphinid distribution, conservation status, Australian Snubfin Dolphin, Indo-Pacific Humpback Dolphin, Indo-Pacific Bottlenose Dolphin.

## INTRODUCTION

THE Australian Snubfin Dolphin *Orcaella heinsohni*, the Indo-Pacific Humpback Dolphin *Sousa chinensis* and the Indo-Pacific Bottlenose Dolphin *Tursiops aduncus* (Snubfin, Humpback and Bottlenose Dolphins, hereafter) are members of the family Delphinidae (McGowen 2011). Snubfin and Humpback Dolphins are found in tropical, shallow, coastal waters of northern Australia (Bannister *et al.* 1996; Parra *et al.* 2004; Beasley *et al.* 2005), while Bottlenose Dolphins occur around much of Australia's vast coastline, including continental islands and reefs (Krützen and Allen 2008). Bottlenose Dolphins have been, and continue to be, the subjects of in-depth research, on topics such as population size, social structure, genetic connectivity and behaviour, in most Australian States (e.g., Connor *et al.* 2001; Chilvers and Corkeron 2003; Wiszniewski *et al.* 2009). With the exception of reviews of existing knowledge (Corkeron *et al.* 1997, Parra *et al.* 2002, 2004), detailed information on Snubfin and Humpback Dolphins is available only for a few selected areas along Queensland's east coast (Chilvers *et al.* 2005, Parra *et al.* 2006, 2011; Cagnazzi *et al.* 2011).

Bejder *et al.* (2012) highlighted the paradoxes caused by the lack of data on these species, the current status of their conservation listing and

the issues this raises for the environmental impact assessment process. The key points from this are briefly summarized below. Little scientific research on inshore dolphins has been conducted in north-western Australia. To date, most investigations have been associated with Environmental Impact Assessments, funded by proponents of development, in attempts to establish the environmental sustainability of large-scale coastal development. In general, the data from these studies are not available to management agencies or independent scientists, and the rigour of these surveys is not subject to peer-review. Thus, no peer-reviewed publications on the distribution, abundance or conservation status of north-western Australia's inshore delphinids are currently available in the literature (Bejder *et al.*, 2012). Despite this lack of data, Humpback and Bottlenose Dolphins are recognized by the Commonwealth Government as occurring across Australia's entire northwest coast (DSEWPaC 2011b; DSEWPaC 2011c), but Snubfin Dolphins are recorded only as far west as Roebuck Bay by both the Commonwealth and Western Australian (WA) State Governments (DSEWPaC 2011a; DEC 2011a, respectively).

In comparison to the coastlines of south-east Asia, northern Australia has a very sparse human population and, as a result of isolation from human impacts in the past, this area might

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have been considered a stronghold for tropical inshore dolphins for the future (Frère *et al.* 2011). However, the current and future scale of development across north-western Australia is enormous and participants at the Australian Tropical Inshore Dolphin Workshop, held in May 2010, highlighted that data on the distribution and connectivity between dolphin populations are urgently required (DEWHA 2010). Here, we provide the first peer-reviewed account of inshore delphinid sightings across north-western Australia. Our findings highlight the need for (a) more dedicated dolphin research and monitoring effort in this region, using appropriate techniques for estimating dolphin population size and connectivity and (b) recognition that coastal developments in the region are likely to impact these species.

## METHODS

### Study region and sites

We conducted fieldwork at seven sites across ca. 1 500 km of coastline in north-western Australia (Fig. 1). This region includes sections of the northern Gascoyne, Pilbara and western

Kimberley coasts (from ca. 23.1°S: 113.8°E to 17.9°S: 122.2°E) and encompasses the coastal fringe of the North West Shelf. It is one of the most economically significant regions in Australia, producing most of Australia's oil and gas and has ports that carry the vast majority of Australia's iron ore exports (CSIRO 2007). This coastal stretch is also characterized by habitats with high ecological value, including sponge gardens, coral reefs, seagrass meadows and mangrove forests (CSIRO 2007). These, in turn, support diverse teleost, elasmobranch, marine reptile and mammal communities. Protected species, including sea snakes (*Hydrophiinae*), turtles (*Chelonioidae*), Dugongs *Dugong dugon*, whales (*Mysticeti*) and Whale Sharks *Rhincodon typus*, reside in or migrate through these waters. Recent research also suggests that Roebuck Bay is critical habitat for a Snubfin Dolphin population (Thiele 2010).

