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Abstract

Fatty acid biomarkers and dual stable isotopes ($\delta^{13}C$ and $\delta^{15}N$) were used to identify the preferred food sources of consumers in a mangrove tidal creek and nearby unforested (mud bank) and forested areas located in the Can Gio Mangrove Biosphere Reserve (Southern Vietnam). We analysed 15 macro-invertebrates and 1 fish species representing primary consumers and their immediate predators in this area. Specific groups of fatty acids were used to trace the fate of various food sources (i.e., suspended particulate organic matter, mangrove litter and sedimentary organic matter). The $\delta^{13}C$ and $\delta^{15}N$ of consumers ranged from -26.9 to -18.8‰ and from 1.1 to 9.9‰, respectively. The trophic pathway based on mangrove litter, characteristic of mangrove ecosystems, is nutritionally sustaining various crab and snail species. In contrast, it appears that the most mobile species (fish and shrimps), living in the water column and possibly migrating with tides, are mostly feeding on suspended particulate organic matter, suggesting that this trophic pathway is of great importance for connectivity among tropical coastal ecosystems. Our study suggests that snails and crabs mainly act as mineralisers, processing high quantities of detrital material to meet their nutritional needs and thus releasing nutrients through the production of faeces, that are further mineralised by microorganisms, while locally grown phytoplankton reintegrates these compounds into its biomass and feeds migrating species. We highlight here a possible link between mangrove litter and coastal food webs.

Keywords: mangrove, food webs, stable isotopes, fatty acids, Vietnam

1. Introduction

Numerous studies have examined food webs in mangrove forests (Rodelli et al., 1984; Abrantes and Sheaves, 2009; Nordhaus et al., 2011; Tue et al., 2012), but the way benthic fauna contributes to organic matter (OM) cycling in mangrove ecosystems still remains poorly understood (Sousa and Dangremond, 2011). The ability of mangrove soils to store OM and control the balance between forest production and exports is a key issue in most mangrove carbon budget studies (Bouillon et al., 2008; Alongi, 2014). The role of faunal communities is crucial for the processing within and/or the export of OM from mangrove forests. Early studies by Odum and Heald (1975) lead to a schematic representation of mangrove food webs emphasizing the basal role of leaf litter. The flow of energy was assumed to pass from leaf litter to predators through bacterial and fungal conditioning and detritus consumers. This model was later expanded to include phytoplankton, benthic microalgae, root epiphytes and seagrasses (Odum et al., 1982).

Robertson and Blaber (1992) hypothesised that phytoplankton production plays an important role in supporting various trophic levels in estuarine mangrove ecosystems. Stable isotope studies confirmed this hypothesis and showed that organisms, including shrimps (Dittel et al., 1997; Willems et al., 2016), gastropods (Bouillon et al., 2002) and fiddler crabs (France, 1998; Vermeiren et al., 2015) derive their carbon and nitrogen from phytoplankton and/or benthic microalgae (BMA) to a much greater extent than from mangrove detritus. Meanwhile, lipid biomarkers (i.e. fatty acids; FA), were used to trace phytoplankton in estuarine food chains through the abundance of the highly unsaturated FA (HUFA $\geq$ 20 carbons and 2 double bounds) 20:5ω3 and 22:6ω3 (Alfaro et al., 2006) and mangrove litter contribution using the C_{18} polyunsaturated FA (C_{18} PUFA) 18:2ω6 and 18:3ω3 (Hall et al., 2006). In addition, the importance of bacteria in the diet of shrimp post-larvae, gastropods and

fiddler crabs was identified from the relative proportion of odd-branched FA (iso and anteiso, BrFA) in consumer tissues (Meziane and Tsuchiya, 2000; Gatune et al., 2014).

Both stable isotope and FA biomarker tools are based on the assumption that the composition of organism tissues reflects the food they assimilate, but each has its own limitations. Basically, a predator stores nutrients and FA with as little modification as possible, and thus both its stable isotopes and its FA composition are relatively similar to that of its food sources. Tracing consumer diets using stable isotope analysis requires non-overlapping signatures of available food sources (Bouillon et al., 2008) and a good knowledge of the trophic enrichment factor, which may be highly variable among both organisms and food sources (Vanderklift and Ponsard, 2003; Bui and Lee, 2014; Schwamborn and Giarrizzo, 2015). It also requires an exhaustive sampling of potential food sources such as BMA (Lee et al., 2001), root epiphytes (Bouillon et al., 2004; Alfaro 2008) or leaf-shredder faeces (Camilleri, 1992; Werry and Lee, 2005). Fatty acids are rarely produced by only one group of organisms, and the relative proportions of FA biomarkers to total FA rather than absolute abundances of single FA must be considered. Fatty acid composition of consumers depends on the metabolic processing of absorbed FA, including deposition in adipose tissue without modification, specific transformations between absorption and deposition and *de novo* synthesis by the consumer, which may vary among taxonomic groups (Budge et al., 2006) and make interpretations more difficult. The combination of stable isotope signatures and FA biomarkers is a promising tool to refine our understanding of trophic web relationships in mangrove ecosystems (Bouillon et al., 2008; Vermeiren et al., 2015), as previously done in temperate seagrass beds (Kharlamenko et al., 2001; Alfaro et al., 2006; Dubois et al., 2014) and other marine habitats (Kelly and Scheibling, 2012)

This study aims to identify the role of 16 abundant animal species on OM cycling in a mangrove tidal creek and nearby unforested (mud bank) and forested areas located in the Can

Gio Mangrove Biosphere Reserve (Southern Vietnam). We hypothesised that phytoplankton inputs are important for the basal food chain in this tropical mangrove ecosystem, thus reinforcing the abovementioned hypothesis of Robertson and Blaber (1992). Our study combines FA biomarkers and stable isotopes ($\delta^{13}C$ and $\delta^{15}N$) to understand basal resources utilisation in this tropical mangrove.

