Report following use of AATAMS VR100 (August 2009)

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PROJECT NAME

Movement, feeding and behaviour of reef sharks at Ningaloo Reef, Western Australia

SUMMARY

This project will examine the movement patterns and feeding ecology of reef sharks at Ningaloo Reef. We are primarily focussing on movement patterns of black tip (*Carcharhinus melanopterus*), white tip (*Triaenodon obesus*), grey reef sharks (*Carcharhinus amblyrhynchos*) and juvenile lemon sharks (*Negaprion acutidens*), but are also monitoring nervous sharks (*Carcharhinus cautus*) and tiger sharks (*Galeocerdo cuvier*).

Movement patterns are monitored using acoustic tags made by VEMCO© (V13s & V16s), which are implanted internally or mounted externally and transmit information to an array of acoustic receivers (VR2ws). The receivers have been deployed in a number of key locations at Ningaloo Reef to maximise coverage of the study site. The current arrays and curtains, which will most likely benefit this project, are situated at Tantabiddi, Mangrove Bay, Norwegian Bay, Point Maud and Skeleton Bay. Acoustic monitoring will provide information on long-term, broad movement patterns of reef sharks and help answer questions relating to residency times, aggregation patterns and inter-species habitat partitioning.

Movement patterns observed with acoustic monitoring will only provide information while animals are within receiver range, and will not provide detailed movement patterns of individuals. This project will aim to answer some broad ecological questions about reef sharks at Ningaloo Reef, which requires an understanding of fine-scale movement patterns. Therefore, We will also observe reef shark movement by actively tracking a number of tagged sharks over 24hr periods. This part of the study will provide information regarding habitat usage, home range sizes and will also help confirm the broad-scale movement patterns observed with acoustic monitoring.

The final stage of my project will look at the feeding habits of reef sharks at Ningaloo Reef. We will use stable isotope analysis to examine the trophic role of these sharks within the reef community. This will involve tissue sampling during tagging sessions, as well as establishing a potential prey library.

PROJECT AIMS

The aims of our recent field work were:

1) To become familiar with the VR100 and software in preparation for active tracking of sharks;
2) To range test the equipment and;
3) Track one to two sharks.

LEVEL OF ACHIEVEMENT

1) *Familiarisation with equipment and software*

This aim was mostly achieved; however some training would be advisable prior to upcoming field work in November / December 2009. The chief investigator plans to attend the AATAMS / VEMCO workshop at SIMS at the beginning of November.

2) *Range testing*

We were able to successfully range test the VR100 at the study site, in favourable conditions. The results are presented herein.

3) *Reef shark tracking*

We made two attempts at tracking sharks; however were not able to fulfil this aim. We plan to do 15 active tracks of three species of reef sharks during our next field trip.

METHODS

Our most recent field work took place at Coral Bay (23° 07'S, 113° 45'E), which was from 9th to the 21st of August 2009. We tested VEMCO V13 and V16 continuous pingers with the VR100 receiver and hydrophone at Skeleton Bay, as was the testing of the kayak method for active tracking (e.g. Meyer & Holland 2001, Meyer & Holland 2005, Papastamatiou et al. 2009). Reef shark tracking was attempted immediately off Point Maud (23° 12'S, 113° 75'E), as well as further North. Range testing and tracking were done in this area, because this is where the Coral Bay section of the Ningaloo Reef Ecosystem Tracking Array (NRETA) is, which consists of 9 VEMCO VR2 receivers (Fig.1). In addition, most reef shark tagging to date has occurred within this area, due to the abundance and species diversity, as well as seasonal inshore aggregations.