We collected photographic and biopsy data on inshore dolphins at seven different sites across WA's tropical north-west as part of a study on the genetic connectivity and abundance of Bottlenose Dolphins in the Pilbara (Allen and Loneragan 2010). A secondary aim of this study

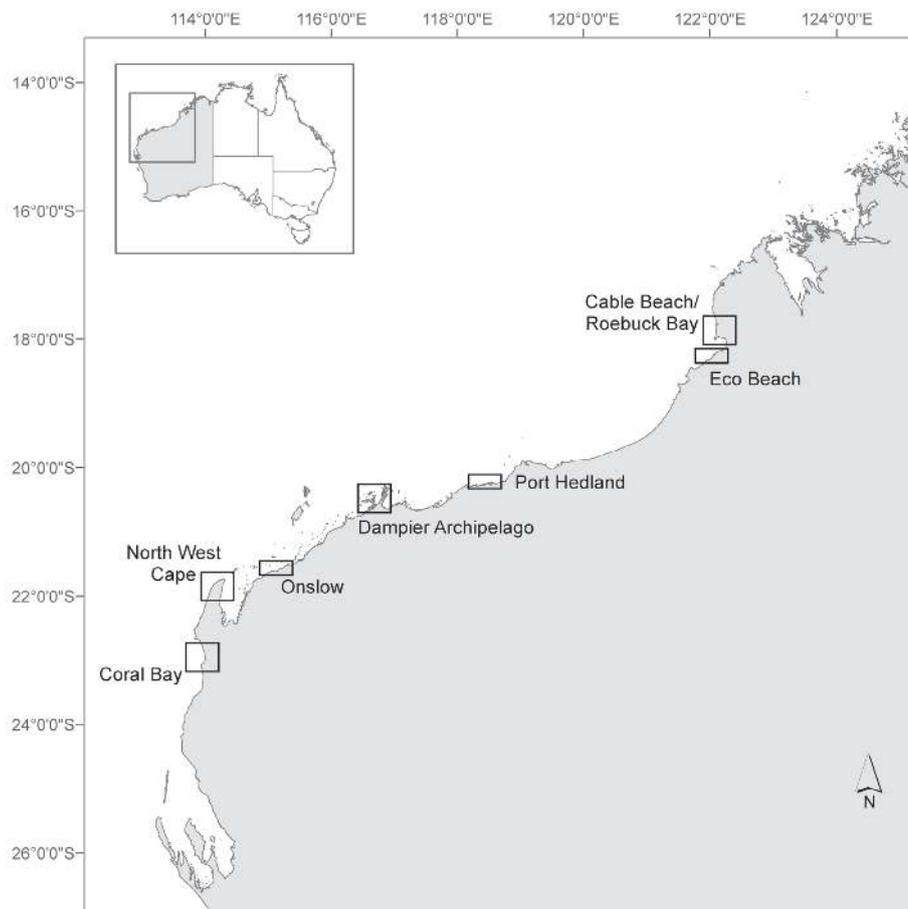


Fig. 1. Biopsy survey sites for Australian Snubfin (*Orcaella heinsohni*), Indo-Pacific Humpback (*Sousa chinensis*) and Indo-Pacific Bottlenose Dolphins (*Tursiops aduncus*) in north-western Australia.

was to collect biopsy samples of Snubfin and Humpback Dolphins as part of a broader collaboration on these species (Parra *et al.* unpub. data). Specific sites included the waters around Coral Bay (23.1°S: 113.8°E), the North West Cape (21.8°S: 114.1°E), Onslow (21.6°S: 115.1°E), the Dampier Archipelago (20.6°S: 116.7°E), Port Hedland (20.3°S: 118.6°E), Eco Beach (18.3°S: 122.1°E) and Cable Beach/Roebuck Bay (18.0°S: 122.2°E) to the north-east (Fig. 1).