2. Materials and methods

2.1. Study site

The study was conducted during the monsoon season in 2015 (19-20 October) in a 1.4 km long mangrove tidal creek (10°30'24"N 106°52'57E; Fig. 1). The mangrove creek is located in the core zone of the Can Gio Mangrove Biosphere Reserve (UNESCO/MAB Project, 2000) and receives no freshwater input from the catchment. The mangrove ecosystem is formed by the deltaic confluence of the Saigon, Dong Nai and Vam Co Rivers, which drain into the South China Sea and covers 720 km^2 (Nam et al., 2014). The forest is largely dominated by the species *Rhizophora apiculata*, massively replanted after the Vietnam War (1955-1975). The creek under study was bordered by a 30 m wide fringe hosting species such as *Avicennia alba* and *Sonneratia alba*. Water salinity ranged from 16 to 23 and tidal amplitude was 2.1 m, with maximum and minimum water levels of 2.8 m and 0.7 m, respectively.

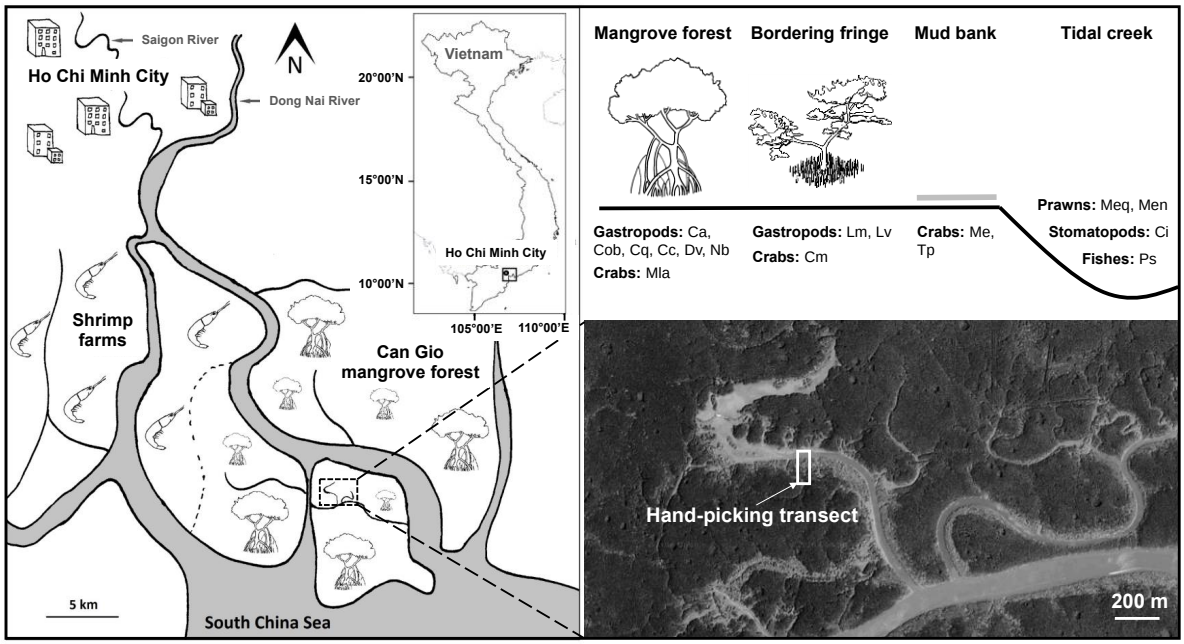

Fig. 1: Sampling site in the tidal creek of the Can Gio Mangrove Biosphere Reserve (Southern Vietnam). Habitats and animal samples are placed on the transect scheme. Acronyms are similar to those of Tue et al. (2012) who studied a similar system in Northern Vietnam. Ca = *Cassidula aurisfelis*; Cc = *Chicoreus capucinus*; Cm = *Clistocoeloma merguiense*; Ci =*Cloridopsis immaculata*; Cob =*Cerithidea obtusa*; Cq = *Cerithidea quoyii*;Dv = *Neripteron (Dostia) violaceum*; Lm = *Littoraria melanostoma*; Lv = *Littoraria vespacea*; Me = *Metaplax elegans*; Men =*Metapenaeus ensis*; Meq = *Macrobrachium equidens*; Mla = *Metopograpsus latifrons*; Nb = *Nerita balteata*; Tp = *Tubuca (Uca) paradussumieri*; Ps = *Planiliza sp. B*

2.2 Sample collection

Tree leaves, fauna and sediment were collected in four replicates at low tide along a transect perpendicular to the tidal creek (Fig. 1). Freshly fallen tree leaves were hand-picked together with crabs and gastropods, while fish, prawns and stomatopods were collected within the mangrove creek by local fishermen. All gastropods were collected on mangrove trees

while crabs were caught on tree trunks or on the sediment, according to the species. We collected 16 species among the most abundant animals along the mangrove transect and that are widely distributed in South East Asian mangroves (Rodelli et al., 1984; Tan, 2008; Nordhaus et al., 2011; Tue et al., 2012; Diele et al., 2013). We considered that they were representative of the primary consumers and their immediate predators in the mangroves of this region. Sediment cores (1 cm depth × 2 cm Ø) were randomly sampled in the three zones: *Rhizophora*, *Avicennia* and mudflat. Benthic microalgae could not be isolated from sediments and were not analysed. We monitored suspended particulate organic matter (SPOM) during a 26 h asymmetric neap tidal cycle. Surface water was taken every two hours (14 samplings) and immediately vacuum-filtered through pre-combusted and pre-weighted glass fibre filters (Whatman® GF/F 0.7 μm) until clogging (requiring 250 mL to 1.2 L of water). We discussed changes in SPOM quality during the tidal cycle in a previous study (David et al. 2018). All samples were kept on ice during sampling and stored at -25°C until analysed (less than 6 months after sampling).

