Complex yet fauna-deficient seagrass ecosystems at risk in southern Myanmar

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Abstract

Dependence on seafood across Southeast Asia is extensive. Myanmar is no exception, but the country's provisioning marine ecosystems are threatened. Seagrass is one habitat that is frequently overlooked in management as an important fisheries resource, despite its nursery function. In Myanmar, research on seagrass habitats is particularly sparse, and as a result, our understanding of seagrass exploitation remains limited. In this study, we provide a baseline assessment of the seagrass-associated fish assemblages at four locations in the Myeik Archipelago in southern Myanmar using mono Baited Remote Underwater Video systems. Across the sites surveyed only 12 taxa of motile fauna were recorded. Relative to other regional and global studies this figure is meagre. Our data adds to a growing literature suggesting that the marine habitats of Myanmar are in decline. Despite the lack of recorded seagrass associated fauna, our study revealed minimal impacts to seagrass meadows from eutrophication or sedimentation, and the meadows included appeared to be healthy. The sites with the highest number of motile fauna were within Myanmar's only National Marine Park offering some optimism for the effectiveness of protection, but further assessments are required to allow targeted management of Myanmar's seagrass meadows.

Keywords: Seagrass fisheries, Myanmar, Myeik Archipelago, over-fishing, fisheries resources, BRUV

Introduction

Dependence on seafood across Southeast Asia is extensive (Donner and Potere, 2007), and this holds true for Myanmar (Russell, 2015). However, tropical marine ecosystems are in decline (Burke et al., 2011; Giri et al., 2011; Pauly, 1998; Waycott et al., 2009), along with their associated fisheries (Pauly, 1998). While there is a magnitude of reasons for fishery decline, Malthusian over-fishing has been pivotal (McClanahan et al., 2009). In Myanmar, due to historical political uncertainty, formal management of marine ecosystems has been absent until relatively recently.

Tropical marine ecosystems, like those present along the 3000km coastline of Myanmar, form an inter-connected seascape that supports a diversity of marine organisms throughout their life stages. Connected coastal habitats provide daily foraging for adult fish to residency areas for juveniles (Harborne et al., 2006; Harborne et al., 2008; Nagelkerken et al., 2008; Unsworth et al., 2008). Seagrass meadows are one component of these tropical marine systems, also providing critical fishery grounds (de la Torre-Castro and Ronnback, 2004; Exton, 2010; Nordlund et al., 2017; Unsworth and Cullen, 2010). Seagrass meadows provide nursery habitat for numerous fish species that are relied upon for food and livelihoods (Beck et al., 2001; Gillanders, 2006; Heck et al., 2003; Nagelkerken et al., 2012; Unsworth et al., 2014a).

Across the Indo-Pacific, marine research, monitoring and conservation funding has been geared towards coral reefs and to a lesser extent mangroves. This trend is mostly a result of tropical coastal marine fisheries often being referred to misleadingly as ‘coral reef fisheries’ (Nordlund et al., 2017; Unsworth and Cullen, 2010). Despite recognition for their valuable ecosystem services, the role of seagrasses in supporting fisheries productivity and importantly food supply has largely been ignored until recently (de la Torre-Castro et al., 2014; Duarte et al., 2008; Nordlund et al., 2017; Unsworth and Cullen, 2010). In Myanmar, limited research effort means we have a more limited understanding of seagrass ecosystems. To date, seagrass ecosystem research in Myanmar has focused on mapping meadows and recording the seagrass species’ present (Giardino et al., 2016; Ilangakoon and Tun, 2007; Novak et al., 2009; Soe-Htun et al., 2015; Soe-Htun et al., 2001). In 2001 Soe-Htun et al. (2001), described seagrasses in Myanmar as being in “pristine and climax conditions” with “no stresses.” In 2015, however, the same authors suggested that this is no longer the case (Soe-Htun et al., 2015). Seagrass meadows in Myanmar are now suffering from the same regional problems, including eutrophication and sedimentation, observed elsewhere in Southeast Asia (Ooi et al., 2011; Satumanatpan, 2008; Satumanatpan et al., 2011). Previous monitoring reports suggest seagrass meadows in Myanmar support a rich biodiversity of marine life, including fish from families including Chaetodontidae (butterflyfishes), Pomacanthidae (angelfishes), Labridae (wrasses), Siganidae (rabbitfishes), Mugilidae (mullets) and Clupeidae (herring) (Soe-Htun et al., 2001). Surveys of Myanmar's coral reef and demersal fisheries in recent years have shown a rapid decline in biodiversity (Howard et al., 2014; Obura et al., 2014; Russell, 2015, 2016). Therefore, it is likely that seagrass fisheries have also seen a similar fate.

