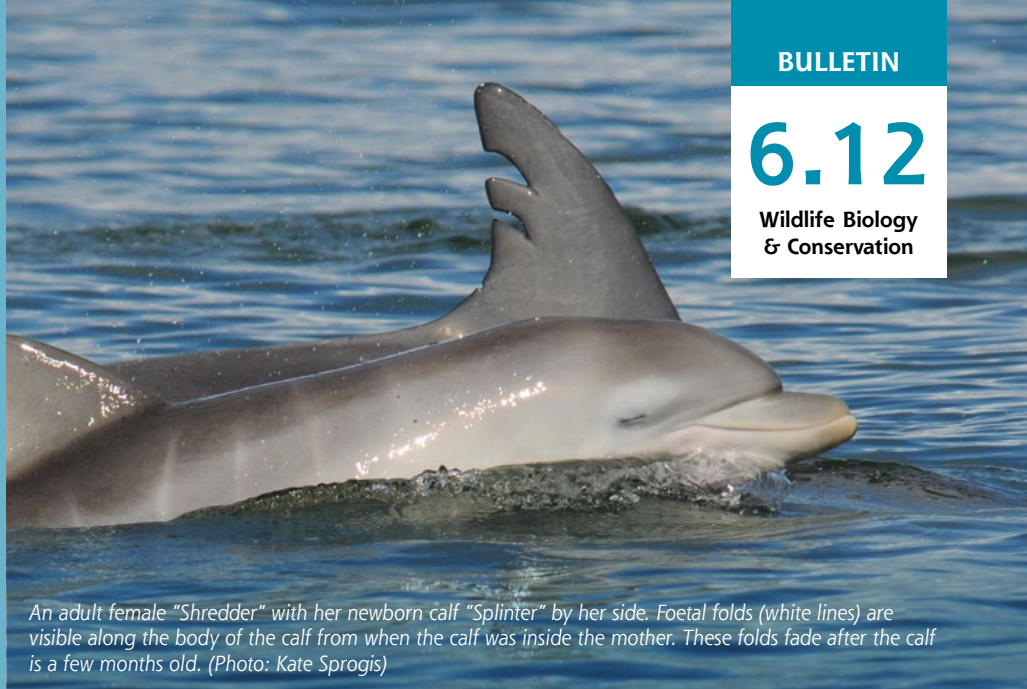




# 2016 RESEARCH FINDINGS

in the School of

**VETERINARY & LIFE  
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An adult female "Shredder" with her newborn calf "Splinter" by her side. Foetal folds (white lines) are visible along the body of the calf from when the calf was inside the mother. These folds fade after the calf is a few months old. (Photo: Kate Sprogis)

HOLLY RAUDINO, CELINE FRÈRE, HALINA KOBRYN AND LARS BEJDER

## Seasonal cyclicality of associations, calving and distribution of adult female bottlenose dolphins: Management implications

Conservation management typically focuses on protecting wildlife habitat that is linked to important behaviours, such as resting, breeding or caring for young. Understanding the timing of these behaviours, and where they take place, is critical to determining appropriate management measures to protect key life processes of wildlife populations.

In this recently published study (Smith *et al.* 2016), we combined the study of dolphin sociality, distribution and calving to identify spatio-temporal sensitivities of Indo-Pacific bottlenose dolphins to inform management. The study population, occurring off Bunbury, Western Australia, has been forecast to decline in abundance given current rates of female reproduction (Manlik *et al.*, 2016). As such, identifying and protecting vulnerable times and habitats is necessary to promote the long-term viability of this population.

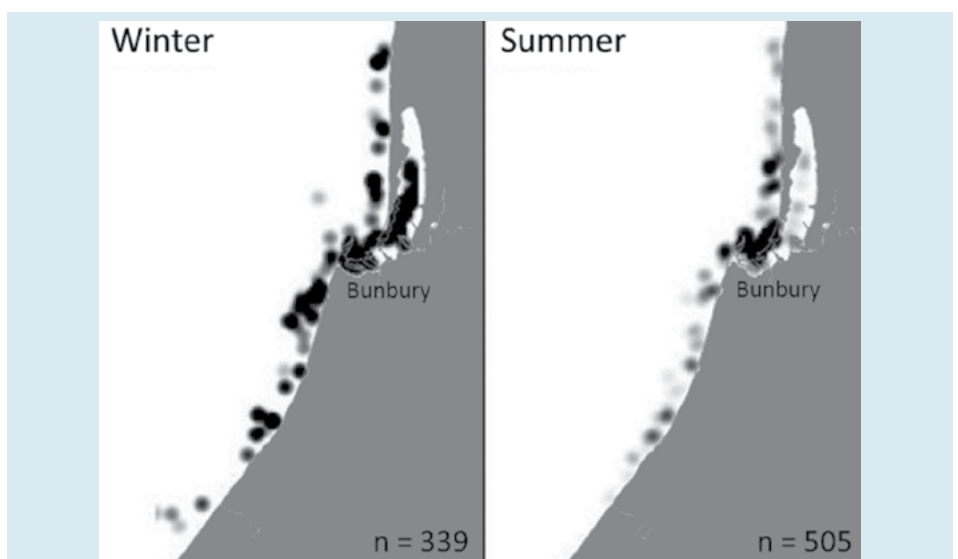
### Methods

Over three consecutive years, 231 boat-based photo-identification and behavioural surveys were conducted to identify individual adult female bottlenose dolphins in 120km<sup>2</sup> of coastal and estuarine waters. Recording the appearance of neonatal calves provided information on the timing of calving, while the