2.3 Sample processing and analysis

Total length was measured for gastropods, prawns, stomatopod and fish, and carapace width was taken for crabs. Organisms were then identified by taxonomists from the Muséum National d'Histoire Naturelle (MNHN, Paris, France) and from other institutions (see acknowledgments). The collected material were freeze-dried and powdered for FA and stable isotopes analyses. Individual samples consisted of one sediment core, one SPOM filter, one tree leave or one animal. For crab species, we analysed muscles from the claw, for shrimp species we used muscles from the abdomen and for the fish we took white muscles from the flank. Tissues of gastropods could not be isolated. The entire organism was removed from its shell, tissues were homogenised and the pooled material was used. Four samples were

analysed for each species and food source, except for the less frequent species *Cassidula aurisfelis* and *Cloridopsis immaculata* for which only 2 and 3 individuals could be sampled, respectively.

We extracted lipids following a slightly modified protocol of Bligh and Dyer (1959), as described in Meziane and Tsuchiya (2000) and using 100 mg of dry material for tree leaves, 30 mg for animal tissue (except for the small species *Littoraria vespacea* and *Metaplax elegans* for which 5 mg was used), 1 g of sediments and 20-70 mg of suspended matter for SPOM. Tricosanoic acid (23:0) was used as an internal standard to measure the absolute FA concentration. We quantified fatty acid methyl esters (FAME) by gas chromatography (Varian 3800-GC), using a flame ionisation detector. Identification of FA was performed using coupled gas chromatography mass spectrometry (Varian 450-GC; Varian 220-MS), and comparison of GC retention times with commercial standards (Supelco® 37 component FAME mix and marine source polyunsaturated FAME n°1 mix). We report values as % of total FA or absolute concentrations (μg g^{-1} or mg g^{-1}).

We performed isotopic analyses on the same samples that were powdered for lipid extractions, except for SPOM analyses for which a whole filter was used. Tree leaves and fauna samples were prepared without pre-treatment, while sediment and SPOM samples were fumigated for 16h at room temperature using 37% HCl to remove carbonates. All samples were prepared in tin capsules. Stable isotopes were analysed at the University of California Davis Stable Isotope Facility (Department of Plant Sciences, UC Davis, Davis, California) using a Vario EL Cube elemental analyser interfaced to a PDZ Europa 20–20 isotope ratio mass spectrometer. Carbon and nitrogen stable isotope ratios were reported in delta notation for δ^{13}Cand δ^{15}N relative to Vienna PeeDee Belemnite and atmospheric air, respectively.

2.4 Data analysis

The isotopic signatures of potential food sources overlapped each other, and thus we could not appropriately estimate sources contribution to the animals' diet using Bayesian mixing models such as SIAR or MixSIR. Stable isotope results were interpreted individually for each species, taking into account available literature on species and their suggested food sources. The trophic level of animals was determined according to their $\delta^{15}N$ signature, assuming an *a priori* $\Delta\delta^{15}N \sim 2.8‰$ between trophic level (Vanderklift and Ponsard, 2003). This trophic shift was however adapted using conclusions from FA analysis and previous knowledge on the feeding ecology of studied organisms, given that the trophic discrimination factor may vary widely in tropical mangrove ecosystems depending on species and food sources (Schwamborn and Giarrizzo, 2015).

We visualised the underlying structure of both food sources and consumer FA profiles using non-standardised principal component analysis (PCA) on relative contribution data matrices. The number of replicates per species-samples (n = 4) was enough to highlight meaningful significant differences among species taking into account natural intraspecific variability in both food sources and consumers. An initial data square root transformation was performed to alleviate variance heteroscedasticity (Legendre and Gallagher, 2001). Principal components were calculated using the whole FA profiles, and relevant indicators were posteriorly positioned as supplementary rows. All statistical analyses and graphical representations were performed using R 3.3.2 (R Core Team, 2017).

3. Results

3.1 Stable isotope compositions

The $\delta^{13}C$ of potential food sources ranged from -33.9 to -26.1‰ (Fig. 2). Mangrove leaves of the species *Rhizophora apiculata* exhibited the lowest average $\delta^{13}C$ (-31.1 ± 2.0‰)

and bordering fringe sediment exhibited the highest average $\delta^{13}C$ (-26.7 ± 0.1‰), while other food sources were intermediate (Table 1). We may thus expect animal species feeding on sediment to have higher $\delta^{13}C$ values than those feeding on mangrove leaves. The average consumers' $\delta^{13}C$ ranged from -26.9 to -18.8‰ (Table 1 and Fig. 2). Lowest $\delta^{13}C$ values were found in the pulmonate snail *Cassidula aurisfelis* (-26.9 ± 0.1‰) and highest values were measured in the ocypodid crab *Tubuca paradussumieri* (-18.8 ± 1.4‰).

The $\delta^{15}N$ of potential food sources ranged between 1.4 and 5.0‰ and the three groups of food sources (i.e. SPOM, mangrove leaves and bulk sediments) greatly overlapped one another (Table 1 and Fig. 2). The average consumers' $\delta^{15}N$ ranged from 1.1 to 9.9‰ (Table 1 and Fig. 2). Lowest $\delta^{15}N$ were measured in the potamid snail *Cerithidea quoyii* (1.1 ± 0.7‰) and highest values were found in the stomatopod *Cloridopsis immaculata* (9.9 ± 0.7‰). Among snail species, the mangrove murex snail *Chicoreus capucinus* exhibited the highest $\delta^{15}N$ (7.8 ± 0.6‰). The grapsid crab *Metopograpsus latifrons* exhibited the highest intra-specific $\delta^{15}N$ variability (Fig. 2), with values ranging from 3.4 to 8.1‰.