Understanding habitat links to fisheries, while critical for short-term fisheries management, is important for understanding the vulnerability, and resilience of marine systems to change (Folke, 2006; McClanahan et al., 2009). There is an urgent need to understand the role that different habitat types have in supporting tropical marine fisheries within the Indo-Pacific region. Given the growing evidence of the role, that seagrass meadows play in supporting Indo-Pacific marine fisheries (Nordlund et al., 2017), here we provide a baseline assessment of the seagrass meadows and their associated fish assemblages at four locations in the Myeik Archipelago in southern Myanmar and discuss the implications of our findings.

Methods

Study location

The Myeik Archipelago (formerly Mergui) is comprised of around 800 islands covering around 36,000 km^2 in the southern Tanintharyi coastal region of Myanmar (Fig. 1). The Archipelago is inhabited by a population of approximately 2000-3000 semi-nomadic people, the Moken (also referred to as Sea Gypsies or *Salone* in Burmese) (Schneider et al., 2014). During April and May 2016 floral and faunal assessments were conducted within seagrass meadows at four sites as follows: Taw Wet North (11.41°, 98.12°); Lampi East (10.70°, 98.28°); Bo Cho (10.67°, 98.26°) and; Nyaung Wee (10.50°, 98.23°). Taw Wet North was the northernmost site used in this study, and the seagrass meadow was located in front of a small mangrove habitat, with a small freshwater input. Seagrass meadows at Lampi East and Bo Cho were both located in front of a sandy beach in the absence of mangrove. Lampi East and Bo Cho were within the Lampi Marine National Park (MNP) (Table 1). Lampi Island MNP includes around 3000 people living in 5 settlements within the boundary of the park (MOECAF and Oikos, 2015). Although not within the park, Nyaung Wee is included in this population estimate and was the southernmost site. The seagrass meadow at Nyaung Wee is situated in front of a small mangrove habitat. At all sites, the substrate was muddy sand nearshore, becoming sandy mud further offshore (McKenzie et al., 2001).

Seagrass morphometrics

At each sampling site, 34 haphazardly placed 0.25 m^2 quadrats were sampled from within the seagrass meadow at low tide. Shoot density (0.0225 m^2) was recorded as was total percentage cover and floral species composition (McKenzie et al., 2001). Canopy height was also recorded using the mean height of three leaves in each quadrat. Percentage epiphyte and algal cover were recorded using the Seagrass-Watch quadrat metrics (McKenzie et al., 2001).

Biodiversity assessments

The relative abundance and diversity of fish assemblages were assessed using mono-camera Baited Remote Underwater Video systems (BRUVs). Fish were identified to species level where possible. The mono-BRUVs were constructed based on designs by Cappo et al. (2004), using a stainless steel tripod-style frame as a mount for a GoPro Hero 4 camera. A bait arm (20 mm stainless steel conduit) extending 1m from the base plate of the camera supported a plastic bait container (112 cm^3), holding standardised bait (ground goatfish and sardine – sourced locally), which was replenished before every deployment.

Five sets of three deployments, spaced 50m apart (15 samples) were conducted at Taw Wet North and four sets of three deployments, again spaced 50m apart (12 samples) were conducted at Lampi East, Bo Cho and Nyaung Wee. BRUVs were deployed for 30 minutes which is considered adequate time to assess fish assemblages while remaining cost-effective (Haggitt et al., 2014; Kelaher et al., 2014; Malcolm et al., 2015; Wraith et al., 2013; Wraith, 2007). Additionally, a short sampling duration enables a higher number of samples to be collected, achieving a great spatial representation of the variability of the fish assemblages (Unsworth et al., 2014b). BRUVs were deployed at depths of 0.5 to 1.5m on an incoming tide. All BRUVs sampling was conducted during daylight hours.

Video footage was analysed to determine the MaxN of each fish species in each sample. MaxN is a metric commonly used for the quantification of the relative abundance of fish observed on underwater video (Cappo et al., 2004; Unsworth et al., 2014b). MaxN counts the maximum number of fish recorded at any one time (single video frame) and therefore removes concerns associated with double counting of individual fish (Priede et al., 1994). All footage was analysed using the specialised SeaGIS software EventMeasure v.3.51. MaxN was determined for each species in every video frame throughout the 30 minutes of footage. The highest MaxN for each species at the end of each 30 minutes was then used in further analysis.

Data analysis

Data were tested for homogeneity of variance and normality. Where data were not normal, log transformations were performed so that data met the assumptions of parametric tests. One-way ANOVA was used to test for differences in the key seagrass morphometrics across sites with Bonferroni post-hoc tests for differences between sites using the software SPSS v.23. Analysis of differences in the structure of fish assemblages between sites was conducted using multivariate non-metric multidimensional scaling ordination (nMDS) in PRIMER v.6.1.5, and a 2-way analysis of similarities (ANOSIM) was used to investigate differences identified from MDS (Clarke and Warwick, 1994). All summary data are presented as means ± standard deviation.