### Survey effort, photographic identification and biopsy sampling of dolphins

Fieldwork was conducted between 31st March and 31st July 2010, and involved daily, weather-dependent, boat-based surveys of the near-shore areas (< 5 nm from shore) adjacent to each study site. A *survey* was defined as a day, or part thereof, on the water in a 5.6 m run-about, powered by a 100 horse power outboard motor. *Ad hoc* surveys were conducted in search of dolphins depending on weather conditions, rather than pre-planned or structured transects. Conditions of Beaufort Sea State > 3 were avoided due to the marked difficulties they present in locating, photographing and biopsying dolphins.

When dolphin groups were located, standardized protocols for approaching, photographing and biopsy sampling individual dolphins were followed (as per Würsig and Jefferson 1990 and Krützen *et al.* 2002, respectively). For example, approaching dolphins to within 30 m, refraining from the use of erratic boat handling techniques and avoiding biopsying resting groups and small calves. The data recorded when dolphin groups were located included: location (latitude and longitude), water depth, dolphin species, group size, composition and behaviour. A dolphin *group* was defined as one or more individuals within a 100 m radius of a central individual and engaged in similar behaviour.

### Sightings and sample location plots

On approaching dolphins, we made subjective decisions as to whether or not dolphin behaviour and/or environmental conditions were conducive to successful photographic identification and biopsy sampling. We collected the full suite of data only from dolphin groups from which we were successful in obtaining photographs and biopsy samples. During each survey at each study site, only a limited extent of the total near-shore area (< 5 nm from the coast) was traversed in search of dolphins. Not all the dolphin groups encountered were photographed and/or biopsy sampled. Therefore, the number of sightings and sample plots presented here should not be used to extrapolate population abundance or habitat preference. These data should instead be considered as an approximation of the minimum distribution of inshore dolphins across north-western Australia.

Roebuck Bay has generally been considered the south-western limit of Snubfin Dolphin distribution across northern Australia (DEC 2011a; DSEWPaC 2011a). In order to collect as much information as possible on Snubfin Dolphins, we (a) recorded Snubfin Dolphin sightings regardless of whether or not biopsy samples were obtained; (b) spoke to a range of colleagues about their sightings whilst conducting marine research in the region; and, (c) distributed dolphin sightings data sheets (differentiating between the three inshore delphinid species and dugongs) to personnel employed on or near the entrance to Port Hedland harbour. These sightings sheets requested basic information on the date, time and location of dolphin sightings, as well as species identification based on various morphological characters (certain/uncertain), approximate group size and weather conditions at the time of sighting.

Table 1. Summary of sampling effort and group sighting information from surveys of coastal delphinids at each study site in north-western Australia. In the # groups sampled column, the numbers in parentheses represent the number of groups of each species from which sighting and sample data were collected.

Study site	# surveys	# hours of survey	Species* sightings	# groups sampled	# individuals* sampled
Coral Bay	6	42	Ta Sc	7 (5/2)	Ta=11 Sc=3
North West Cape	20	145	Ta Sc	38 (21/17)	Ta=26 Sc=24
Onslow	1	7	Ta Sc	3 (3/0)	Ta=6
Dampier Archipelago	7	49	Ta Sc Oh	19 (7/12/0)	Ta=25 Sc=20
Port Hedland	8	45	Ta Sc	10 (9/1)	Ta=27 Sc=1
Eco Beach	2	9	Ta	3 (3)	Ta=6
Cable Beach/Roebuck Bay	11	43	Ta Sc Oh	15 (8/0/7)	Ta=6 Oh=15
Totals	55	340	3	95	180

\*Ta = Indo-Pacific Bottlenose Dolphin *Tursiops aduncus*; Sc = Indo-Pacific Humpback Dolphin *Sousa chinensis*; Oh = Australian Snubfin Dolphin *Orcaella heinsohni*.