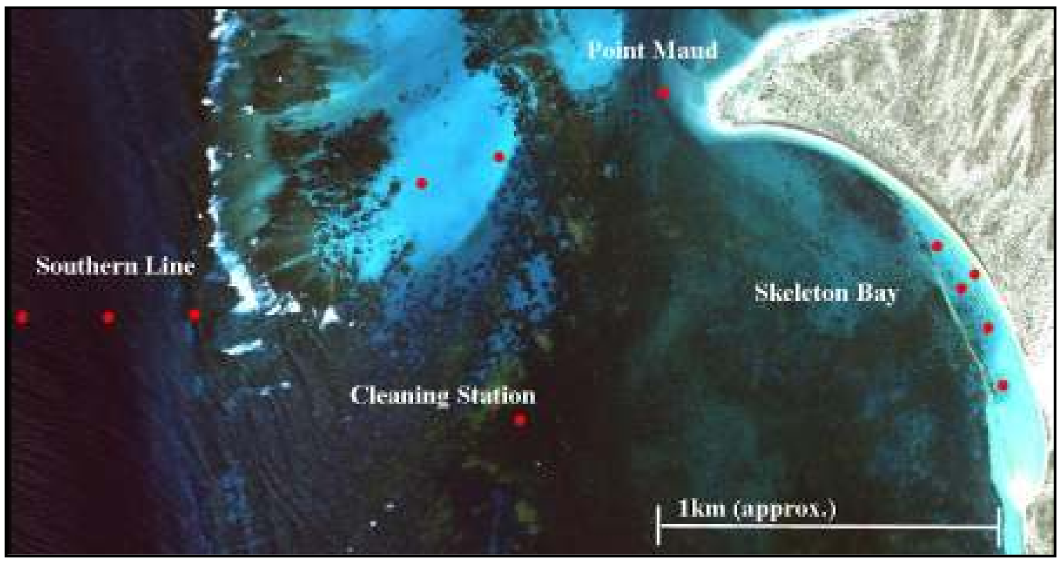

Figure 1. Project study site for reef shark tracking and monitoring at Coral Bay, WA.

Familiarisation with equipment and software

Having never used active tracking equipment before, it was necessary to read the VR100 manual in order to learn how to set up channels for tracking continuous pingers. After this, we tested V13 and V16 continuous pingers with the receiver and hydrophone to check that the system was working. A method of attaching the hydrophone to a telescopic pole was devised, which would allow us to change the length of the pole depending on whether we were tracking from a boat or kayak. In addition we also experimented with external tag attachment methods for our anticipated reef shark tracking.

Range testing

On the 16th of August we range tested the VR100 with both a V13 and a V16 pinger. Range testing was done in Skeleton Bay near our shallowest receiver, in a relatively uniform depth of approximately 50 cm, over a sandy bottom. Wind was less than 5 knots and there was no boat traffic in the area, so there was little signal interference from either of these sources. The reason testing was done in very shallow water, is due to the fact that a large part of our active tracking is anticipated to be within this area during summer aggregations.

Range testing was done by a stationary person holding the VR100 and pole mounted hydrophone in the water, while another person holding a pinger attached walked away from the receiver. The person holding the pinger walked 50 paces in an approximate straight line away from the receiver, stopped, took a way point with a hand held GPS, and continued another 50 paces. This process was repeated until the person with the receiver could no longer detect a signal clearly, in which case they signalled the person carrying the pinger to start coming back. This process was again repeated, in order for range testing to show results 'going way from' and 'coming back' to a receiver, as suggested in the VR100 manual. Throughout the experiment, both the hydrophone and pinger were held around 20 – 30 cm off the bottom in an attempt to minimise signal interference with the substratum. Distances were later calculated and plotted using GPS TrackMaker© 13.6.

After range testing was completed for both pingers, we tested the suitability of a kayak mounted with the VR100 and hydrophone for tracking in shallow water (Fig. 2). We anchored one of the pingers to the substratum and practiced paddling whilst monitoring signal detections.

Figure 2. Practice using the VR100 with pole mounted hydrophone on a kayak in Skeleton Bay.

