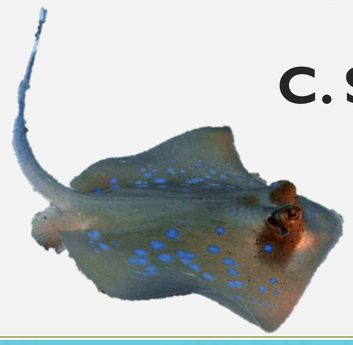
Are we underestimating elasmobranch abundance on BRUVS by using traditional metrics?



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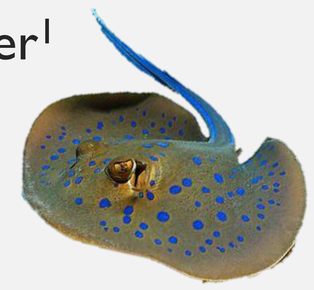

Introduction

- Surveying batoid populations is challenging due to their cryptic nature[1,2,3]
- Baited remote underwater video systems (BRUVS)(Fig. 1) are a reliable, consistent method for surveying predators[1]
- MaxN is the most commonly used metric for analysing BRUVS footage[4], it is the maximum number of individuals observed in a single frame of video[5]
- MaxN is a conservative estimate and it is unclear how well it represents true abundance
- Identification of unique individuals to assess populations has been conducted with static photos[6] and may be possible in BRUVS footage

AIMS:

- Determine if individual batoids could be distinguished in BRUVS footage
- Determine if there are differences between MaxN and identified individuals (MaxIND), and if so does it differ between species and levels of protection

Methods

- BRUVS were deployed in Malaysian Borneo at depths 0-40 m across different reef habitats for a minimum of 60 minutes
- Deployments across 3 sites with varying levels of protection:
  - Tunku Abdul Rahman Park (TARP) – Closed to fishing
  - Tun Sakaran Marine Park (TSMP) – Subsistence fishing
  - Mabul / Kapalai (MK) – Open to fishing
- 2 trained annotators marked presence of all rays observed
- All videos with bluspotted maskrays (*Neotrygon orientalis)* and bluespotted fantail rays (*Taeniura lymma)* were reanalysed for individual identification
- For each observation the best possible frames were extracted from the video to illustrate key identifying features (Fig. 2)
- Frames were then compared to differentiate between individuals within each deployment (Fig. 3)

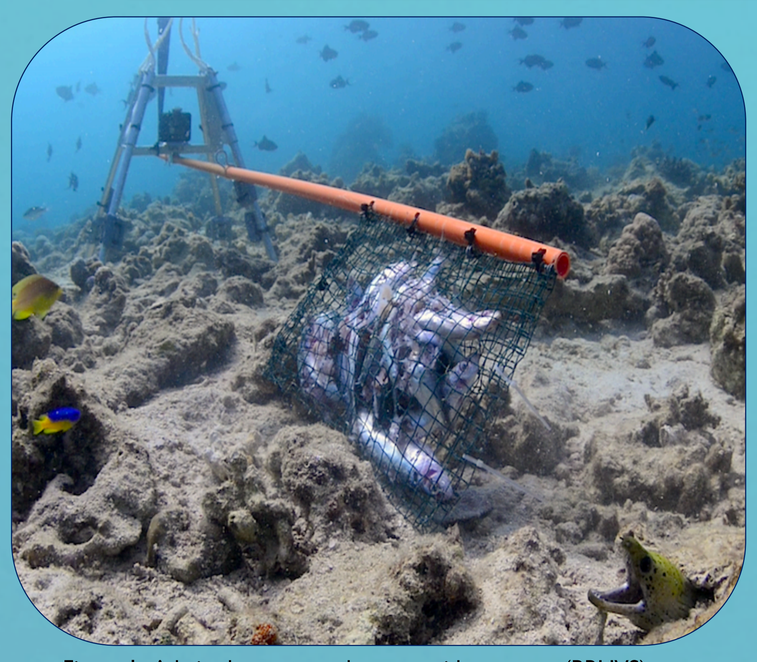

Figure 1. A baited remote underwater video system (BRUVS) set in Malaysian Borneo.