## RESULTS

### Survey effort, sightings and sampling locations

Over the four month sampling period, 55 surveys (days, or part thereof) were conducted in the coastal waters adjacent to the seven field sites (Table 1). Each of these surveys consisted of between one and ten h (mean 6.2 h) of sampling effort. We were able to approach and collect data from 95 dolphin groups, obtaining 180 biopsy samples in total (Table 1).

The number of surveys conducted ranged from one to 20 per site. As expected, Bottlenose Dolphins were observed at each sampling location across north-western Australia, while Humpback Dolphins were observed at all sites

except the two surveys conducted in the waters off Eco Beach (Table 1; Fig. 2). The highest rates of biopsy samples collected (approachable dolphin groups) per h of effort from these two species were obtained in the Dampier Archipelago and off Onslow and Port Hedland (ca. 0.92, 0.80 and 0.62 samples obtained per h, respectively).

Snubfin Dolphin groups were observed on two occasions north of Cable Beach and frequently in Roebuck Bay. This species was seen least often south-west of these areas, with only one individual observed interacting with a large group of Bottlenose Dolphins near Angel Island in the Dampier Archipelago on the 21st May 2010 (Table 1; Fig. 2). In addition to this observation, Snubfin Dolphin sightings were

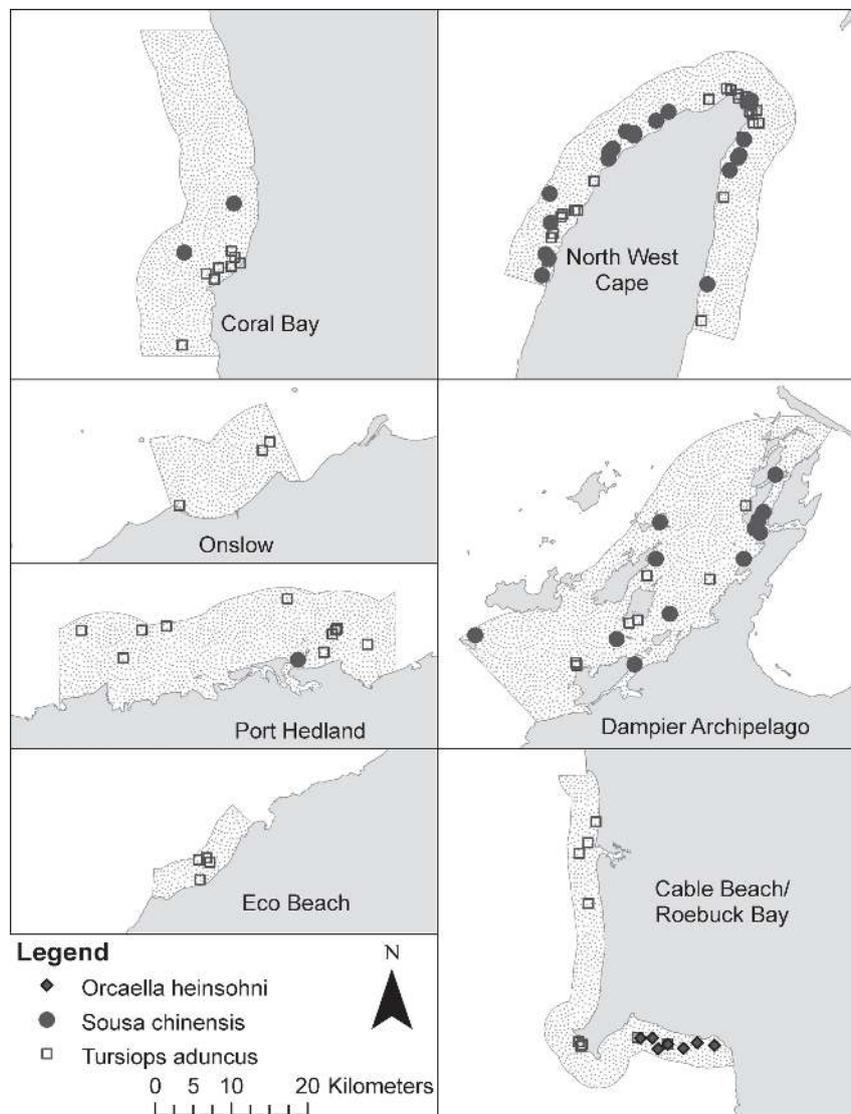


Fig. 2. Approximate limits of survey areas and locations of Australian Snubfin (*Orcaella heinsohni*), Indo-Pacific Humpback (*Sousa chinensis*) and Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) groups from which biopsy samples were taken in north-western Australia. Note that (i) locations of dolphin groups that were not biopsy sampled are not reported; (ii) each sampling location may reflect individual or multiple biopsy sampling events; and (iii) sampling effort was not systematic and varied between each study area.

Table 2. Summary of reported sightings of Snubfin Dolphins from researchers and the community.

Location	Latitude	Longitude	Observer
North West Cape	-21.94	113.94	M. Langdon*
Exmouth Gulf	-22.41	114.26	C. Jenner*
Montebello Islands	-20.34	115.78	V. Jaiteh*
Dampier Archipelago	-20.50	116.79	S. Allen* and D. Cagnazzi*
Port Hedland	-20.30	118.58	G. Evangelakis
Port Hedland	-20.31	118.57	W. Cavallaro

\*Observers with training in the natural sciences and experience in the field.