Results

Seagrass condition

All seagrass meadows surveyed were mixed species meadows. The dominant species across all sites was *Cymodocea rotundata* (>80%; Table 2). Seagrass morphometrics differed across the four sites (see Fig. 2). Significant differences in seagrass cover were observed between sites ($F_{3, 125} = 4.4250$, $p < 0.001$). Highest percentage cover values were recorded at Nyaung Wee (48.9 ± 27.5 %), which were significantly different from the lowest values at Bo Cho (28.3 ± 21.1 %). Seagrass cover at Taw Wet North (32.2 ± 25.5 %) and Lampi East (42.6 ± 28.7 %) did not significantly differ from the other two sites. There were no significant differences in shoot density across sites, where highest values were recorded at Lampi East (266.4 ± 155.13 m^{2-1}) and lowest at Taw Wet North (219.2 ± 146.1 m^{2-1}).

Significant differences in canopy height were recorded between sites ($F_{3, 125} = 7.231$, $p < 0.001$). Values were highest at Taw Wet North (9.9 ± 2.8 cm) and lowest at Bo Cho (6.6 ± 2.8 cm). Significant differences in canopy height were observed between Taw Wet North and Bo Cho, and Taw Wet North and Lampi East (7.5 ± 6.6 cm). Significant differences in epiphyte cover ($F_{3, 125} = 11.635$, $p < .001$) were observed between sites. Epiphyte cover was characteristically low at Taw Wet North, Bo Cho and Nyaung Wee and high values at Lampi East (20.3 ± 23.3 %) were responsible for differences between sites. Taw Wet North had no algae present and was responsible for significant differences in algae cover between sites ($F_{3, 125} = 7.602$, $p < .001$).

Faunal abundance

A total of 27 x 30-minute video ‘samples’ were collected from within the seagrass meadows. A total of 85 faunal individuals (based on MaxN) from 12 different taxa were recorded, of which 1 was a Cephalopod. Some individuals could only be identified to family level (e.g. Gobiidae and Lutjanidae). Total relative faunal abundance (MaxN) per sample ranged from 17 individuals at Bo Cho to 0 individuals (at all sites). The average relative fish abundance (MaxN) across all sites and samples was 1.7 ± 3.7. In Taw Wet North this was 0.3 ± 0.6, in Lampi East 3.0 ± 4.6, in Bo Cho 2.9 ± 5.6 and Nyaung Wee was 0.8 ± 1.4 (see Fig. 3).

Species diversity

The mean number of species was highest at Lampi East, with 1.3 ± 2.1 species per sample. At Bo Cho, this was 1.0 ± 1.5, and at Nyaung Wee this was 0.3 ± 0.5. The mean number of species was lowest at Taw Wet North, with 0.2 ± 0.4. Average sample diversity (Shannon Wiener H') was highest at Lampi East (0.3 ± 0.5) and Bo Cho (0.2 ± 0.4). There was no sample diversity at Nyaung Wee or Taw Wet North (0.0 ± 0.0) (Fig. 3).

The most abundant fish species across all sites were the northern whiting (*Sillago sihama*) (7.0 ± 4.5), the common silver-biddy (*Gerres oyena*) (3.1 ± 1.6) and the pearly-spotted wrasse (*Halichoeres bicolor)* (2.0 ± 1.2). While seven individuals of the seagrass wrasse (*Novaculoides macrolepidotus*) were recorded, these were observed in only one sample. *G. oyena* was most frequent across all sites, occurring in 14 % of samples, followed by *H. bicolor* (10 %) and individuals from the Gobiidae family (10 %) then *S. sihama* (8 %). In total, only two taxa were recorded at Taw Wet North and Nyaung Wee. Nine taxa were recorded at Lampi East and seven at Bo Cho. The most frequently observed species in Taw Wet North was *S. sihama*, which was present in 13 % of the samples. In Lampi East the most frequently observed species were *G. oyena* (25 %), fish from the Gobiidae family (25 %) and *H. bicolor* (17 %). The most frequently observed species at Bo Cho sand *were H. bicolor* (17 %), thumbprint emperor (*Lethrinus harak*) (25%) and *S. sihama* (17%). *G. oyena* (25%) was the most frequently sampled fish in Nyaung Wee (Table. 3).

Species assemblages

The faunal species assemblages within the four seagrass meadows were not significantly different from each other (ANOSIM, $R = 0.04$, $P = 0.067$). Pairwise tests confirmed individual inter-site differences between Taw Wet North and Lampi East ($R = 0.09$, $P < 0.05$). No grouping existed for samples from the four sites, indicating some over-lapping of species assemblages (Fig. 4).

Discussion

Despite historical reports of rich and abundant seagrass meadows in Myanmar (Soe-Htun et al. (2001)) the present study provides convincing evidence that the seagrass fisheries within the Myeik Archipelago are in a potentially perilous state. Evidence of the limited seagrass fishery adds to a growing literature suggesting that Myanmar's marine habitats are in decline (Howard et al., 2014; Russell, 2015, 2016). Although the absence of seagrass associated fauna is of concern, our study suggests that the floral component of these seagrass meadows is in a healthy state with minimal visible impacts from eutrophication or sedimentation.

