

# Sedentary or mobile? Variability in space and depth use of an exploited reef fish

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## Background

- Movement defines the distribution of species, and knowledge of movement patterns is useful for understanding population dynamics and potential effects of exploitation<sup>1</sup>
- The combination of passive acoustic telemetry and conventional tagging enables the movement of multiple individuals to be monitored over multiple spatial and temporal scales<sup>2</sup>
- As an important component of tropical fisheries worldwide<sup>3</sup>, identifying whether Lethrinids follow a sedentary or mobile lifestyle is important when considering management strategies e.g. spatial closures

**AIM:** to identify whether adult *Lethrinus miniatus* are sedentary or mobile, by defining the residency, activity space and depth use patterns

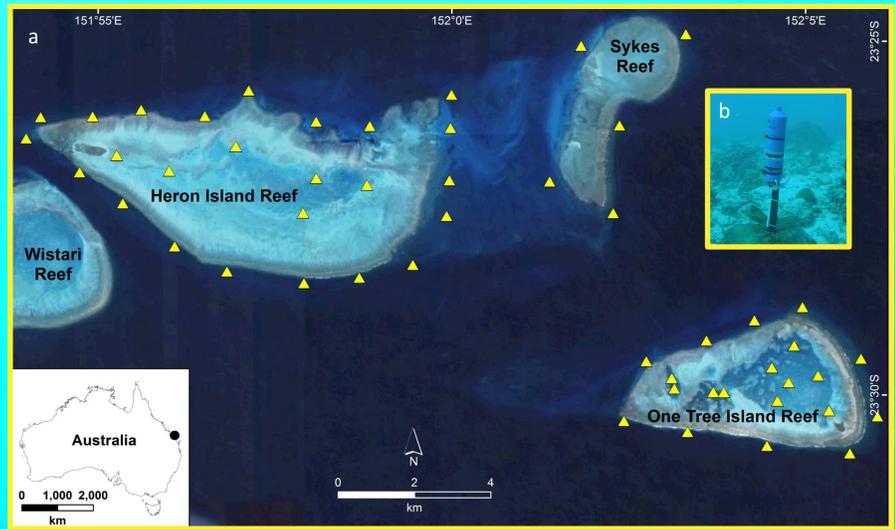


Fig. 1. Location of the Capricorn-Bunker reefs, Southern Great Barrier Reef Australia (a), depicting position of the underwater acoustic receivers (triangles & b)



Fig. 2. Release of *Lethrinus miniatus* after tagging with V13P acoustic transmitter and external identification tag

## Methods

- Fifty-two Vemco VR2W<sup>®</sup> acoustic receivers in the Capricorn-Bunker reefs, Australia (Fig. 1) monitored the presence and movement patterns of 60 *L. miniatus* (Fig. 2)
- For individuals detected for > 5 days, daily presence, residency index and average positions of individuals (2h intervals)<sup>4</sup> were calculated
- Areas of core use (50% kernel utilisation distributions, KUDs) and extent (95% KUDs) were calculated in two ways: horizontally (hKUD) and vertically (vKUD)<sup>5</sup> (Fig. 3)
- Linear regressions tested whether residency, or activity space were related to fish size (fork length, FL)
- Mixed effects models using an information theoretic approach (AIC<sub>c</sub>) examined trends in mean depth use by FL, hour, day and month

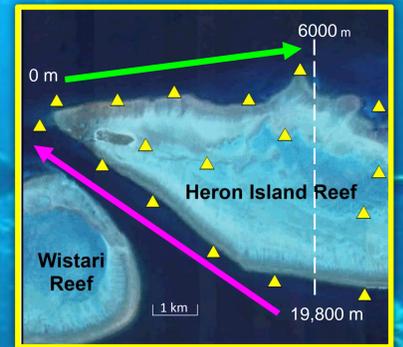


Fig. 3. For each receiver (triangles) around the reef edge, reef distance (m) was calculated as the distance from the northwest point of Heron Island Reef in a clockwise direction