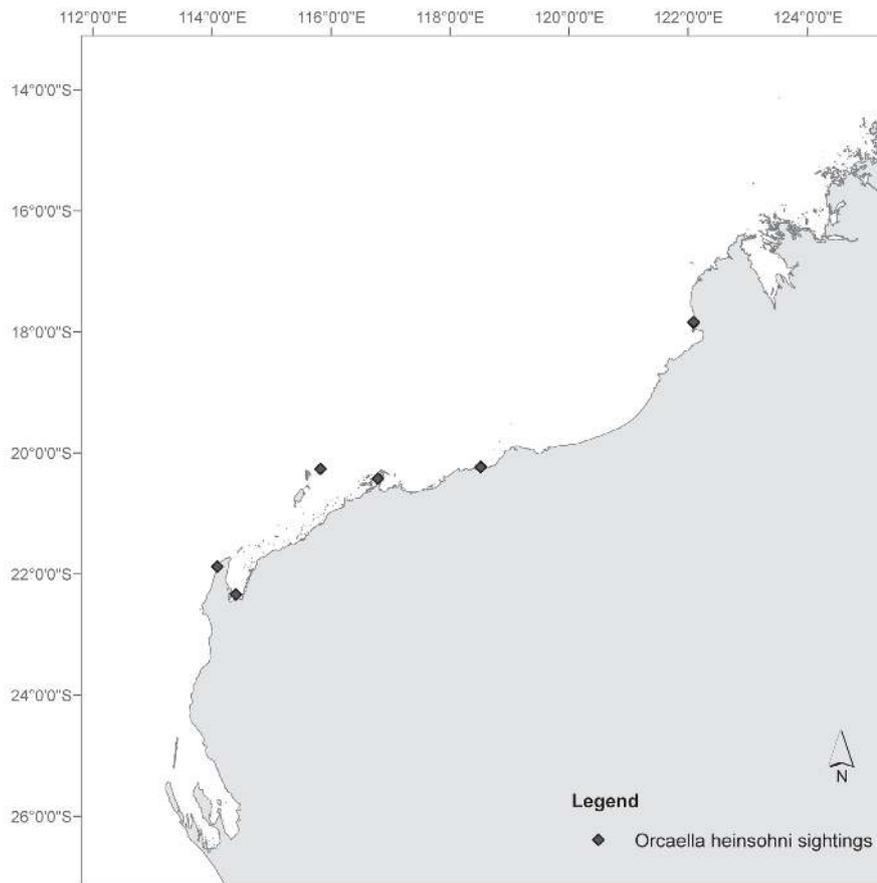


Fig. 3. Sightings of Snubfin Dolphins across north-western Australia.

reported south-west of Cable Beach/Roebuck Bay from the Montebello Islands, Exmouth Gulf and the North West Cape by colleagues conducting marine field research unrelated to this project (Table 2; Fig. 3). Furthermore, we received 12 completed dolphin sightings sheets from employees working on Port Hedland harbour in 2010. Two of these 12 sightings were classified as Snubfin Dolphins with certainty (Table 2; Fig. 3).

## DISCUSSION

### Sightings and distribution of tropical inshore dolphins across north-western Australia

The sightings and sample data presented here indicate that both Indo-Pacific Humpback and Indo-Pacific Bottlenose Dolphins occur in the coastal waters adjacent to each coastal township of north-western Australia, including: Coral Bay

and North West Cape (Exmouth) in the northern Gascoyne region, north-east across the Pilbara coast (Onslow, Dampier and Port Hedland) to Cable Beach and Roebuck Bay (Broome) in the western Kimberley. Both species were encountered regularly in diverse habitats, from the clear waters over Ningaloo Reef to the often-turbid waters around the Dampier Archipelago, Port Hedland and Cable Beach. Humpback and Bottlenose Dolphins were encountered regularly, despite the relatively low level of effort in the field, but we have no direct measure of abundance or density of each species at the seven sites.