Reef shark tracking

We tried to track reef sharks on the 18th and 19th of August, though were unable to catch any. We tried fishing from the beach within Skeleton Bay, where we normally do most of our tagging in summer, but were unsuccessful due to few sharks being present. We also tried fishing from the boat off Point Maud and farther north, but were also unsuccessful. Unfortunately we did not have any other chances to track during this trip, as we were assisting with two other projects and time was limited. Future reef shark tracking work is planned for November / December 2009.

RESULTS

Range testing

The paths walked with both V16 and V13 pingers were in approximate straight lines along the shore away and toward the VR100 receiver (Figs. 3 & 4). Only slight deviations were observed between the path away from – and toward the receiver. Total path lengths also differed somewhat, with the paths being 2,113 m and 2,472m for the V16 and V13 pingers respectively. The maximum distance away from the receiver that the V16 was taken was 286 m, and 309 m for the V13.

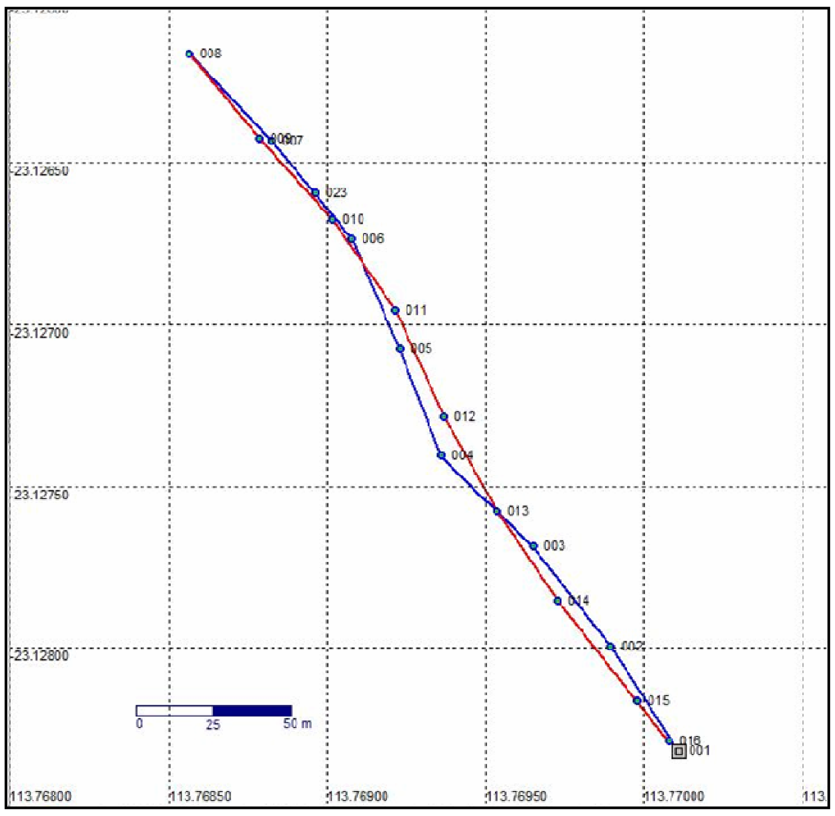

Figure 3. Path walked with V16 pinger. Blue line denotes away track and red line denotes toward track. Grey square represents VR100 receiver.

