IMOS Integrated Marine Observing System

IMOS is an initiative of the Australian Government being conducted as part of the National Collaborative Research Infrastructure Strategy

Australian Acoustic Tagging and Monitoring System (AATAMS)

Final Report following the use of AATAMS VR2W receivers

1. Project title

The Yongala's Halo of Holes - Who is Digging It?

2. Authors

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3. Project summary

This project aims to document the habitat use of large stingrays around the iconic shipwreck of the Yongala in the Great Barrier Reef region. To date, we have tagged six female Taeniura meyeni, and one female Himantura spp. with Vemco V9P-2L tags. The animals are currently tracked with an array of VR2's arranged around the wreck in an overlapping pattern, which will allow us to discriminate between regions of the seafloor that we have identified from multibeam bathymetry data as potentially different habitat partitions. The currently deployed VR2's are on loan from CSIRO and are due for return in early November 2007. Part of the study is an ongoing in-situ calibration of the array, which includes a permanently moored reference tag and an ADCP current and wave gauge, which will provide an in-depth receiver performance verification. In order to extend the monitoring period until Sept 2008 to provide a full year of tracking data (which is covered by the lifetime of the deployed tags), we are seeking the support of AATAMS.

4. Project aims

Short term aim :
To document the homerange and habitat use of large stingrays at the iconic wreck of the Yongala.
Long term aim:
To establish what role the 'ecosystem wreck' plays as seabed 'island' habitat for resident and transient species.

5. Level of achievement

Short term aim

We were successfully able to document the ray's usage of the habitat Yongala as set out in the AATAMS-supported study. This project formed part of a larger-scale study on a halo of holes on the seabed surrounding the wreck of the Yongala. The array was deployed in a fashion to partition the seafloor in order to relate the ray's movement to the location of the holes, and to investigate whether or not the holes may be caused – or at least utilised – by the rays. Due to a compromised detection capability (see below), we were not able to determine the ray's movements at a sufficiently high spatial and temporal resolution to establish a spatial relationship between ray movement and holes.

Long term aim

Together with substantial visual observations of the rays carried out concurrently to the tracking study, as well as intensive geophysical and video mapping of the 'habitat Yongala', this study greatly enhances our understanding of the role wreck play as island habitats. Although a lot of work remains in order to achieve this goal fully, we consider it achieved within the scope of the project.

6. Methods

Timeline

Jul 2007	deployment of CSIRO receivers
Sep 2007	7 animals tagged
Oct 2007	one additional animal tagged; turnaround of CSIRO receivers
Nov 2007	retrieval of CSIRO receivers; deployment of AATAMS receivers
Jun 2008	two additional animals tagged
Sep 2008	retrieval of AATAMS receivers

Tagging

The animals were tagged by diving with a modified hand spear. Seven female and one male ray were tagged in early September and early November 2007 respectively, and an additional male and female animal were tagged in June 2008.

Receiver Deployment

In-line moorings were deployed in ca 27m water depth consisting of a bottom weight, the receiver 6m above the seafloor (hydrophone pointing downwards), a float 3m above the receiver, and a top float for retrieval. CSIRO VR2's were deployed in a circular array around the wreck from July to November 2007. These were replaced with AATAMS VR2W's deployed from November 2007 to October 2008. A further receiver was deployed a few kilometres away from the Yongala in the vicinity of a small wreck of a dive vessel located during this study.

Range Testing

Prior to deployment, a range test was carried out ca 500m north of the Yongala in order to determine detection range. VR2's were deployed in a straight line at different distances from a V9P tag. Two VR2's were deployed on each mooring. The results suggested a detection range of approximately 350m (black squares in Fig 1). Subsequently, *in situ* range tests at the Yongala were carried out during periods of receiver turnarounds. These tests showed a greatly reduced detection probability in the array deployed around the shipwreck (yellow dots in Fig 1).