The distribution of Humpback Dolphins in Western Australian waters has previously been documented as extending south-west to Ningaloo Reef/Coral Bay, with sightings as far south as Shark Bay considered rare (Parra *et al.* 2004, DEC 2011b, DSEWPac 2011a). However, Hodgson *et al.* (2007) reported numerous sightings of Humpback Dolphins, several with a high degree of certainty, during aerial surveys for Dugongs in the western gulf of Shark Bay. Furthermore, two dolphin research teams have now encountered and photographically identified small numbers of Humpback Dolphins off Cape Peron, Shark Bay, in recent years (Connor, pers. comm. 2010; Patterson, pers. comm. 2011). Humpback Dolphin distribution maps should thus be updated to include waters as far south as 25°S on the WA coast.

Snubfin Dolphins were encountered only once by the research team in the sites to the south-west of Cable Beach/Roebuck Bay, but incidental sightings by colleagues and employees of industrial port operations from Port Hedland harbour, the Montebello Islands, Exmouth Gulf and the North West Cape corroborate their occurrence in these areas. Regardless of whether these sightings were of vagrant individuals or groups, or observations of temporary or permanent residents, they represent a clear range extension for this species. The current State and Commonwealth Government maps (as well as those published by the International Union for the Conservation of Nature), indicating that Cable Beach and Roebuck Bay represent the south-western limit of Snubfin Dolphin distribution, require revision. Further, the dedicated research on the abundance, distribution and residency patterns of each species recommended by DEWHA (2010) and Bejder *et al.* (2012) needs to occur significantly further south-west than that already underway in the western Kimberley (e.g., Thiele 2010, Thiele unpub. data).