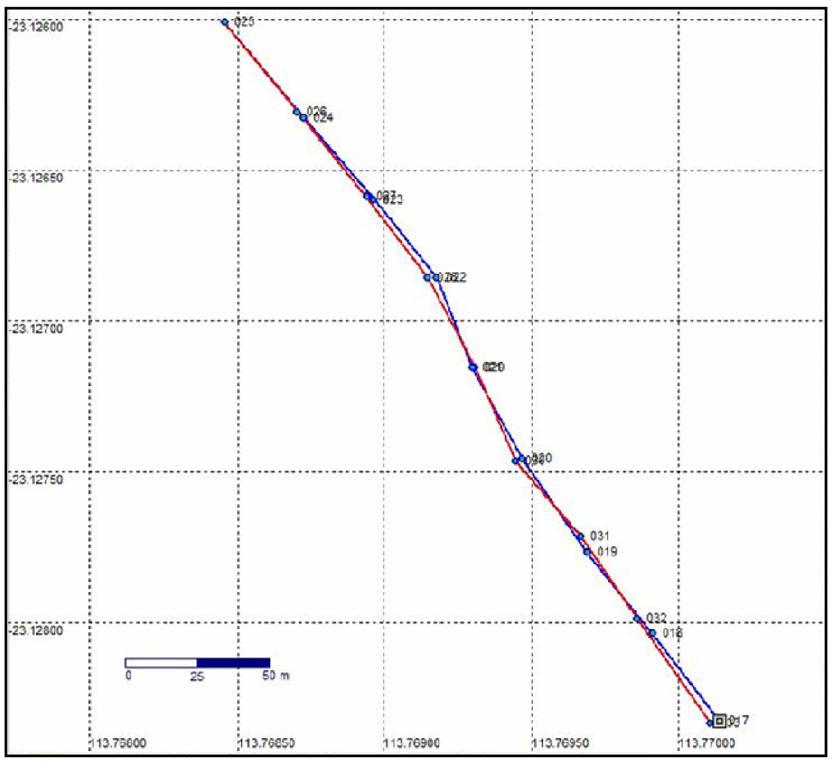

Figure 4. Path walked with V13 pinger. Blue line denotes away track and red line denotes toward track. Grey square represents VR100 receiver.

Total times spent on each range test were 12 and 16 minutes for the V13 and V16 pingers respectively (Figs. 5 & 6). In general, there was a trend of decreasing detection frequency and strength over time for the first half of the tests, and an inverse relationship for the latter half of the tests. The maximum number of detections received in any one minute was 44 from both pingers. Maximum signal strength was at the beginning and end of each test. The maximum signal strength recorded from the V16 pinger was 113 dB and the minimum was 32 dB. The maximum signal strength for the V13 was 113 dB and the minimum was 35 dB.