Across the sites surveyed, only 12 taxa of motile fauna were recorded. Relative to other regional and global studies this is extremely low (Esteban et al., 2017; Unsworth et al., 2014a). Across the Indo-Pacific, the number of seagrass-associated fish species is high. Nearly 700 species of fish are reported to have been observed in seagrass meadows across the Indo Pacific, the most common species' being *Lethrinus harak*, *Siganus canaliculatus* and *Gerres oyena* (Unsworth et al., 2014a). The apparent lack of these species' in the present study is cause alone for concern.

Multiple studies from the Indo-Pacific region suggest that many recognised and important reef dwellers, for example, Lethrinids and Siganids, utilise multiple habitat types, yet these families were also sparse in the seagrass meadows sampled in the present study. One *Siganus canaliculatus* individual was observed at Lampi East, one *Lethrinus variagatus* individual was observed at Taw Wet North and one *Lethrinus harak* individual was observed at Bo Cho. While some seagrass dependant (known to spend their whole life in seagrass) species such as *Gerres oyena* were present (Berkstrom et al., 2013; Dorenbosch et al., 2005; Unsworth et al., 2008), their low abundance appears uncharacteristic of the Indo-Pacific region. Multiple habitats use by marine fauna is primarily related to foraging migrations (as adults) or ontogenetic dietary shifts (as juveniles) (Nagelkerken, 2009). Reliance on multiple habitats underlines the importance of all habitat types and connectivity for maintaining fish assemblages. It could, therefore, be the case that other connected supporting habitats within the study region are in poor health. Dynamite fishing is ripe within the Myeik archipelago, and formal enforcement measures to reduce/prevent this activity have only come into force in recent years within the Lampi Marine National Park (MNP) (MOECAF and Oikos, 2015). However, despite new 'written' protection measures, which is a progressive step, dynamite continues to be used. However, coral reef habitats within the archipelago are of average-good condition based on the scale used by Habibi et al. (2007); (Howard et al., 2014; Obura et al., 2014). Mangrove communities, although minor regarding extension (notably within Lampi MNP), are also in good condition with recognised high ecological value (Oikos and BANCA, 2011). This suggests that the fishery resource is simple highly overexploited.

Seagrass meadows are well known to fishers in Myanmar as an important fishing and invertebrate gleaning (e.g. sea cucumbers) area (Schneider et al., 2014). Local people often refer to seagrass as *Leik-Sar-Phat-Myet*, (directly translated as…..) recognising it as the food of marine turtles (Soe-Htun et al., 2015; Soe-Htun et al., 2001). So although seagrasses and associated habitats within the Myeik Archipelago are remote from large human populations, they are facing the common problems associated with extensive overfishing (even within an artisanal small-scale fishery) and perhaps overgrazing seen across the Indo-Pacific region in previous decades (McManus, 1997). Barrier Net fishing, with nets that close off entire bays (Plate 1) are common, and trawlers operate close to shore targeting shrimps and other fish species (Soe-Htun et al., 2015). Anecdotal field observations confirm these fishing practices (table. 4) and confirm the removal of top predators, including sharks. The lack of top predatory fish is a distressing finding highlighted by the present study and previous studies in connected habitats (Howard et al., 2014; Russell, 2016). While we appreciate all samples from the present study were collected during the day, and lower abundances of predatory fish can be expected due to diel differences in feeding activity (Unsworth et al., 2007), there were no fish from predatory fish families such as Carangidae, Serranidae or Lutjanidae recorded. Methods were the same as those conducted in other seagrass meadows from the region where much higher abundances were recorded (Esteban et al., 2017; Unsworth et al., 2015). Even in extremely low abundance, these predatory fish are much more receptive when using daytime baited cameras. The lack of predatory species is symptomatic of a highly exploited fishery (see Plate 1.).

Herbivorous fish species are well recognised for their key functional role in supporting the resilience of tropical marine systems by consuming excess algal or epiphytic growth. Essentially herbivorous fish species prevent tropical marine systems from flipping into a state of algal dominance (Maxwell et al., 2017). In the present study, seagrass was generally healthy across all four sites, with low algal and epiphyte cover suggesting that there may be more herbivores present than the study observed. However, other environmental conditions for seagrass growth were favourable (good water clarity, limited physical disturbance) which may negate the immediate need for herbivores in this context and herbivores have also been confirmed lacking in adjacent habitats (Howard et al., 2014; Obura et al., 2014). The lack of herbivores remains a concern as it places the long-term resilience of seagrass within this archipelago in doubt (Burkholder et al., 2013).

The present study provides an abundance and diversity baseline for seagrass meadows within the Myeik Archipelago; it also offers some optimism for the future. Sites with the highest fish abundance and diversity (Lampi East and Bo Cho) are within Myanmar's only Marine National Park (MOECAF and Oikos, 2015). It is possible that the recent development of a five-year management plan and on the ground support to ranger patrols by the international NGO Istituto Oikos is having a positive impact on the marine environment.