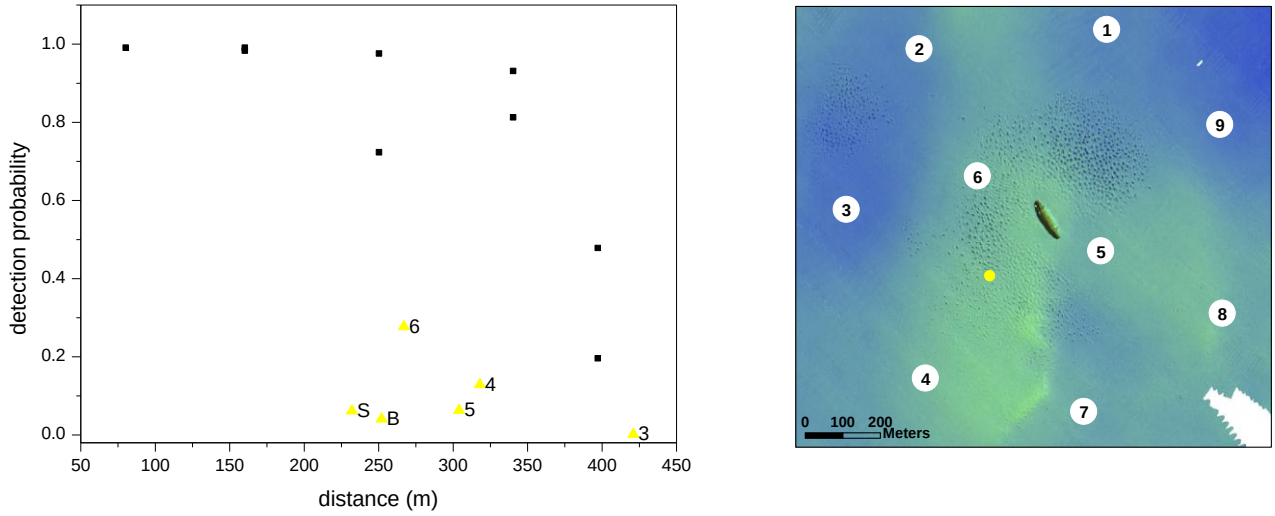

Figure 1: (left) range test results; (right) receiver deployment overview. Black squares indicate range test 500m north of the wreck, and yellow dots correspond to sentinel tags temporarily deployed at respective receiver locations 3, 4, 5 and 6, and stern (S) and bow (B) of wreck.

Data Analysis

Data was subsequently analysed and visualised as time series plots for detections on individual receivers in order to assess receiver performance. The later was also investigated by applying metrics derived by Simpfendorfer et al (2008). Detection time series of individual animals provided information of animal movement, and the depth information transmitted by the tags was used to assess vertical movement behaviour of the rays.

7. Results

Data recovered form CSIRO receivers in Oct and Nov 2007 provide the most valuable information due to a subsequent, to-date unexplained deterioration of detection capability with time. A receiver performance analysis suggests that the wreck causes acoustic shadowing and reflection, resulting in self-collision of the emitted signals, which compromises the ability to detect animals not only close to the wreck.

Notwithstanding these apparent instrumental limitations, we have learnt a great deal on the site fidelity of these previously unstudied animals. The most important findings on the usage of the wreck by the rays are (a) approximately half of the tagged animals remained in the study area for less than 24 hours after the tagging, and subsequently moved out of the study area, not to be seen again at the Yongala for months. The remaining female rays visited the Yongala irregularly, and the tagged male remained at the Yongala more or less continuously (Fig 2). Overall, this suggests that black-blotched Fantail Rays may not be as permanently resident to the Yongala as previously thought; (b) both the observed location and water depth of the animals illustrate a strong diurnal pattern in habitat usage (Fig 2). The rays spend the day on or close to the seafloor away from the wreck, whereas at night they are found in shallower depths around or directly on the wreck; (c) from visual observations, it has been established that the Yongala acts as a cleaning station for the rays. Data collected between Nov 2007 and Sep 2008 confirm these previously observed movement patterns.

