

A. The objectives and purposes of the action;

- 1) to determine the residency period of whale sharks at Christmas Island
- 2) to establish the importance of Christmas Island to whale sharks and whether the proposed marine park expansion at Christmas Island covers the movements of this species
- 3) to determine whether whale sharks move to areas where protection is not in place for this species

B. The equipment and methods used;

Whale sharks will be located from the research vessel or with the use of a drone. Directions from the drone pilot / skipper will enable the researchers to position the vessel approximately 50 m in front of the swimming direction of the whale shark. Research staff will enter the water and swim alongside the whale shark: an identification photo will be collected; the shark's size estimated; and sex documented by external observation. The behaviour of the whale shark will be assessed prior to a deployment attempt: if the shark is swimming fast and changing direction when approached, the tagging procedure will be aborted until another shark displaying calm behaviour can be found; if the animal is swimming slowly at the surface, a tag will be deployed. The behaviour of the shark post-tagging will be recorded.

Whale sharks will be fitted with telemetry devices using a small, minimally invasive metal spring clamp on the dorsal fin, while the researcher is swimming alongside the animal in its natural oceanic environment. The researcher will open the arms of the clamp and position the clamp on the leading edge, near the distal margin of the fin. The clamps are small (relative to the size of the whale shark), consisting of a coiled spring at the anterior end, with two clamp arms (150 mm length) extending posteriorly. Each arm has two 10 mm hospital-grade stainless steel pins which, while not penetrating the shark's skin, use the pressure from the coil spring to stay attached to the sharks fin for required term of deployment.

The only material making contact with the shark are the four stainless steel pins (diameter 2 mm). The clamp arms provide a surface to which a small telemetry device can be secured. This telemetry device (satellite tag) is small and hydrodynamically shaped to reduce drag.

From previous studies using fin-mounted clamps, on almost all occasions, sharks show little or no reaction to tagging. Where a reaction is observed e.g. increased swimming speed or a dive, the behaviour of the shark will usually return to their pre-tagging activities within a matter of minutes. Indeed, in a previous study using fin-mounted clamps at another known aggregation site i.e. Ningaloo Reef, it was shown that even whale sharks that display a "substantial reaction" to tagging, return to "natural behaviours" within minutes of the tagging event (Gleiss et al. 2009).

A total of 15 animals will be tagged over the duration of the project (i.e. five animals required per year for three years).

Where possible, varied size and sex of target animals will be chosen (between 4 m and 9 m), representative of the population demographics of animals at most known aggregation sites for this species. An identification image will be taken so record which animal was tagged and uploaded to the global whale shark photo-identification database (SharkBook).

Post-tagging, each whale shark will remain at liberty.

Any impact to the animals will be mitigated via the clamps having an inbuilt corrodible link that will ensure that any non-retrieved tags will dislodge within 6-9 months of the tagging event.

The tag/clamp unit has been hydrodynamically designed to minimise drag and potential wear to the fin. In addition, the units are painted with antifoul to mitigate the collection of organic material which would increase drag. The unit is in contact with the fin at only four points (pins) that ensures the tag unit arms remain away from the fin, thereby reducing the potential for damage to the fin. Combined with the corrodible link built into the design, we are confident that the tag unit will dislodge from the animal within 6-9 months resulting in little or no damage to the fin.

NB. although precautions are in place to ensure damage is minimised, a recent study published in 2021 has reported on the rapid rate of healing in whale sharks and the ability to regrow fins (see Womersley et al., 2021).

Gleiss, A. C., Norman, B., Liebsch, N., Francis, C., & Wilson, R. P. (2009). A new prospect for tagging large free-swimming sharks with motion-sensitive data-loggers. *Fisheries Research*, 97(1-2), 11-16.

Womersley, F., Hancock, J., Perry, C. T., & Rowat, D. (2021). Wound-healing capabilities of whale sharks (*Rhincodon typus*) and implications for conservation management. *Conservation Physiology*, 9(1), coaa120.