Behavioural ecology of Irrawaddy, *Orcaella brevirostris* (Owen in Gray, 1866), and Indo-Pacific humpback dolphins, *Sousa chinensis* (Osbeck, 1765), in northeast Queensland, Australia: a comparative study

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Parra, G. J., P. J. Corkeron, and H. Marsh. 2004. The Indo-Pacific humpback dolphin, *Sousa chinensis* (Osbeck, 1765), in Australian waters: a summary of current knowledge. Aquatic Mammals **30**:195.

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Related publications:

Van Parijs, S. M., **G. J. Parra**, and P. J. Corkeron. 2000. Sounds produced by Australian Irrawaddy dolphins, *Orcaella brevirostris*. Journal of the Acoustical Society of America **108**:1938-1940.

ABSTRACT

Irrawaddy dolphins, *Orcaella brevirostris,* and Indo-Pacific humpback dolphins (hereafter humpback dolphins), *Sousa chinensis,* are two of the least known species of coastal dolphins found in the Indian and West Pacific Ocean region. Both species occur in sympatry throughout most of their range in Australian waters, where they have been little studied. As a result, the conservation status of Australian populations of Irrawaddy and humpback dolphins is unknown and conservation and management actions have been hampered by this lack of knowledge.

To overcome this lack of knowledge and improve the capacity to effectively conserve and manage Australian populations of Irrawaddy and humpback dolphins, this study aimed to contribute information on different aspects of their behavioural ecology. As both species co-occur throughout most of their range in Australian waters, an additional aim of this study was to analyse the degree of ecological separation between them. This comparative approach served two purposes: 1) to provide species-specific information on different aspects of the behavioural ecology (e.g., habitat use, social structure) of these species, and 2) to provide insights into the mechanisms promoting their coexistence.

Boat-based surveys were carried out in different areas along the east coast of Queensland between 1999-2002, focusing mainly in one area, Cleveland Bay Dugong Protected Area (hereafter referred as Cleveland Bay), where populations of both species are known to co-occur and where weather and logistical considerations allowed for almost year-round boat-based observations.

Analysis of data on the spatial distribution of Irrawaddy and humpback dolphin schools along different areas along the east coast of Queensland indicated that the distribution of Irrawaddy and humpback dolphins was strongly influenced by proximity to the coast, with both species occurring closer to land than would be expected under a random scenario. When comparing between species, Irrawaddy dolphins occurred closer to river mouths than humpback dolphins, but this interspecific difference was not constant across study areas. Based on the spatial distribution of both species in the areas surveyed, I found that the existing protected areas may not include the most critical habitats for Irrawaddy and humpback dolphins.

In Cleveland Bay, I found that Irrawaddy and humpback dolphins were present year round between 1999 and 2002. There was no evidence of variation in their occurrence with year or season. Irrawaddy and humpback dolphins used coastal

waters of Cleveland Bay mainly for foraging activities indicating this area represents an important feeding area within their home range.

I also found that Irrawaddy and humpback dolphins exhibit significantly different school dynamics, with Irrawaddy dolphins forming larger schools (mean ± SE = 5.3 ± 0.35) than humpback dolphins (mean ± SE = 3.5 ± 0.19). School of both species were mainly composed of adult individuals and, in proportion to the total number of animals within a school, Irrawaddy dolphins had a greater number of adults than humpback dolphin schools. Differences in school size and composition may be attributed to socioecological and phylogenetic factors. There is evidence from my studies that social as well as behavioural constraints may be responsible for these differences in school sizes.

Analysis of the relative use of space by both species using kernel methods showed that Irrawaddy and humpback dolphins do not use Cleveland Bay uniformly. The representative ranges (95% kernel range) of Irrawaddy and humpback dolphins were similar in size and location covering mainly the area between the Port of Townsville and the mouth of the Black River. The area around the Port of Townsville was used heavily by both species and represented a core area of use (50% kernel range) for both Irrawaddy and humpback dolphins. Irrawaddy dolphins had another core area between the mouths of the Bohle and Black Rivers. The behaviour of Irrawaddy and humpback dolphins within and outside their core areas was dominated by foraging and travelling activities. The 95% representative ranges of Irrawaddy and humpback dolphins showed considerable spatial overlap (81%). Additionally, the Utilization Distibutions (UDs) of both species showed strong correlation ($r_s = 0.55$, $P < 0.05$), indicating strong concordance in the utilization patterns of shared areas by both species.

Despite considerable overlap and concordance in space use patterns, Irrawaddy and humpback dolphins showed different habitat preferences. Within their representative range Irrawaddy dolphins preferred shallow (0-2 m) waters with seagrass meadows, and occurred closer to river mouths than humpback dolphins. Humpback dolphins showed preference for deeper waters (2-5 m deep), followed by waters close to the coast, shallow waters (1-2 m deep) with no seagrass, and dredge channels (5-15 m deep). I propose that these differences in habitat preference are important factors promoting the coexistence of Irrawaddy and humpback dolphins.

