



## FACT SHEET

### **ROBUST, COMPARABLE POPULATION METRICS THROUGH COLLABORATIVE PHOTO-MONITORING OF WHALE SHARKS *RHINCODON TYPUS***

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This collection of frequently asked questions was assembled by the authors over the development and peer review of the study. The questions and answers are designed to help clarify salient points of the paper.

#### ***What are the important facts to take away from this paper?***

1. More whale sharks are returning to the northern area of Ningaloo Marine Park (NMP) from season to season, suggesting a growing population.
2. We may not be able to look at northern NMP whale sharks as a single population. Our study suggests that this aggregation contains a philopatric subset of sharks that return to NMP in multiple years and a second category of sharks that only appear in one year.
3. The management guidelines for whale shark ecotourism at Ningaloo appear to be protecting the species. Their application to other locations along whale shark migration routes may provide a viable alternative to hunting the species, one that yields economic and conservation benefits.
4. Our collaborative approach to studying whale sharks greatly increases the amount of data that can be collected, allowing more complex population models to be run.
5. Our techniques can be used directly at other whale shark study locations or cross-applied to other species.

#### ***Past attempts to understand the dynamics of the whale shark population at Ningaloo have suggested a decline in abundance. How is this study different?***

Our study is different from past approaches for a number of reasons.

1. We employed computer-assisted photo-identification and peer review to accurately identify individual whale sharks.
2. We used an online framework to collect almost ten times more data than any previous study of whale sharks at Ningaloo.
3. Data were successfully collected by the authors, from the general public, and from members of the ecotourism industry. Our study shows how this data can be reliably merged, organized, and incorporated into scientific analysis.
4. We identified (or digitally "tagged") 355 whale sharks over 12 years. This is over three times the number of sharks identified in any previous study.

5. Our increased data collection allowed us to use more complex models to understand annual whale shark survival. For example, one-third of the sharks visiting the reef annually are never resighted, while two-thirds appear in two or more years (called “philopatric” sharks). We had to adjust our models accordingly to account for this dichotomy.
6. We ran a number of statistical tests to ensure that the assumptions of our models were satisfied by the real-world behaviour of whale sharks.
7. Our models are based solely on occurrence data. We did not assume any facts about whale sharks for which no data exist. Due to scarcity in data, past attempts to model this species assumed biological parameters that are poorly understood or have no scientific data behind them.
8. Our resulting population models are very useful for local management at Ningaloo and can be re-run each year to understand how each season differs. The results from our models provide statistics that local resource management authorities can use to make decisions on how to protect this species.
9. Our approach can be replicated at other locations where whale sharks are sighted. Our tools can be re-used to study other whale shark populations or even to study other migratory species.
10. Our collected data is fed directly into a global database for whale sharks, allowing connected researchers to analyse their data in light of our results.

***How does this study affect the global outlook for whale sharks as a species?***

Our models provide information only about the whale sharks visiting the northern region of Ningaloo Marine Park (NMP) annually. While the number of sharks returning to that area in multiple seasons appears to be growing, we cannot make assumptions of how this may affect broader Indian Ocean populations, especially considering the migratory nature of whale sharks. Whale sharks remain very poorly understood, and we caution against drawing larger conclusions from our results. Other locations, such as South Africa, and Thailand, have reported declines in population size. The whale shark is currently considered “Vulnerable to Extinction” by the World Conservation Union (IUCN). Application of our tools and techniques to other whale shark study areas will help clarify the real pressure on the species.

According to our study, ecotourism under the guidelines set forth at NMP does not appear to negatively influence whale shark survival or behaviour. This regulated ecotourism can help their conservation by allowing the general public to contribute photos to publishable scientific research. In our study, we demonstrated how these photos can be assembled into repeatable population models that can be used for annual analysis of the health of the population. The conservation guidelines and the tools of our study can be used at other locations along whale sharks migration routes to study and protect the species.