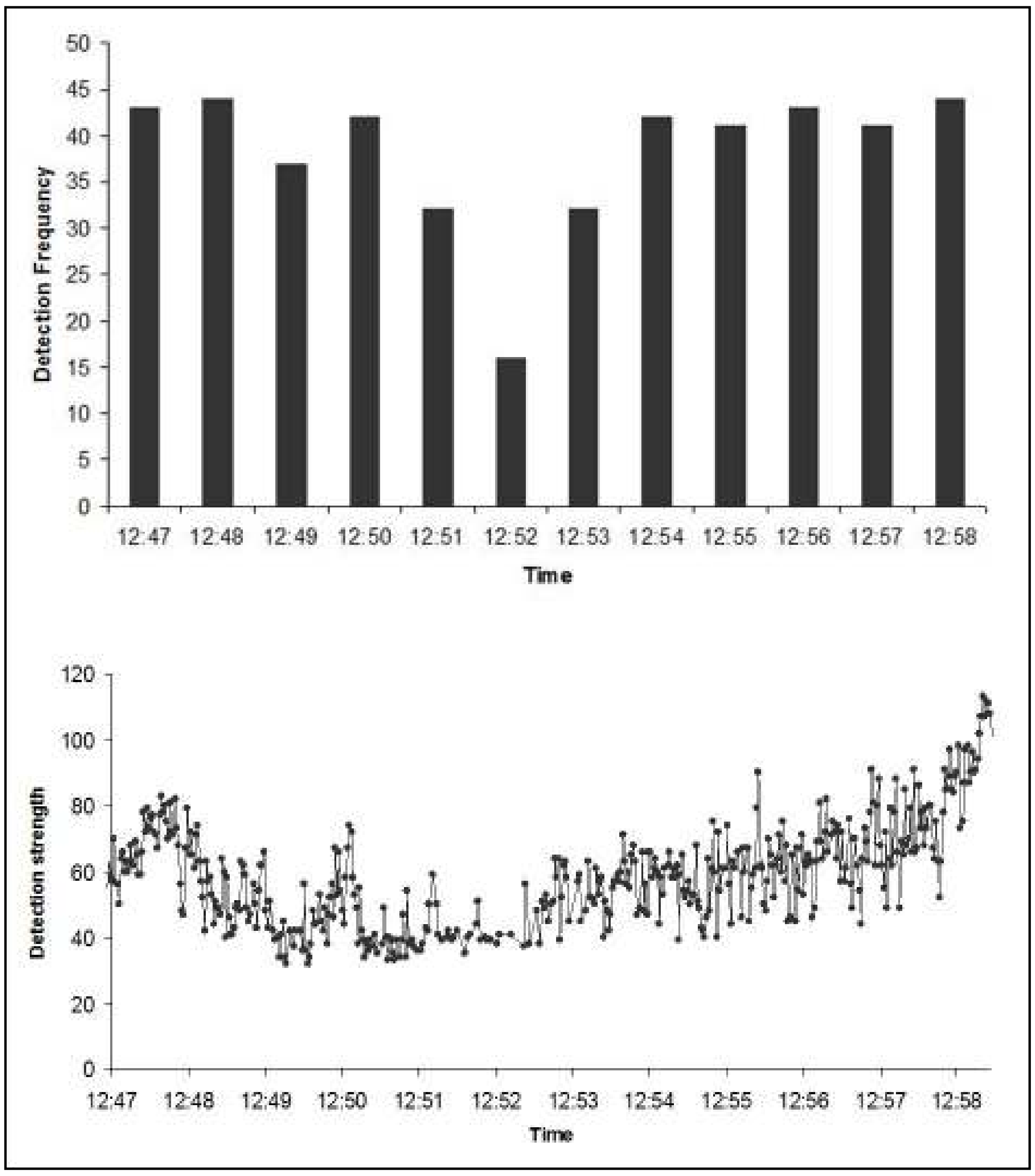

Figure 5. V16 detection frequency and strength during VR100 range testing.