In conclusion, this study provides evidence of the extreme over-exploitation of seagrass meadows, and associated habitats within the Myeik Archipelago. Overexploitation is likely a result of the several thousand fishing boats that operate within the region with limited regulation coupled with the historical and frequent use of dynamite fishing (Howard et al., 2014; Obura et al., 2014; Russell, 2015, 2016; Soe-Htun et al., 2015). While seagrass meadows currently appear healthy their future is questionable given that poor land-use management is resulting in an increase in land clearing for increased agriculture. The altered marine food web (lacking top predators) is likely damaging to the long-term resilience of Myanmar's seagrass ecosystems. Many of the fish species that would have been expected to be seen and are known to be important for food and coastal livelihoods throughout the region, particularly the Emperors, Rabbitfish and the Snappers (Unsworth and Cullen 2010), were absent. Although overexploited, the fish assemblages of coral areas will continue to provide some form of food supply to local people. However, the lack of fish within seagrass meadows here (thus a lack of juvenile recruitment), and the lack of predatory fish species means this food supply is in doubt for future. Current steps are, however, underway to include more seagrass sites within an MPA network planned for the archipelago with Taw Wet included in one of three large protected area sites currently being nominated for MPA status (Dearden, 2016). Overall, the evidence presented here suggests fisheries management is urgently and drastically required to bring sustainability to supporting seagrass stocks.

Acknowledgements

The present study was conducted with funding support from the Sustainable Places Research Institute and logistical support from Fauna & Flora International (Myanmar). The authors would like to thank Salai Mon Nyi Nyi Lin and Antt Maung for their logistical assistance in the field.

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Table 1. Description of the four seagrass sites within the Myeik Archipelago, their designation, proximity to population and adjacent habitats.

Site	**Designation**	**Population**	**Proximity of nearest population**	**Adjacent habitat**	
				mangrove	*coral reef*
Taw Wet North (Taw Wet I.)	None	Uninhabited	~ 8.50 km	✓	*
Lampi East (Lampi I.)	Marine National Park	Inhabited	~ 3.25 km	×	*
Bo Cho I.	Marine National Park	Inhabited	~ 0.05 km	×	*
Nyaung Wee I.	None	Inhabited	~ 1 km	✓	✓

* While coral reef was present on-site observations confirmed that this was degraded and characteristic of previous bomb fishing.

Table 2. Seagrass cover and species composition at four sites within the Myeik Archipelago where *Cr* = *Cymodocea rotundata*, *CS* = *C. serrulata*, *Ho* = *Halophila ovalis*, *Hu* = *Halodule uninervis* and *Th* = *Thalassia hemrichii*.

Location	% Cover	*Cr*	*Cs*	*Ho*	*Hu*	*Th*
Taw Wet	32.1 ± 25.5	95.4 ± 11.6	3.3 ± 11.4	1.2 ±2.7	0.00	0.00
Lampi East	42.6 ± 28.7	93.5 ± 14.3	0.3 ± 1.8	6.0 ± 13.7	0.9 ± 3.4	0.5 ± 2.0
Bo Cho	28.4 ± 21.1	85.1 ± 18.8	17.5 ± 15.1	0.0	0.0	0.0
Nyaung Wee	48.9 ± 27.5	93.8 ± 13.9	0.0	1.4 ± 6.5	4.8 ± 12.9	0.0

Table 3. Presence of individual species of fish recorded in samples using mono Baited Remote Underwater Video systems from four sites across the Myeik Archipelago, as a percentage of the total number of samples from each site.

Family	**Species**	**Common Name**	**Taw Wet North**	**Lampi East**	**Bo Cho**	**Nyaung Wee**
Gerreidae	*Gerres oyena*	Common silver bidy	-	25	8	25
Gobiidae		Goby	-	25	8	8
Labridae	*Halichoeres bicolor*	Pearly-spotted wrasse	-	17	25	-
Labridae	*Novaculoides macrolepidotus*	Seagrass wrasse	-	8	-	-
Lethrinidae	*Lethrinus harak*	Thumbprint emperor	-	-	25	-
Lethrinidae	*Lethrinus variegatus*	Slender emperor	13	-	-	-
Lutjanidae			-	8	-	-
Mugilidae	*Chelon spp.*	Mullet	-	8	-	-
Mullidae	*Parupeneus barberinus*	Dash-and-dot goatfish	-	8	8	-
Pomacentridae	*Pomacentrus spp.*	Dameslfishes	-	8	-	-
Siganidae	*Siganus canaliculatus*	White-spotted spinefoot	-	8	-	-
Sillaginidae	*Shillago siamma*	Northern whiting	7	8	17	-
Tetraodontidae	*Arothron hispidus*	White-spotted puffer	-	-	8	-

Table 4. One observational landing survey from Nyaung Wee, from Thai crab fishermen operating a trawler on soft sedimentary coastal areas within the Myeik Archipelago.