Table 1: Isotopic values ($\delta^{13}C$ and $\delta^{15}N$ in ‰) of the food web components in the Can Gio mangrove tidal creek and nearby areas

Food webs components	Acronym	Size (mm)	$\delta^{13}C$	$\delta^{15}N$	n
			Mean ± SD	Mean ± SD	
Sources					
Sediments	Sed				
Mud bank	Mub	-	-26.8 ± 0.1	3.8 ± 0.0	4
Bordering fringe	Bof	-	-26.7 ± 0.1	4.0 ± 0.1	4
Mangrove forest	Maf	-	-28.6 ± 0.3	3.4 ± 0.1	4
Mangrove leaves	Mang				
Avicennia alba	Ava	-	-27.6 ± 1.1	3.7 ± 1.2	4
Sonneratia alba	Soa	-	-29.5 ± 0.5	4.5 ± 0.5	4
Rhizophora apiculata	Rha	-	-31.1 ± 2.0	4.8 ± 0.1	4
Suspended Particulate Organic Matter	SPOM	-	-27.1 ± 0.7	4.6 ± 0.9	14
Consumers					
Gastropods					
Cassidula aurisfelis	Ca	20-25	-26.9 ± 0.1	4.8 ± 0.3	2
Cerithidea obtusa	Cob	45-60	-25.9 ± 0.5	6.0 ± 0.5	4
Cerithidea quoyii	Cq	40-55	-25.5 ± 0.4	1.1 ± 0.7	4
Chicoreus capucinus	Cc	25-40	-23.1 ± 0.3	7.8 ± 0.6	4
Littoraria melanostoma	Lm	16-20	-25.2 ± 1.2	1.8 ± 1.1	4
Littoraria vespacea	Lv	7-11	-22.7 ± 1.1	2.8 ± 1.0	4
Neripteron (Dostia) violaceum	Dv	12-18	-23.2 ± 0.1	4.4 ± 1.0	4
Nerita balteata	Nb	15-20	-23.3 ± 0.4	4.0 ± 0.9	4
Crabs					
Clistocoeloma merguiense	Cm	30-35	-26.1 ± 0.1	6.5 ± 0.3	4
Metaplax elegans	Me	13-20	-20.1 ± 0.9	7.8 ± 0.4	4
Metopograpsus latifrons	Mla	25-35	-23.3 ± 0.6	5.3 ± 2.0	4
Tubuca (Uca) paradussumieri	Tp	35-45	-18.8 ± 1.4	8.0 ± 0.3	4
Prawns					
Macrobrachium equidens	Meq	55-65	-25.7 ± 0.8	8.1 ± 0.4	4
Metapenaeus ensis	Men	50-65	-26.7 ± 1.3	7.8 ± 0.6	4
Stomatopods					
Cloridopsis immaculata	Ci	80-100	-23.2 ± 0.5	9.9 ± 0.7	3
Fishes					
Planiliza sp. B	Ps	80-110	-21.6 ± 0.7	9.3 ± 0.4	4

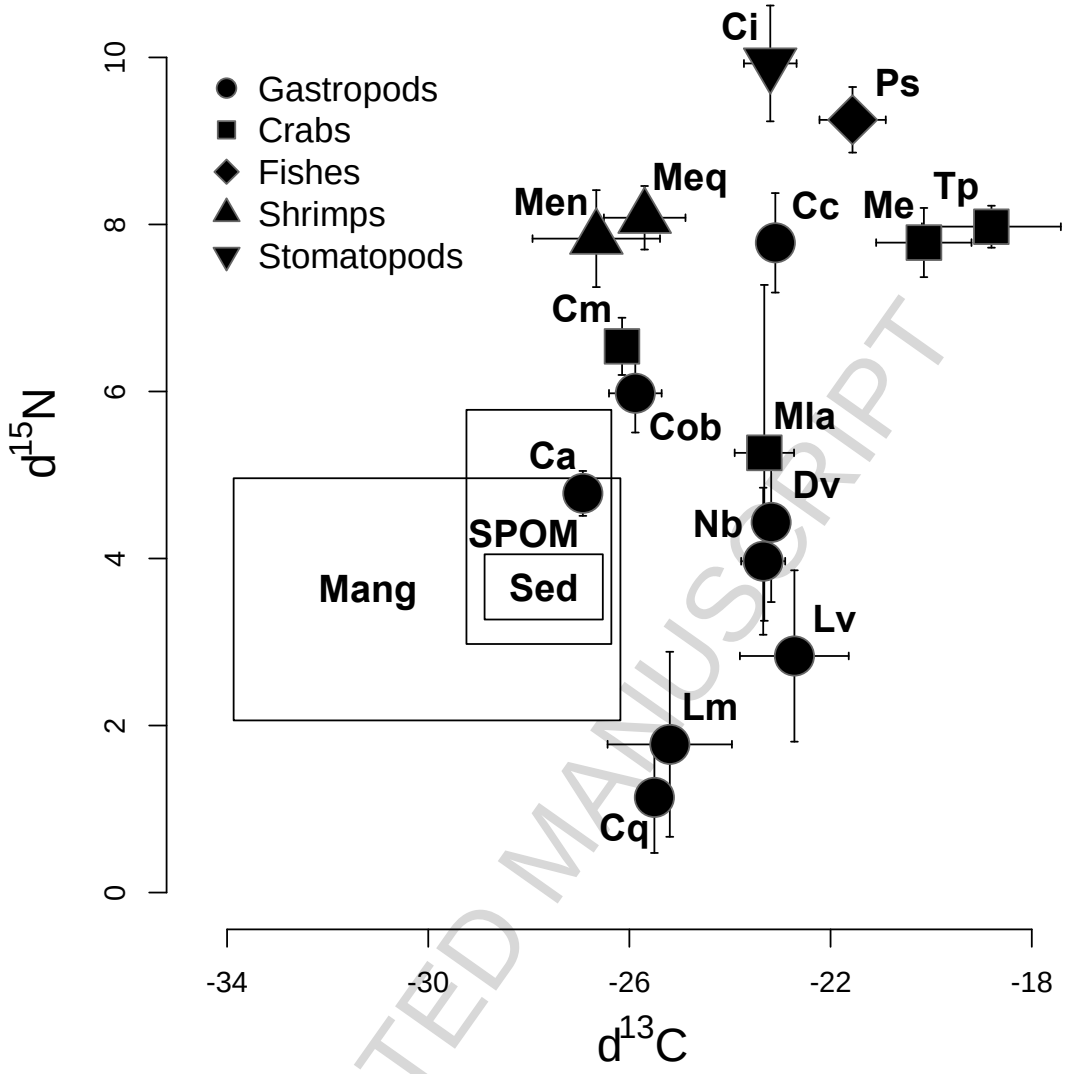

Fig. 2: Isotopic signatures ($\delta^{13}C$ and $\delta^{15}N$) of the food web components in the Can Gio mangrove tidal creek and nearby areas. Boxes correspond to the range of potential food sources. Consumer symbols represent averaged data (± SD). Acronyms are fully displayed in Table 1