During a subsequent biopsy sampling field-trip to the Cable Beach region north of Broome

(September 2011), we also photo-identified and biopsy sampled two groups of a diminutive form of the Spinner Dolphin *Stenella longirostris* sp. Based on phenotype, we tentatively assigned this morph to the Dwarf Spinner Dolphin subspecies *S. l. roseiventris*, known only from the Gulf of Thailand and the Arafura and Timor Seas (Perrin *et al.* 1999). If this field identification is corroborated by genetic analysis, this represents the south-western most record of this subspecies and provides further evidence that more comprehensive data on the biodiversity and population ranges of tropical dolphins are required for north-western Australia.

### **International, Commonwealth and State conservation listings of tropical inshore dolphins**

Internationally, Snubfin and Humpback Dolphins are considered *Near Threatened*, while the Bottlenose Dolphin is listed as *Data Deficient* (Hammond *et al.* 2008; Reeves *et al.* 2008a; Reeves *et al.* 2008b). Each of these classifications comes with precautionary caveats. For the Snubfin Dolphin: “Although the species could be listed as Data Deficient, Near Threatened is more appropriate given its limited range, low densities in surveyed areas, and its continuing vulnerability to bycatch. Rigorous, more extensive surveys are needed to support a re-assessment of the species; it may then be found to qualify for listing as Vulnerable or possibly even Endangered” (Reeves *et al.* 2008b). For the Humpback Dolphin: “Considering the apparently fragmented distribution, the inference of declines in most areas (. . . conservation actions currently are either meager or non-existent in most of the range), and that there could well be fewer than 10 000 mature individuals, the *chinensis*-type geographic form would qualify as Vulnerable. . .” (Reeves *et al.* 2008a). Furthermore, recent genetic data suggests that the Australian Humpback Dolphin is a separate species, or at least subspecies, from those found in south-east Asia (Frère *et al.* 2008, 2011). If these findings are supported by behavioural and morphological evidence, the Australian Humpback Dolphins are likely to be designated as a separate species (as was the case with the Irrawaddy *O. brevirostris* and Snubfin Dolphins: Beasley *et al.* 2005). This would strengthen the case for a higher priority in their conservation listing as the number of mature individuals would likely be markedly fewer than 10 000. And, finally, for the Bottlenose Dolphin: “. . . habitat destruction and incidental takes (of unknown but possibly large magnitude [of dolphins]) may have a significant impact on this species. However, the lack of available information precludes an assessment of this impact” (Hammond *et al.* 2008).

In contrast to the international classifications summarized above, the Australian *Environment Protection and Biodiversity Conservation Act 1999* lists each of these species as “Non-Threatened Migratory Species”. Furthermore, Western Australia’s Department of Environment and Conservation (DEC) does not list any of the inshore dolphin species, or any of the Spinner Dolphin subspecies, as threatened or in need of special protection. (i) This is the first peer-reviewed publication confirming the presence of three or more tropical dolphin species in the rapidly developing coastal regions of north-western Australia; (ii) Basic presence data alone is not a suitable basis upon which DEC and the Environmental Protection Authority should be assessing the impacts of coastal development; (iii) Currently no data on population sizes, trends or movements in north-western Australia are available; (iv) Where these data are available, the need for improved conservation efforts has been emphasized; and (v) These species are not consistently addressed in Environmental Impact Assessments (Bejder *et al.* in press, 2012). Thus, assessments of the abundance, residency and trends in tropical dolphin populations using appropriate and rigorous methods are overdue.

### Conclusions and recommendations

The current lack of data on population size and trends for listed and protected dolphins across north-western Australia precludes informed assessments of the implications of developments on their populations, or indeed, identifying candidate regions for future development or protection. We present the first available, peer-reviewed data for the region, from a limited and non-dedicated survey effort, in order to begin to address the vast knowledge gap on dolphins of north-western Australia. Our data, and the scale of coastal developments in the region, suggests that tropical dolphin species need to be considered as likely to be impacted upon by coastal developments across north-western Australia.

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