Catch	Weight (kg)	Species observed
Invertebrates	24	Mud crab
Fish	60	20+ Blue spotted stingray (*Neotrygon kuhlii*) 5 + White spotted puffer (*Arothron hispidus*) 2 small sharks, (*Carharhinus spp.).* 30+ Spotted scat (*Scatophagus argus*)

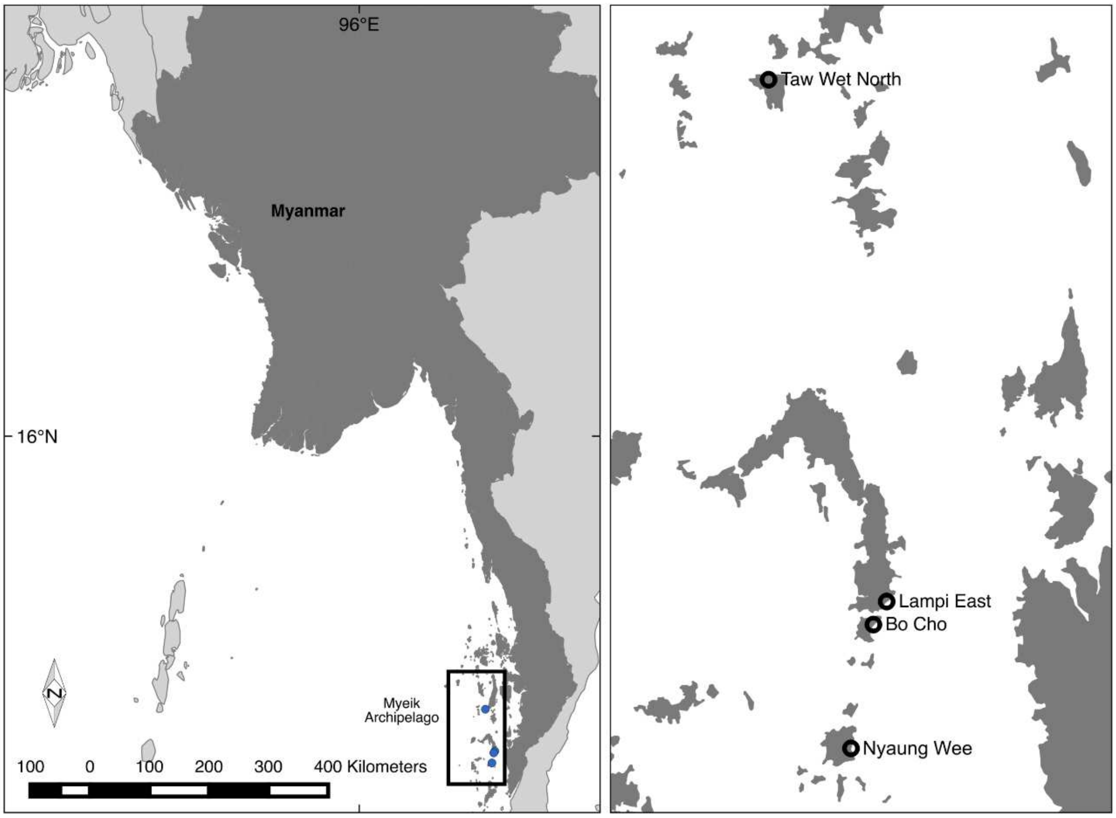

Figure 1. The location of the Myeik Archipelago on the southern coast of Myanmar. Inset: biodiversity and seagrass survey locations in the Myeik Archipelago during April and May 2016.