3.2 Fatty acid composition of potential food sources

A total of 51 FA were identified in the basal food resources (i.e. SPOM, mangrove leaves and sediments). Absolute concentrations of FA are provided in Appendix 1. Mangrove

leaves contained higher concentrations of total FA than sediments and SPOM, but they did not contain C_{16} polyunsaturated FA and highly unsaturated FA (C_{16} PUFA and HUFA; Table 2). The PCA revealed strong dissimilarities between the three sources sampled, with high C_{18} PUFA values correlated to the 1st axis and high values of branched FA (BrFA) correlated to the 2nd axis (Fig. 3). Dominant FA in mangrove leaves were C_{18} PUFA (Table 2 and Fig. 3). Sediments were characterised by low FA concentrations, but proportions highlighted substantial relative abundance of BrFA (Fig. 3). SPOM was dominated by C_{16} and C_{18} saturated (C_{16} + C_{18} SFA) and monounsaturated FA (C_{16} + C_{18} MUFA), and contained the highest HUFA concentration (Table 2). Concentration of FA substantially changed during the tidal cycle (David et al. 2018) but relative proportions remained relatively similar and well differentiated from other food sources (Fig. 3).

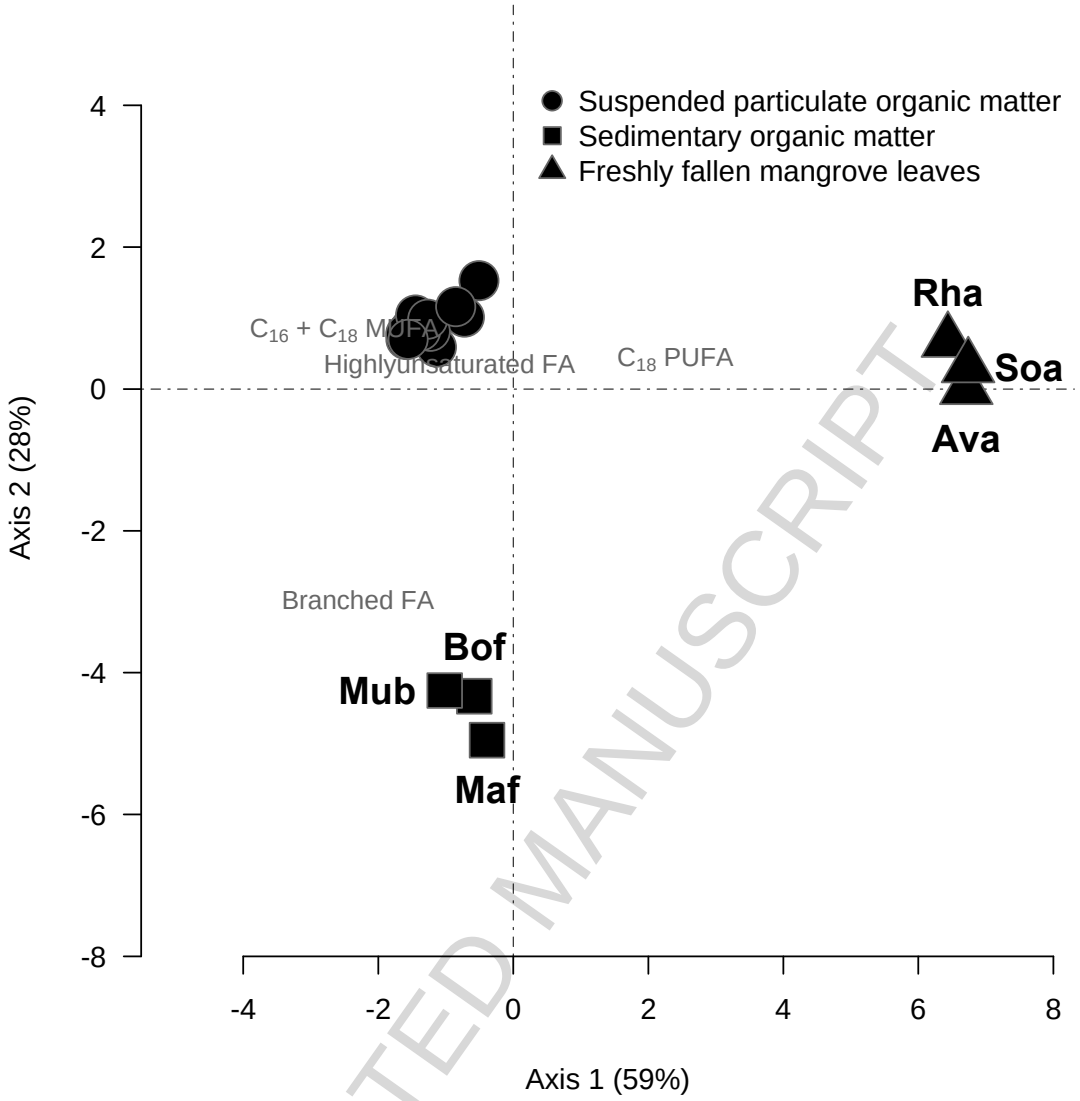

Fig. 3: Mean score of potential food sources on the two first axes of principal component analysis (SD were smaller than symbols size). Texts in grey represent the position of FA biomarkers on the axis. Acronyms are fully displayed in Table 1