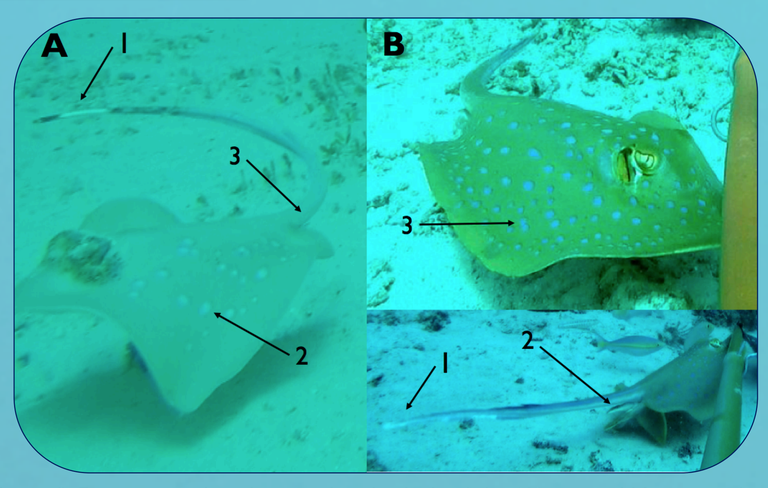

Figure 2. Features used to distinguish individuals of the (A) oriental bluespotted maskray: (1) 'Barcode' – black and white banding on tail, (2) Spot patterns, (3) Sex, and (B) bluespotted fantail ray (1) Tail scratches/ bites (2) Sex (3) Spot patterns. Where possible, multiple features were used in conjunction for distinguishing individuals.

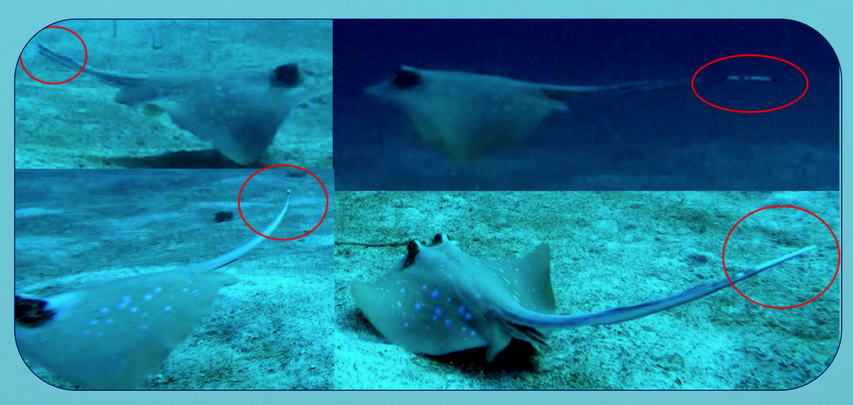

Figure 3. Four oriental bluespotted maskray individuals from the same BRUVS deployment. This video had a MaxN of one, eleven passes were made in front of the camera and four individuals were distinguished.

Results

- In 286 BRUVS, 372 batoids were observed, of which 282 were identifiable as distinct individuals
- Identified 103 unique *N. orientalis* individuals and 67 unique *T. lymma* individuals
- *T. lymma* were present on more videos but *N. orientalis* had a higher MaxN
- MaxIND yielded significantly higher abundances in both species; 2.4X in *N. orientalis* and 1.1X in *T. lymma* (Figs. 4 and 5)
- No difference in ability to distinguish individuals of the two species or between the three sites