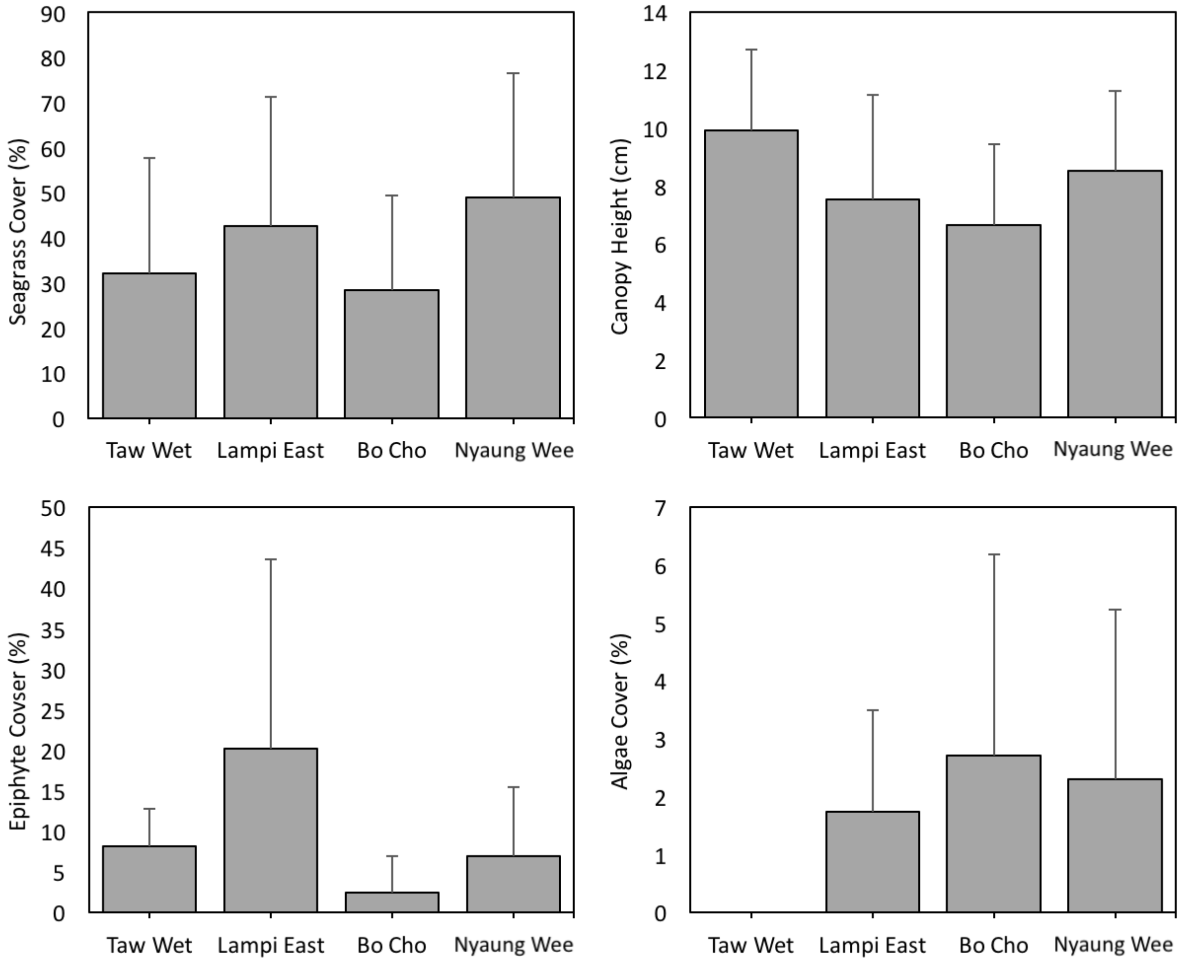

Figure 2. Mean (± SD) seagrass cover, canopy height, epiphyte cover and algae cover for four seagrass meadows across the Myeik Archipelago, Myanmar during April and May 2016.