Table 2: Fatty acid composition in µg g^{-1} (%) ± SD of potential food sources in the Can Gio mangrove tidal creek and nearby areas

Fatty acids (µg g^{-1} (%) ± SD)	Suspended matter (n = 56)	Sedimentary OM (n = 12)	Mangrove leaves (n = 12)
∑ Branched FA	53.2 (5.7) ± 19.0	44.9 (24.0) ± 17.9	-
∑ 16:0 + 18:0 FA	348.5 (34.8) ± 188.2	45.2 (25.0) ± 11.9	3048.0 (36.0) ± 534.2
∑ 16:1 + 18:1 FA	350.1 (35.2) ± 165.9	33.8 (19.0) ± 7.2	634.7 (7.4) ± 175.0
∑ C_{16} PUFA	22.6 (1.9) ± 34.6	1.2 (0.7) ± 0.2	-
∑ C_{18} PUFA	34.3 (2.7) ± 49.6	3.2 (1.7) ± 1.6	3732.4 (43.7) ± 773.8
∑ HUFA	38.9 (3.3) ± 55.1	3.1 (1.8) ± 0.7	-
∑ Other FA	164.5 (16.4) ± 121.8	52.2 (27.7) ± 21.9	1075.6 (12.8) ± 204.5
∑ FA (µg L^{-1})	63.4 ± 49.2	-	-
∑ FA (µg g^{-1})	1012.1 ± 560.4	183.6 ± 59.3	8489.7 ± 1484.1

PUFA = Polyunsaturated FA
HUFA = Highly unsaturated FA

3.3 Fatty acid composition of consumers

A total of 59 FA were found in the fauna samples of the Can Gio mangrove creek and nearby areas. Relative proportions of FA are provided in Appendices 2 and 3.We detected strong differences between the FA profiles of organisms analysed whole (gastropods) and those analysed only as muscle tissues. Gastropod tissues exhibited FA that are barely detected in other organisms (e.g. 20:1ω9, 22:2ω9, 22:2ω6), while they displayed low proportions of ω3 HUFA (e.g. 20:5ω3, 22:6ω3; see Appendices 2 and 3 for details). The exploration of such differences and whether they are due to the mixing of tissues or to taxonomic specificities goes beyond the objectives of our study and thus, organisms analysed whole (gastropods) were considered separately from others. For both groups, the PCA revealed dissimilarities between species, with opposite trends of C_{18} PUFA and HUFA, correlated with the 1st axis, and similar trends of BrFA and C_{16} + C_{18} MUFA, correlated to the 2nd axis (Fig.4).

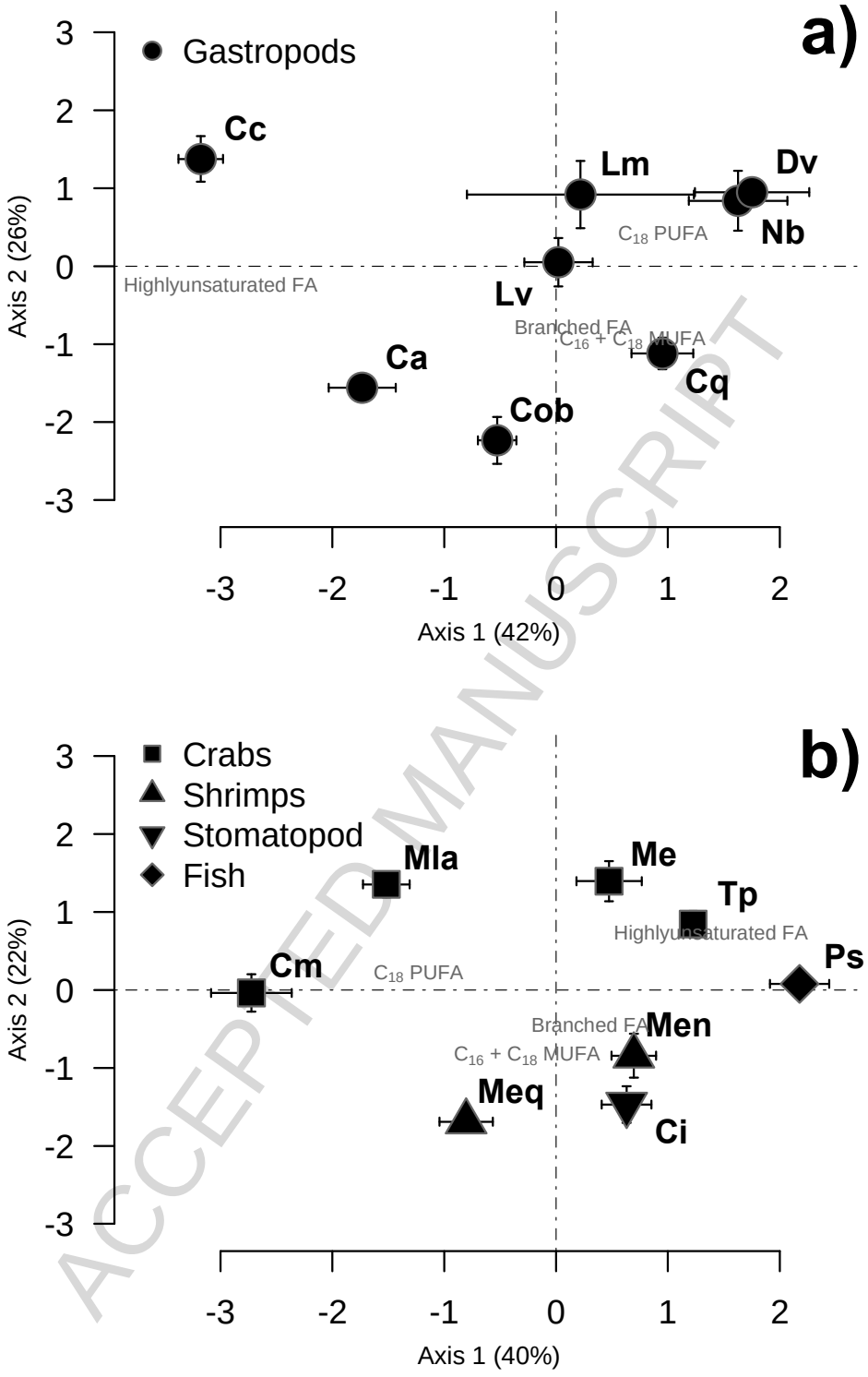

Fig. 4: Mean score of a) gastropod and b) crustacean and fish species on the two first axes of principal component analysis (± SD). Text in grey represents position of FA biomarkers on the axis. Acronyms are fully displayed in Table 1