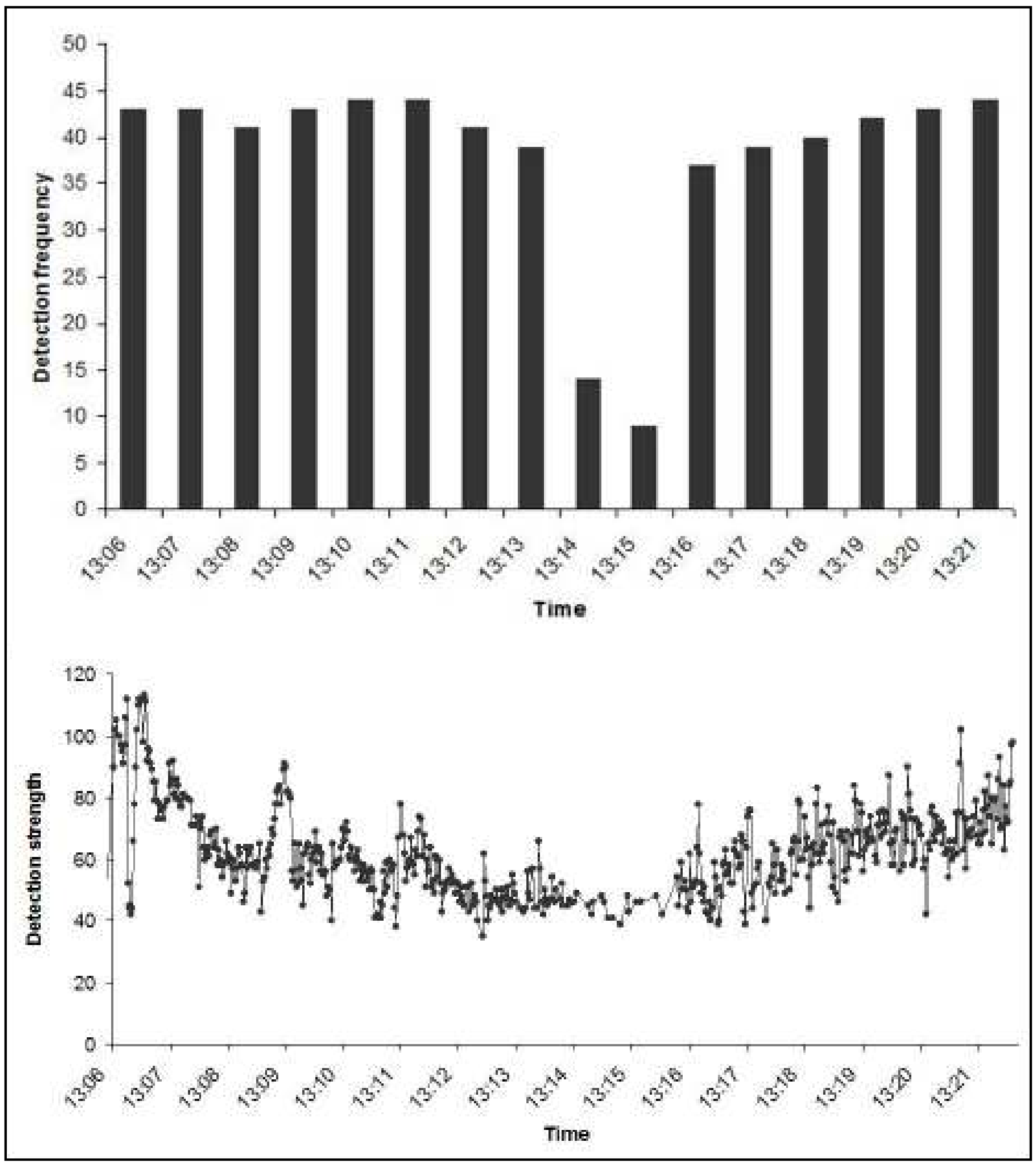

Figure 6. V13 detection frequency and strength during VR100 range testing.

Detection frequency decreased with distance, though a linear relationship was not observed as was expected (Figs. 7 & 8). Detection frequency was reasonably stable within 200 m of the receiver; however rapidly decreased between 200 and 300 m for both pingers. Unfortunately there was an error with the time on the clock in the hand-held GPS, which made matching the time with the VR100 clock impossible. Therefore, distances and detections in figures 7 and 8 are approximations only. Detection frequency did not seem to be affected by the direction of movement (i.e., walking away or towards the receiver).