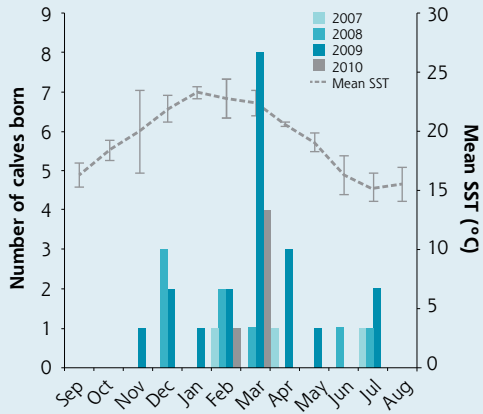
distribution of dolphins was modelled from sighting location data. Analyses of group composition allowed the estimation of association indices as a measure of sociality between individuals, the temporal stability of which were investigated by modelling lagged association rates. Year-round monitoring facilitated the investigation of spatio-temporal patterns in abundance, distribution and behaviour.

### Results and discussion

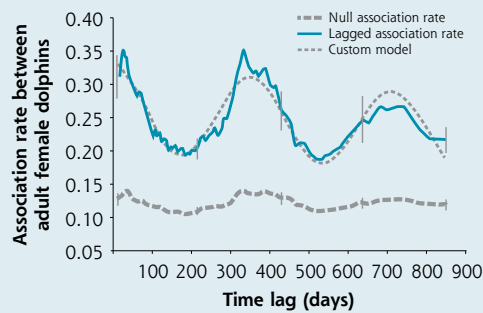
The density distribution of female dolphins was highest in the inner waters during December-February (summer) and March (early autumn) (Figure 1), which also coincided in time with the majority of calving (Figure 2). The temporal stability of social bonds between adult females was measured and remained stable over multiple years. We found that dolphin



**FIGURE 1** Density plots of adult female dolphins sighted during the austral seasons of winter (Jun-Aug; n = 339 sightings) and summer (Dec-Feb; n = 505). Darker shading indicates a higher density of dolphin sightings. Data are pooled across 2007-2010 and include repeated sightings of the same individuals. Dolphin sightings contract to the inner Bunbury waters (Koombana Bay and the Leschenault Estuary) over summer and autumn, and dissipate over the larger study area in winter and spring



**FIGURE 2** The number of dolphins born per month during the 36-month study period (total number of calves  $n = 36$ ) and mean sea surface temperature (SST, Celsius)

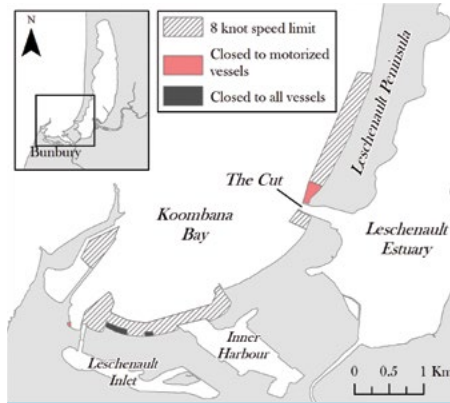


**FIGURE 3** The temporal stability of social bonds between female dolphins was measured (using lagged association rates). A cyclic model best described female-female associations, with an annual peak occurring each summer

distribution, sociality and calving are predictable in time and space. The seasonal cyclicality in social bonds (Figure 3) between adult female dolphins is the first time it has been documented for any dolphin species.

### Conclusions and recommendations

We demonstrate that studies on socially complex species should incorporate social dynamics when evaluating possible impacts of anthropogenic activities. In addition to traditional approaches of protecting important habitat and breeding periods, our study of dolphin sociality provides a new approach to consider in conservation efforts. We identify an area of high conservation



**FIGURE 4** Spatial restrictions on vessel activity in Koombana Bay, designed to minimise disturbance to female dolphins with young calves. These restrictions were effective in legislation from 2013

value to female bottlenose dolphins that can be protected by restricting boat speed and access. Our results informed the implementation of a legislative no-go area and vessel speed restriction areas where the density of females with calves was greatest (Figure 4). ■

### For more information

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### Acknowledgements

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Adult female dolphins come together in summer and autumn in the inner waters to form nursery groups. This is likely advantageous in protecting against predators such as sharks, and harassment from adult males looking for mating opportunities. (Photo: Holly Raudino)

### References

- 1 Manlik, O., McDonald, J.A., Mann, J., Smith, H.C., Bejder, L., Krützen, M., Connor, R.C., Heithaus, R.M., Lacy, R.C., and Sherwin, W.B. 2016. The relative importance of reproduction and survival for the viability of two dolphin populations: implications for the management of slow-growing vertebrate taxa. *Ecology and Evolution*.
- 2 Smith, H., Frere, C., Kobryn, H. and Bejder, L. 2016. Dolphin sociality, distribution and calving as important behavioural patterns informing management. *Animal Conservation*. doi: 10.1111/acv.12263

### Sponsors

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