Population dynamics and ecology of the spinner

(Stenella longirostris) and bottlenose (Tursiops

aduncus) dolphins of Mauritius

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This thesis is presented for the degree of Doctor of Philosophy of Murdoch University,

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“It is helpful to be reminded of the teaching of anthropologist Margaret Mead: “Never doubt that a small group of thoughtful, committed citizens can change the world: indeed, it’s the only thing that ever has.” Most of the time, success stories in marine conservation come from painstaking, long-term commitment by individuals or groups who do not allow themselves to be overcome by frustration.”

Giovanni Bearzi – *Marine Conservation on Paper* – page 2

T51 (‘Mother’) and the first newborn bottlenose dolphin recorded -January 2009, neither were seen again during the study.

Spinner dolphin off Morne.
I declare that this thesis is my own account of my research and contains as its main content work, which has not been submitted for a degree at any tertiary education institution.

.................................................................

Imogen Webster
Abstract

No detailed study has ever been conducted on the spinner (*Stenella longirostris*) and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) that inhabit the waters around Mauritius. The general lack of knowledge regarding local cetaceans and concerns regarding the potential impacts of numerous anthropogenic activities in the area, in particular the dolphin watching, prompted this study. The extensive development seen along the west coast over the last two decades and the rapid growth of the dolphin watching activity since 2000 are cause for concern for the sustainability of these populations. Photo-identification data were collected between April 2008 and June 2010 along a 30km length of coast on the south west of the island where a dolphin watching industry is concentrated. Data were used to obtain the first estimates of abundance, site fidelity and residency patterns for these species, along with social structure and genetic information. Collectively these are to be used to make recommendations for conservation and management which are needed urgently to limit impacts of the high levels of human activity along this area of coast.

Bottlenose dolphins were encountered at a rate of 0.53 groups h⁻¹ (0.07 s.e.) and sightings occurred in mean conditions of 13.3m (0.8 s.e.) water clarity, 26.1°C (0.3 s.e.) sea surface temperature (SST) and 20.6 meters depth (1.6 s.e.). Thirty five bottlenose dolphins were identified as distinctively marked individuals (DMI). Three newborn bottlenose dolphins were recorded during the study and the overall percentage of calves in the population was calculated at 20%. Population estimates found that less than 100 individuals used this area of coast. Sightings of bottlenose dolphins occurred along the entire 30km length of coast included in the study and displayed high levels of site fidelity.
as indicated by high long-term re-sighting frequencies. Comparisons of site use found that the highest sighting rates were observed at Morne in the south while the lowest was in Black River Bay. The 50% kernel contours covered the area between Tamarin Bay and Black River Bay and also Morne, occupying an area of 20.0km$^2$ while the home range covered 69.5km$^2$.

Average group size for bottlenose dolphins was 5.5 (0.3 s.e.) but a significant reduction in average group size was observed during the second year of the study (t-test, p<0.01). The mean group size was significantly larger at Morne compared to the other sites (Welch test: F=5.29, df=31.65, p<<0.01). Investigation of social structure revealed low mean levels of association 0.14 (0.05 s.e.) but some degree of preferred associations was found between identified individuals. Temporal analysis of associations resulted in the population being described as having two levels of casual acquaintances. This model suggested that 9% of identified individuals were casual acquaintances staying together for a few days, while 5% of associations lasted at least the length of the study period. Analysis looking for community division within the population determined that all animals seen regularly were part of a single community. The bottlenose dolphins had low levels of genetic diversity ($H_e$: 34%) and displayed high levels of relatededness from shared mtDNA, though these results were based on a small number of samples. There was no evidence of a recent bottleneck but the bottlenose dolphins displayed a mode-shift indicating a loss of rare alleles.

Habitat features for spinner dolphin sightings were very similar to those of the bottlenose dolphins at 14.5m (0.5 s.e.) clarity, 25.9°C (0.2 s.e.) SST and 20.4m (1.0 s.e.) depth but the encounter rate was higher at 0.94 groups h$^{-1}$ (0.12 s.e.). The percentage of marked
individuals in the population was determined to be 22% and 83 spinner dolphins were identified as distinctively marked individuals (DMI). Calves made up approximately 10% of the population and newborns were recorded throughout the year. Subsequent estimates indicated that less than 500 spinner dolphins used this area. High long-term re-sighting frequencies implied that the spinner dolphins displayed considerable site fidelity to the area of coast included in the study area. However, comparison of site use found that Point Moyenne Bay had the highest sighting rate and the lowest, Benitier. The 50% kernel contours for spinner dolphins were centred in the three bay areas and covered 9.1km$^2$ while the area covered by the 95% kernel contours was 53.0km$^2$.

Mean group size was 52.4 (1.9 s.e.) for spinner dolphins. No significant difference in group size was observed between the sites (Welch test: F=1.86, df=65.72, p=0.09). Investigation of social structure revealed low mean levels of association (mean ± s.e.: 0.14±0.05), however, as with the bottlenose dolphins, there were preferred associations between some identified individuals. The model that best fit the data for the temporal analysis described two levels of casual acquaintances. The short term associations were not a good representation of the data but long term parameters suggested that 3% of identified individuals associated for 19.57 years (16.12yr s.e.). Analysis looking for community division within the population determined that all animals seen regularly were part of a single community. The spinner dolphins had high levels of genetic diversity ($H_e$: 64%) similar to levels reported elsewhere, and were polymorphic at all 27 loci analysed. Levels of shared mtDNA were low with 12 haplotypes identified from 35 samples. There was no evidence of a recent bottleneck in the population with the distribution of allele classes displaying the typical L-shape graph.
The results calculated from a total 544.83 hours spent with 387 groups of spinner (n=250) and bottlenose dolphins (n=137) encountered over 229 days, revealed that both species were dependent on this area of coast for daily activities and had similar social structures. The direct sympatric relationship between these two species is possible due to differences in their behaviour and prey. Point Moyenne, Tamarin Bay and Morne appear to be particularly important areas for the daily activities of these species. Their use of these near-shore areas means both species are being impacted by high levels of interaction from dolphin watching boats and other anthropogenic activities. The long term continuation of the research is vital for monitoring these populations and also those in adjacent areas where dolphin watching is increasing. The small population size of the bottlenose dolphins, the low genetic diversity and their movement patterns suggest they are particularly vulnerable to localised extinction. As such the need for confirmation that anthropogenic activities, (e.g. dolphin watching), are impacting on these populations should not be an impediment in implementing conservation measures. Management strategies should be made with the input of local stakeholders to increase awareness, control existing human activities and minimise possible impacts with the view to maintaining viable population health and size for both species, thus ensuring the long-term sustainability of both the industry and the animals it relies on.
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