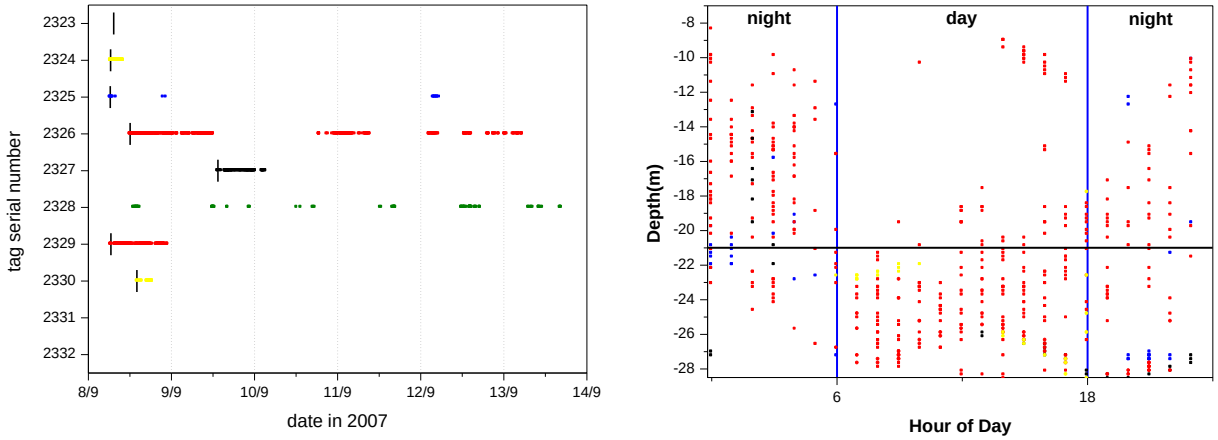

Figure 2: (left) Example detection time series covering the first six days after tagging (all receivers). Note that tag no 2328 was deployed on a mooring as sentinel tag, and not on an animal; (right) Diurnal plot of depth observations during the first month of observation (all tags).

8. Discussion

From the tracking study, we are learning new aspects of the life of this previously poorly studied species of ray, and their association with the wreck of the Yongala. The results will help further our understanding of artificial habitats and Marine Protected Zones in the Great Barrier Reef, and ultimately contribute to their efficient management. Rays are on the list of priority research of GBRMPA, not least for the reason that there is not much known on some of the largest animals in the GBR. This study is making a contribution to this research priority of the management agency.

The acoustic data sheds some light on the movement and habitat use of Taeniura meyeni, but does not allow us to draw definitive conclusions on the connection of the rays to the halo of holes around the Yongala. Whilst the animals regularly visit the halo, it is difficult to extract a consistent movement pattern. Geophysical data collected concurrently to the tracking study indicate that the creation of new holes occurs on a larger than yearly time scale, suggesting that a tracking study of a similar time scale may be required to further the understanding. We now also have some evidence that other fish may play a role in the creation of the holes.

9. Outputs

Scientific presentations: CRC Reef & Torres Strait workshop, Townsville July 2006
AATAMS workshop SIMS, Sydney Nov 2007
European Institute of Marine Studies, Brest (France) May 2008
Ecolab, Observatoire Midi-Pyrenees, Toulouse (France) Jul 2009

Public presentations: Fishermen's Landing Fishing Club (invited), Townsville Mar 2008

Regular coverage in AIMS@JCU newsletters and reports (published on web).

Journal publications are in preparation.

10. Acknowledgements

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11. References

Simpfendorfer CA, Heupel MR, Collins AB, 2008. Variation in the performance of acoustic receivers and its implication for positioning algorithms in a riverine setting, Can J Fish Aquat Sci 65:482-492