## Results

- 26 individuals were detected for > 5 days between April 2011 and September 2013
- **Residency index:** 0.01 to 1 (mean ± SE = 0.31 ± 0.07), FL was not related to any parameter estimated
- 50% of the individuals were detected only at one receiver (mean = 108 days) indicating high site fidelity
- **Horizontal space use:** 0.36 ± 0.04 km<sup>2</sup> (50% hKUD) and 1.93 ± 0.27 km<sup>2</sup> (95% hKUD). Observed maximum space used was < 4 km<sup>2</sup>
- **Vertical space use:** 50% and 95% vKUDs varied among individuals, utilising a range of depths. Activity space extent (95% vKUD) overlapped for some individuals (e.g. Fig. 4)
- **Long-distance movement:** observed for one individual (ID 6707) which was recaptured c. 160 km on an adjacent reef platform after 495 days at liberty (Fig. 5)
- **Depth use:** best explained by month (AIC<sub>c</sub> weight = 0.97, *p* < 0.001), but no clear trend was observed – which suggests that trends in prey distribution or abiotic factors potentially influenced depth use

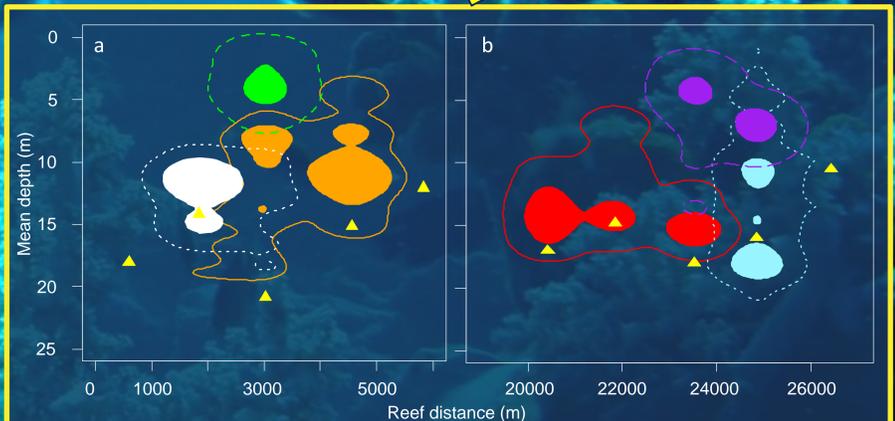


Fig. 4. Vertical activity space estimates for six individuals (colours) at northwest (a) and southwest (b) Heron Island Reef. Solid colour indicates core activity space (50% vKUD) and lines indicate extent (95% vKUD) with reef distance (m). Triangles denote receiver locations

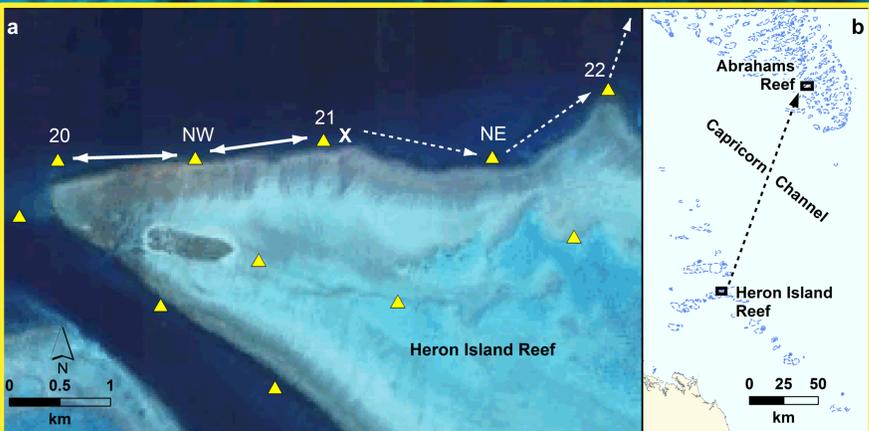


Fig. 5. Movement of individual ID 6707 at Heron Island Reef (a) indicating release point (X), movement over 11 months (solid arrows) between receivers (triangles; 20, NW, 21) and movement over the last day of detections (dashed arrows between receivers 21, NE and 22). Recapture location at Abrahams Reef (b) was approximately 160 km from Heron Island Reef

## Conclusions

- Evidence exists for both a sedentary and mobile lifestyle for *L. miniatus* – partial migration is common for other species, where some individuals move broadly while the majority remain resident<sup>6,7</sup>
- Broad-scale movement is important for connectivity
- Spatial closures that cover reef slope areas (> 4 km<sup>2</sup>) could provide protection from fishing for a substantial proportion of the population that displayed high site fidelity and moderate-sized activity spaces (over a period of up to 12 months)
- Yet, variability in movement patterns for this species highlights that no single management strategy fits all species/individuals within a species, therefore multiple regulatory methods should be employed

### References:

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