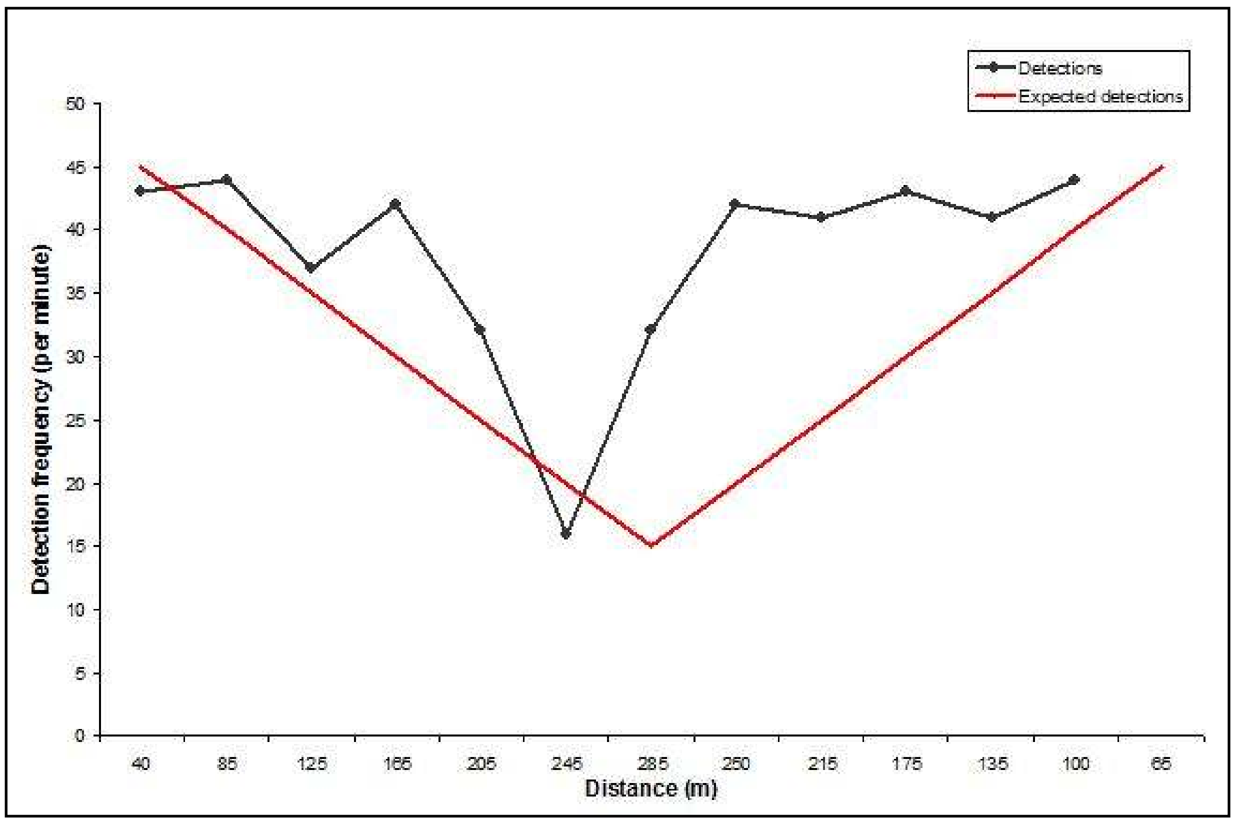

Figure 7. Detections from V16 pinger over approximate distance.

