



INDONESIA DISSERTATION/THESIS PROJECT

IN37 Moving to better places: an assessment of the abundance and behaviour of butterflyfish in Indonesia

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In the Anthropocene, almost all environments, and therefore organisms, have been subject to change due to anthropological activities and associated impacts. Complex interactions between the environment and organisms shape biological communities. Behaviour can be considered a key mediator between individuals and their environment, with behaviour modification acting as the primary and most immediate response to changing conditions. Behaviour therefore plays a pivotal role in the adjustment of individuals to rapid environmental change and can therefore be used to explain both inter and intraspecific variation between and within species. For example, in marine habitats, anthropogenic activity is rapidly changing environmental conditions. Coral reefs are undergoing particularly substantial change around the world as mass coral bleaching and other disturbance events disrupt ecological communities.

Species that depend on live coral for survival will therefore be affected by declines in coral health. Butterflyfish (*Chaetodon spp.*) are one such species. Almost all butterflyfish species feed on live coral to some extent. Some species are obligate corallivores, and rely on coral cover directly for survival. Some of the obligate corallivore butterflyfish are specialised to feed on two one or two coral species. Other species are facultative corallivores, whereby live coral forms just part of their diet. Territoriality, or the size of butterflyfish territories have been shown to increase in areas of lower coral cover, associated with a need to invest energy in foraging for minimal resources rather than investing in territory defence. Similarly, declines in aggressive interactions have been documented across numerous butterflyfish species across the Indo-Pacific following the 2016 mass bleaching event. Specialist obligate corallivore species have also been shown to invest less in pair bonding following declines in live coral cover.

As well as behavioural changes, changes in abundance and species composition are apparent following bleaching events. Both obligate and facultative corallivores have been shown to decline in abundance following declines in coral cover. Furthermore, whilst obligate corallivores have been shown to dominate where coral cover is high, this is not the case as coral cover starts to decline, resulting in changes in butterflyfish species composition following bleaching events. Their reliance on coral for survival makes butterflyfishes a suitable indicator species of reef health. Documenting changes in butterflyfish behaviour and abundance is therefore important for monitoring both declines in reef health and the persistence of these species in the future.

In 2019, butterflyfish specific surveys were conducted to address changes in abundance, density and diversity across two sites of varying coral cover. Initial behavioural observation surveys were also conducted on a few different butterflyfish species. Students have the option to expand this work across further sites to develop an assessment of butterflyfish abundance and diversity around Hoga Island and the neighbouring Kaledupa reef sites. Students could focus on specific species or categorise all species into obligate or facultative corallivores to determine the susceptibility of different foraging types to changing coral cover.

There is also the option to study butterflyfish behaviour, through behavioural observations of one, or a few species, both within and across sites. Students also have the option to focus on specific aspects of behaviour, such as foraging time budgets, whereby time spent feeding, the number of bites taken and the dietary preference of species is recorded and compared across different sites. There is also the option to focus on aggressive interactions. This would involve selecting one or two species and documenting the number and length of aggressive interactions, as well as recording the species involved in these interactions.

PhD research on butterflyfish behaviour and personality in 2019 identified a possible link between two obligate corallivore species, *C.lunulatus* and *C.baronessa*, whereby the presence of *C.baronessa* could influence the behaviour of *C.lunulatus*. There would therefore also be the option for a student to investigate this link further by conducting behavioural observations on these two species.

Recommended Reading

Berumen M (2001) Diet and Territory Size of Butterflyfish in Habitats with Varying Coral Cover and Composition, *The University of Arkansas Undergraduate Research Journal 2*

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Clifton J (2010) Marine Research and Conservation in the Coral Triangle : the Wakatobi National Park

Cox EF (2014) Corallivory :The Coral's Point of View. In Pratchett M, Berumen M, Kapoor B (2014). *Biology of butterflyfishes*. CRC Press, Boca Raton, Florida

Keith SA, Baird AH, Hobbs JA, Woolsey ES, Hoey AS, Fadli N, Sanders NJ (2018) Synchronous behavioural shifts in reef fishes linked to mass coral bleaching. *Nature Climate Change*

Pratchett MS, Wilson SK, Berumen ML, McCormick MI (2004) Sublethal effects of coral bleaching on an obligate coral feeding butterflyfish. *Coral Reefs 23*(3): 352–356

Pratchett MS, Wilson SK, Baird AH (2006) Declines in the abundance of Chaetodon butterflyfishes following extensive coral depletion. *Journal of Fish Biology 69*(5): 1269–1280

Pratchett MS, Berumen ML, Kapoor BG (2014) *Biology of Butterflyfishes*. CRC Press, Boca Raton, Florida

Samways MJ (2005) Breakdown of butterflyfish (Chaetodontidae) territories associated with the onset of a mass coral bleaching event. *Aquatic Conservation: Marine and Freshwater Ecosystems 15*: 101–107

Thompson CA, Matthews S, Hoey AS, Pratchett MS (2019) Changes in sociality of butterflyfishes linked to population declines and coral loss. *Coral Reefs 38*(3): 527–537

Tricas T (1989) Determinants of feeding territory size in the coralivorous butterflyfish. *Animal Behaviour 37*: 830–841

Wilson SK, Graham NAJ, Pratchett MS (2013) Susceptibility of butterflyfish to habitat disturbance: do 'chaets' ever prosper? In: *Biology of Butterflyfishes* (eds Pratchett MS, Berumen ML, Kapoor BG), 226–240. CRC Press, Boca Raton, Florida