Gastropod analysis showed high HUFA proportions in *Chicoreus capucinus* tissues compared to other species, while littorinid and neritid snails exhibited high C_{18} PUFA relative abundances. Potamids and the species *Cassidula aurisfelis* exhibited high BrFA and C_{16} + C_{18} MUFA proportions (Table 3 and Fig. 4a). High HUFA proportions were measured in the varunid crab *Metaplax elegans*, the ocypodid crab *Tubuca paradussumieri* and the mullet *Planiliza sp. B*, while the grapsid crab *Metopograpsus latifrons* and the sesarmid crab *Clistocoeloma merguiense* exhibited high C_{18} PUFA proportions (Table 3 and Fig. 4b). Prawns and the stomatopod *Cloridopsis immaculata* showed high relative abundances of branched FA and C_{16} + C_{18} MUFA (Table 3 and Fig. 4b).

Table 3: Fatty acid composition (%) of consumers in the Can Gio mangrove tidal creek and nearby areas

Fatty acids (%)	Cassidula aurisfelis (n = 2)	Cerithidea obtusa (n = 4)	Cerithidea quoyii (n = 4)	Chicoreus capucinus (n = 4)	Littoraria melanostoma (n = 4)	Littoraria vespacea (n = 4)	Neripteron violaceum (n = 4)	Nerita balteata (n = 4)
∑ Branched FA	5.3 ± 1.5	6.1 ± 0.2	4.9 ± 0.4	2.4 ± 1.4	3.1 ± 0.6	2.2 ± 0.4	3.2 ± 0.5	3.4 ± 0.2
∑ 16:0 + 18:0 FA	22.3 ± 0.7	29.0 ± 1.3	31.8 ± 2.8	17.4 ± 1.3	28.5 ± 3.3	27.2 ± 4.5	25.0 ± 1.1	24.5 ± 0.9
∑ 16:1 + 18:1 FA	14.7 ± 0.2	18.0 ± 2.2	16.9 ± 1.5	6.2 ± 1.9	12.0 ± 3.0	10.4 ± 1.2	14.8 ± 0.8	15.8 ± 2.6
∑ 20:1 + 22:1 FA	6.3 ± 0.3	5.0 ± 0.3	5.5 ± 0.8	10.9 ± 0.6	6.1 ± 0.2	6.1 ± 1.2	7.1 ± 0.4	6.6 ± 1.0
∑ C16 PUFA	0.3 ± 0.1	0.4 ± 0.1	1.3 ± 0.3	0.3 ± 0.0	1.1 ± 0.4	1.5 ± 0.6	2.8 ± 0.8	2.5 ± 0.4
∑ C18 PUFA	4.9 ± 0.2	4.7 ± 0.4	10.0 ± 1.4	4.7 ± 0.5	10.8 ± 1.7	14.9 ± 2.2	19.3 ± 2.5	19.2 ± 2.5
∑ HUFA	37.5 ± 3.0	26.6 ± 2.4	20.5 ± 2.2	49.8 ± 1.9	27.5 ± 0.5	29.4 ± 8.4	18.6 ± 2.4	21.1 ± 3.2
∑ Other FA	8.9 ± 1.1	10.1 ± 0.7	9.1 ± 0.8	8.2 ± 1.0	11.0 ± 1.4	8.3 ± 3.0	9.3 ± 0.7	6.9 ± 0.3
∑ FA (mg g^{-1})	25.0 ± 6.1	40.6 ± 3.3	68.6 ± 21.4	14.3 ± 3.5	44.1 ± 7.8	48.1 ± 32.7	54.3 ± 17.7	72.5 ± 27.5

Fatty acids (%)	Clistocoeloma merguiense (n = 4)	Metaplax elegans (n = 4)	Metopograpsus latifrons (n = 4)	Tubuca paradussumieri (n = 4)	Macrobrachium equidens (n = 4)	Metapenaeus ensis (n = 4)	Cloridopsis immaculata (n = 3)	Planiliza sp. B (n = 4)
∑ Branched FA	0.7 ± 0.2	1.3 ± 0.3	0.7 ± 0.1	1.1 ± 0.4	1.5 ± 0.2	3.6 ± 0.7	1.9 ± 0.3	0.9 ± 0.1
∑ 16:0 + 18:0 FA	25.9 ± 1.3	29.2 ± 1.2	25.6 ± 0.7	27.5 ± 1.0	32.1 ± 1.3	27.3 ± 0.7	34.4 ± 0.6	36.4 ± 0.2
∑ 16:1 + 18:1 FA	21.2 ± 1.1	14.0 ± 1.0	13.9 ± 1.6	17.1 ± 2.1	28.7 ± 2.3	16.0 ± 1.8	20.5 ± 0.9	11.7 ± 0.4
∑ 20:1 + 22:1 FA	0.4 ± 0.2	1.7 ± 0.3	0.5 ± 0.1	1.5 ± 0.1	0.5 ± 0.0	1.6 ± 0.2	1.4 ± 0.5	1.0 ± 0.1
∑ C16 PUFA	0.0 ± 0.0	1.4 ± 1.0	0.2 ± 0.1	0.9 ± 0.1	0.1 ± 0.0	0.2 ± 0.0	1.0 ± 0.4	1.0 ± 0.5
∑ C18 PUFA	22.6 ± 2.8	6.7 ± 1.7	16.9 ± 2.6	4.5 ± 0.3	8.2 ± 1.8	4.7 ± 0.7	5.7 ± 0.7	1.7 ± 0.1
∑ HUFA	23.3 ± 1.7	39.3 ± 4.2	38.1 ± 2.7	36.1 ± 2.0	21.6 ± 0.6	36.9 ± 1.9	22.8 ± 1.9	41.8 ± 1.5
∑ Other FA	5.8 ± 0.6	6.5 ± 1.3	4.1 ± 0.3	11.2 ± 1.8	7.3 ± 0.4	9.8 ± 0.6	12.3 ± 0.6	5.6 ± 1.0
∑ FA (mg g^{-1})	19.8 ± 3.7	26.6 ± 21.4	18.2 ± 3.6	17.0 ± 2.8	49.1 ± 5.4	29.7 ± 3.0	73.0 ± 10.7	29.7 ± 1.5