I photo-identified 63 Irrawaddy dolphins and 54 humpback dolphins in Cleveland Bay. Analysis of monthly and annual sighting rates of identified animals indicated most individuals were not permanent residents in the bay, but most used the area from year to year. Irrawaddy and humpback dolphins identified in more than one year were mainly identified and re-identified during the dry season between May and September when greater survey effort was carried out. The low standard distance deviations of Irrawaddy and humpback dolphins sighted on eight or more occasions indicated that individuals of both species tended to come back to specific areas within Cleveland Bay. The observed sighting patterns of individual Irrawaddy and humpback dolphins fitted exponential models of emigration + reimmigration, indicating that some animals are permanent residents while others reimmigrate into the study area after certain periods of time. I suggest site fidelity patterns may reflect fluctuations in prey resource availability and levels of predation risk within Cleveland Bay.

The ranges of individual animals of both species sighted on eight or more occasions were similar in size; length and location. Individual ranges of both species extended over similar areas, covering mainly the stretch of coastline southeast and northwest of the Port of Townsville. This pattern of interspecific overlap in range patterns indicated a lack of species-specific territories.

Analysis of association patterns among identified individuals indicated that Irrawaddy and humpback dolphins were more frequently seen with a particular companion than would be expected by chance. Cluster analysis showed that individual Irrawaddy dolphins may form strong associations with more than one individual. Strong associations between humpback dolphins appeared to be limited to pairs of animals. The social model that best described this relationship suggested that at any one time an individual Irrawaddy dolphin had two types of associates: "constant companions" and "casual acquaintances". The mean number of associates (constant companions + casual acquaintances) suggested by the model was approximately eight, of which four were constant companions. The fit of all social models to the data from humpback dolphins suggested a complex pattern of associations between individual humpback dolphins that may involve various associates with different levels of temporal stability. Differences in the social systems of both species could be explained by their different phylogenetic relationships among the Delphinidae and/or exposure to different levels of predation risk.

Photo-identification data collected between 1999-2002 and open mark-recapture models provided abundance estimates of Irrawaddy and humpback dolphins inhabiting the coastal waters of Cleveland Bay. Based on the open population model that best fitted the data, I estimated that less than a hundred individuals of each dolphin species used Cleveland Bay between 1999 and 2002. Based on historical data, it is certain that both species have been subject to anthropogenic mortality in the past due to entanglement in shark nets set for bather protection, and in commercial gillnets. A power analysis of the abundance estimates of both species and their associated variation indicated that, even with relatively unbiased and precise abundance estimates (CV = 0.08), population trends will be extremely difficult to detect within the space of a few years unless decreases in population size are worryingly high (> 20% p.a.). Because of their small population sizes, Irrawaddy and humpback dolphins are particularly vulnerable to local extinction. Detection of population trends should not be a necessary criterion for enacting conservation measures of both species.

My observations on the interspecific interactions among individuals of both species showed that encounters between Irrawaddy and humpback dolphins are common and predominantly of an aggressive/sexual nature in Cleveland Bay. The individuals involved in aggressive/sexual interactions appear to be mainly adult-male humpback dolphins and adult-female Irrawaddy dolphins with calves. During these encounters, humpback dolphins were dominant in initiating chasing, and seeking physical contact with Irrawaddy dolphins, while the latter tried to swim away or showed resistance to the interaction. I suggest the predominant aggressive/sexual interactions observed may reflect: 1) a physical training or skill development function that would have beneficial effects for future interactions between male humpback dolphins and their female conspecifics; 2) a mechanistic basis for some competitive interactions and patterns of resource partitioning between these two species of coastal dolphins; and 3) a relative scarcity of female humpback dolphins.

This study is the first comprehensive investigation of Irrawaddy and humpback dolphins in the Australian/Papua New Guinean region. The information collected provides a preliminary scientific basis for their future conservation and management. Given the certainty that the continuing loss of global biodiversity will be particularly severe in coastal ecosystems, the conservation and management of Irrawaddy and humpback dolphins will need to be intensive and adaptive. The potential for the conservation and management of Irrawaddy and humpback dolphin

populations along the Queensland coast is relatively good. However, in view of the concerns raised in this study about the long-term survival of these two species, and evidence that Australian populations of Irrawaddy and humpback dolphins represent different species/subspecies from populations elsewhere, future research directed at enhancing our ecological knowledge throughout Queensland and other areas of their range in Australia will be essential to inform their conservation.

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