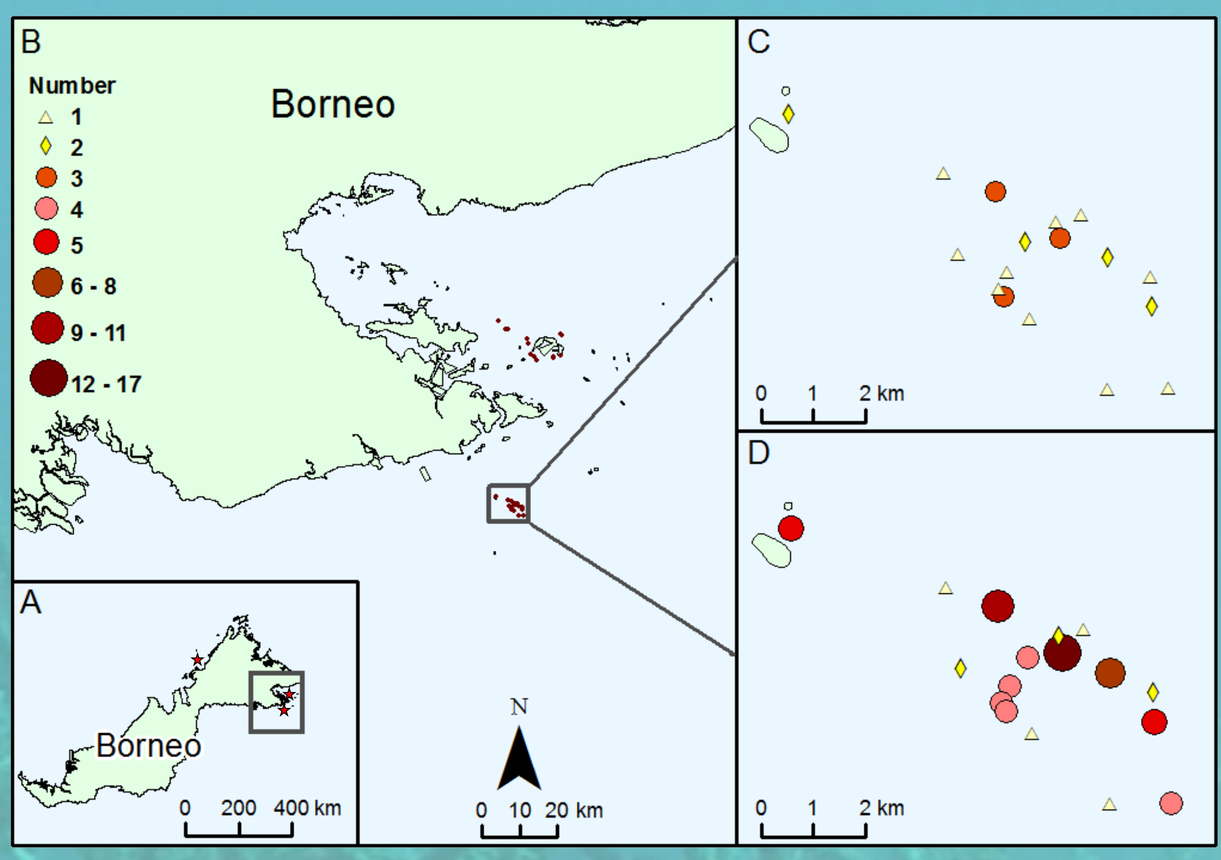

Figure 4. A) Malaysian Borneo, red stars indicate 3 sites. B) BRUVS drops off Semporna. C) MaxN of drops with oriental bluespotted maskrays present in Mabul/Kapalai. Only videos with at least one maskray present were included. D) Number of identified individuals on BRUVS with oriental bluespotted maskrays present in Mabul/Kapalai.

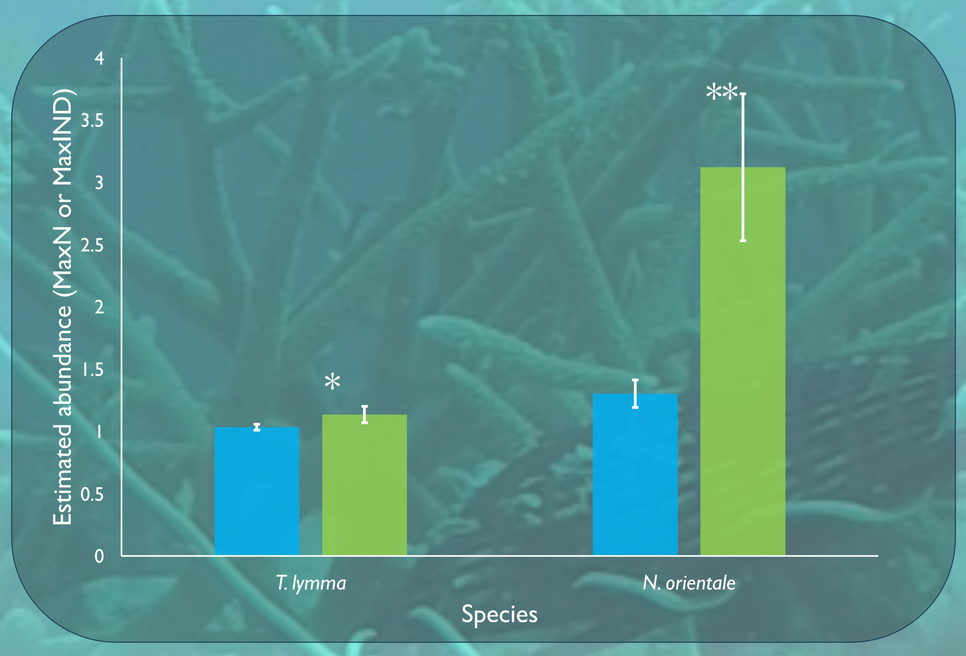

Figure 5. Mean numbers of identified *T. lymma* and *N. orientalis* were significantly lower than the mean number of observations of a single species (* $p<0.05$; ** $p<0.005$). Error bars represent one standard deviation, green bars represent number of identified individuals (MaxIND) and blue bars represent MaxN.

Conclusions

- MaxN significantly underestimated abundances in two stingray species
- MaxIND is a better estimate but more time consuming analyses are required
- MaxIND cannot be used for all species – need obvious distinguishing features
- No correlation between MaxN and MaxIND; differences are species specific
- Important to understand limitations of BRUVS in population estimates

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