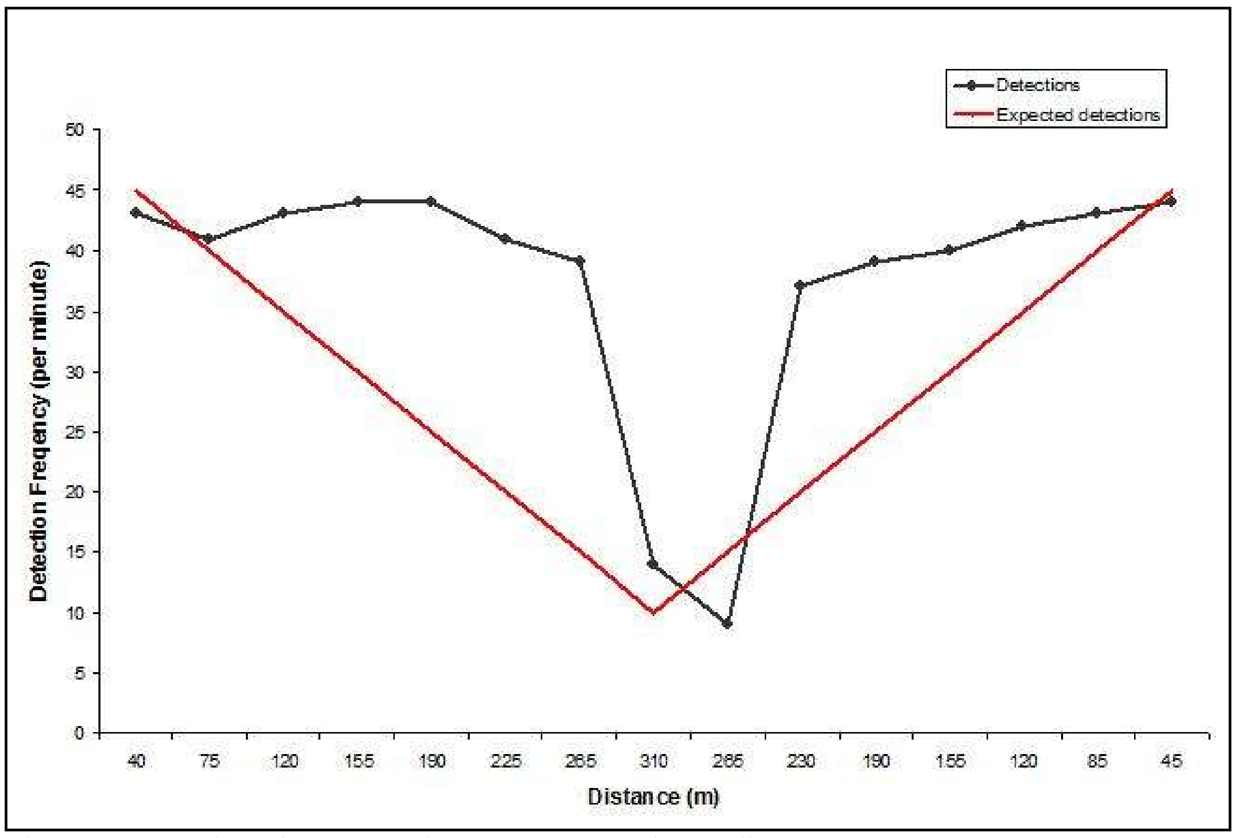

Figure 8. Detections from V13 pinger over approximate distance.

The kayak intended to be used for active tracking when the tide is low, or in extremely shallow areas, proved to be too unstable for carrying the active tracking equipment. Having the hydrophone mounted on a pole also made paddling and steering difficult.

DISCUSSION

The reason range test times and path length differed for each tag may have been due to differences in walking speed, as each pinger was carried by a different person. Pingers should be carried by the same person in future tests, to avoid bias in step length or walking speed. It is interesting the V13 was detected at a greater distance than the V16; again this may have been due to VR100 user bias.

In general, detection frequency and strength decreased as pinger distance from the receiver increased, which was as expected. The reason this pattern was not linear as expected, is uncertain. The sandy substrate was fairly even and depth was maintained at around 50 cm for most of the area. However, there was a very slight rise at around midway through both tracks, which may have interfered with signal detections. Water depth may have decreased to as little as 30 cm for a short period during each test.

A maximum distance of between 250 and 300 m is not ideal for tracking sharks; however this was to be expected given that the water depth in which range testing was done, was extremely shallow. At this distance in shallow water, a kayak would be ideal for maintaining signal reception. When sharks are aggregating in this shallow area, they generally do not move great distances or move quickly, therefore this method seems to be promising provided weather conditions are suitable.

We should have synchronised the time on our hand held GPS with the time on our VR100 to ensure time and distance corresponded more precisely. This is the most likely reason that the minimum detections recorded are not aligned with maximum distance for wither pingers. Furthermore, future range testing should be done while the VR100 has the manual gain set, rather than the automatic gain.

A larger kayak with pedal power would also be beneficial for actively tracking fish with the VR100 and hydrophone. A pedal system would allow the user to control the hydrophone and monitor the receiver more efficiently. Furthermore, Ningaloo Reef often has unfavourable conditions in the afternoon during summer months, which would necessitate a larger, more stable kayak.

OUTPUTS

To date We have presented preliminary results from this project at 5 conferences which were: Ningaloo Research Symposium 2008, Coast to Coast 2008, OCS Conference 2008, Greenhouse 2009, and IPFC 2009.

ACKNOWLEDGEMENTS
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