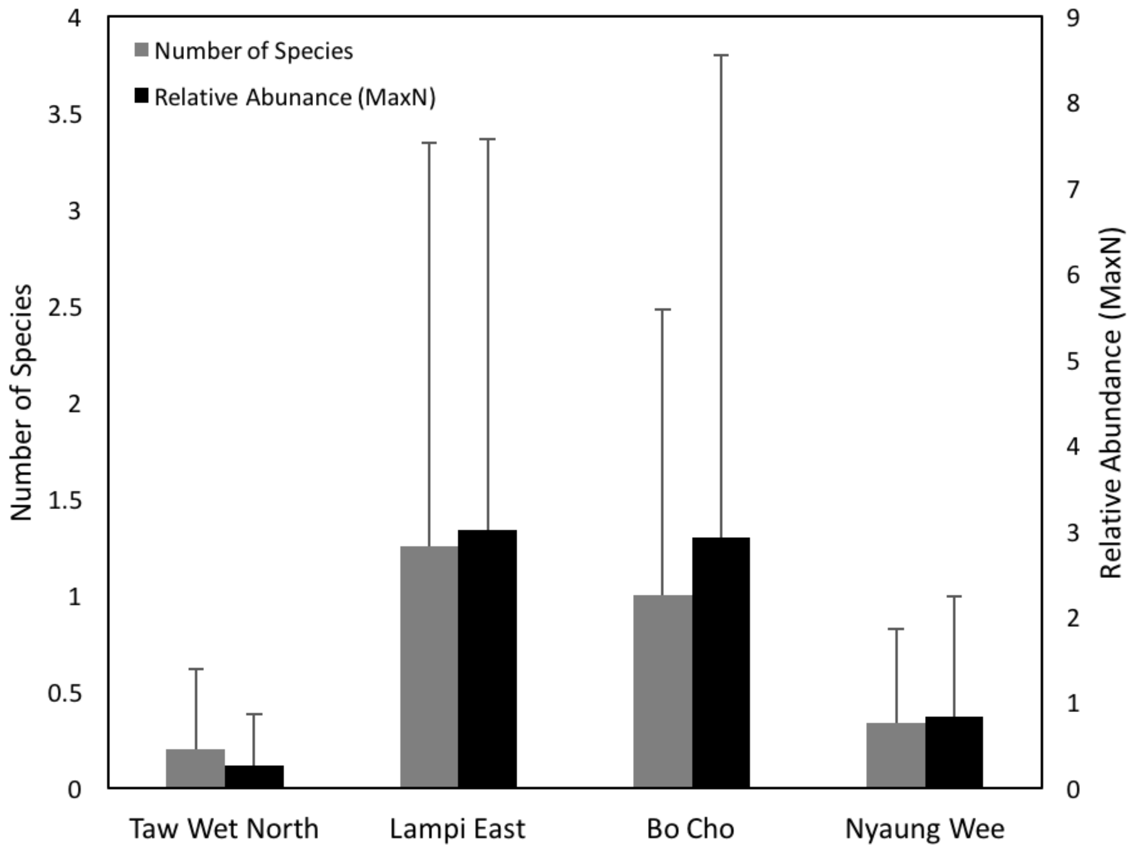

Figure 3. Mean (± SD) abundance and number of species of motile fauna recorded within four seagrass meadows across the Myeik Archipelago, Myanmar during April and May 2016 using mono Baited Remote Underwater Video systems.

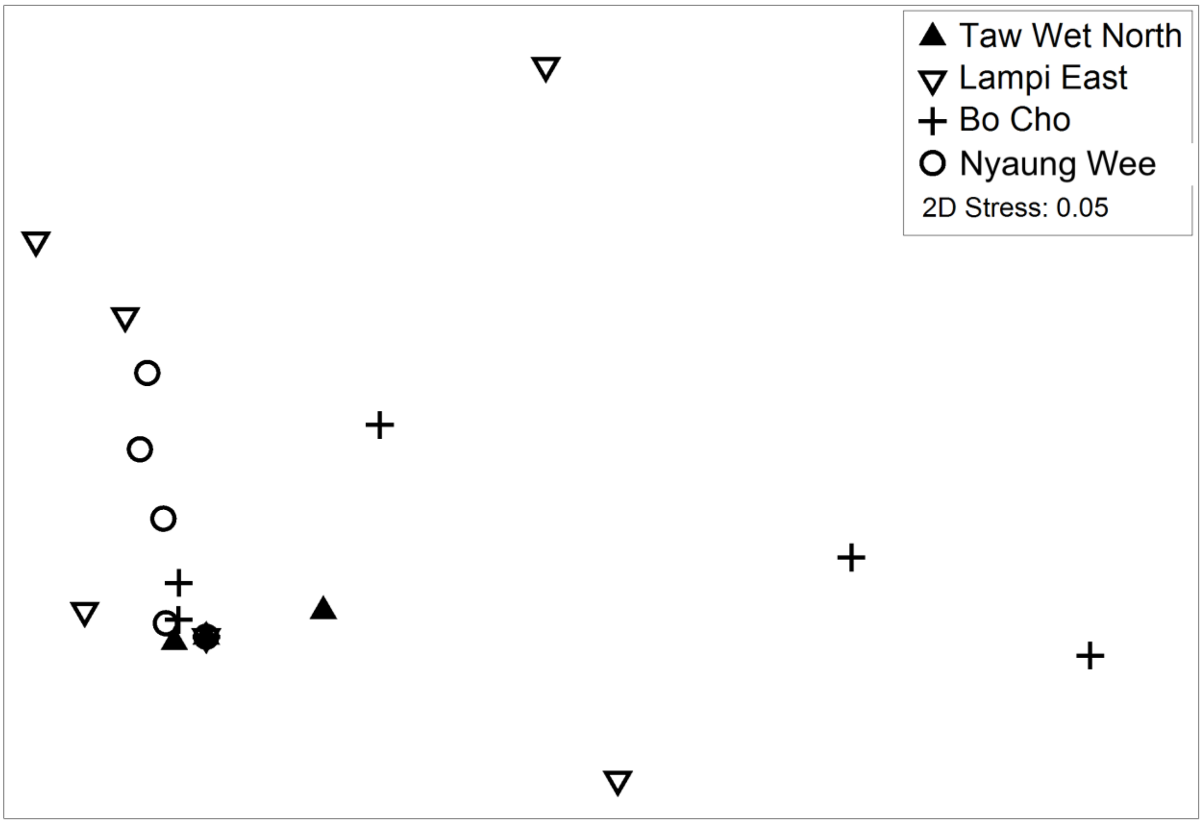

Figure 4. Two-dimensional non-metric MDS scaling configuration for comparisons between motile faunal assemblages recorded within seagrass meadows at four locations during April and May 2016 the Myeik Archipelago, Myanmar using mono Baited Remote Underwater Video systems.

Plate 1. Fishers at Taw Wet North utilising a barrier net that stretches across the entire bay (638 m), to collect fish as the tide retreats. Picture provided by Ko Htwe.