PUFA = Polyunsaturated FA; HUFA = Highly unsaturated FA

4. Discussion

4.1 Isotopic and fatty acid composition of potential food sources

The core zone of Can Gio Mangrove Biosphere Reserve is a relatively preserved mangrove ecosystem that hosts a high diversity of species and habitats (Tuan and Kuenzer, 2012). There is no abundant presence of macroalgae or seagrasses in any area of the mangrove, contrary to other areas in the Indo-Pacific, where such food sources were shown to play a crucial role in food web interactions (Meziane and Tsuchiya, 2000; Alfaro et al., 2006; Abrantes and Sheaves, 2009). In the tidal creek studied, the basal food sources are assumed to derive mostly from decomposing mangrove leaves, but we hypothesised that estuarine phytoplankton and BMA are also important basal resources.

The $\delta^{13}C$ of SPOM was depleted compared to the results of Tue et al. (2012), who studied a mangrove ecosystem in the Red River Delta in Northern Vietnam (-27.1 ± 0.7 ‰ in our study vs. -23.9 ± 0.8 ‰ in that of Tue et al., 2012), while sediments and mangrove leaves exhibited relative similar values than in the Tue et al.'s (2012) study and others in the Indo-Pacific (Rodelli et al. 1984, Abrantes and Sheaves 2009, Alfaro et al. 2006). In a previous study, we concluded that this high depletion resulted from the utilisation by phytoplankton of mangrove-derived carbon with low $\delta^{13}C$ rather than the large abundance of mangrove detritus fragments (David et al., 2018). The consumer species assemblage of Tue et al. (2012) was relatively similar to the present study and thus, exploring the differences between our $\delta^{13}C$ dataset with theirs offers an opportunity to assess the contribution of SPOM to the diet of organisms which are common to both the Red River Delta and the Can Gio mangrove. We expect animal species consuming SPOM to exhibit substantially lower $\delta^{13}C$ values in our study than in that of Tue et al. (2012).

C_{18} PUFA in mangrove leaves are mostly constituted by the FA 18:2ω6 and 18:3ω3 (Appendix 1). These biomarkers have also been detected in high proportions in seagrasses (Kharlamenko et al., 2001; Alfaro et al., 2006; Dubois et al. 2014) and in brown and green macroalgae (Nelson et al., 2002), but since such food sources were not observed in any area of the Can Gio mangrove, the sum of C_{18} PUFA can be considered as a good biomarker for mangrove leaves in this ecosystem. More widely, C_{18} PUFA are also important components of mangrove propagules and pneumatophores (Wanningama et al., 1981; Xu et al., 1997), which can constitute substantial food sources in mangrove food webs (Sousa and Dangremond, 2011), along with stems, flowers, etc. We were not able to differentiate such components in this study and thus we will group all these basal food sources under the term "mangrove litter".

Elevated proportions of BrFA in sediments are consistent with previous observations in mangrove ecosystems (Meziane and Tsuchiya, 2000; Aschenbroich et al., 2015). Branched FA are exclusively synthesised by bacteria (Kaneda, 1991), which are actually abundant in sediments, but might also be found in any decaying material transported as SPOM, and in basal resources that could not be sampled in this study, such as BMA or root epiphytes (Alfaro, 2008).

Highly unsaturated FA in SPOM are mostly constituted by the FA 20:5ω3 (Appendix 1), which is essentially synthesised either by planktonic or benthic diatoms (Dalsgaard et al., 2003; Kelly and Scheibling, 2012). These FA can be transferred to higher trophic levels through meiofauna consumption (Coull, 2009) but can also be derived from the ingestion and following conversion of ω3 C_{18} PUFA (Monroig et al., 2013). We measured $\delta^{13}C$ values of SPOM as low as -29.2‰ when phytoplankton was the dominant FA source in this mangrove creek (David et al. 2018), while $\delta^{13}C$ values of BMA are always above -24‰ and generally

around -20‰ (Bouillon et al. 2008, 2011). Isotopic ratio of carbon can thus be used to differentiate BMA from phytoplankton while FA are not specific enough to do so.

C_{16} and C_{18} MUFA are ubiquitous FA found in any kind of OM and can be synthesised *de novo* by animals (Dalsgaard et al., 2003), originate from PUFA degradation (Aschenbroich et al., 2015) or be produced by diatoms and other algae (Kelly and Scheibling, 2012). They can hardly be used as liable tracers of specific OM sources in this ecosystem but were nevertheless more abundant in SPOM.

All these specific FA biomarkers were used to identify the preferred food sources of consumers, with a particular emphasize on C_{18} PUFA relative abundance as a tracer of mangrove litter and HUFA relative abundance as a tracer of microalgae-derived OM.

4.2 Identification of consumers' diets

The two potamid snails sampled in the Can Gio mangrove creek exhibited high BrFA and C_{16} + C_{18} MUFA proportions (Table 3 and Fig. 4a), suggesting that they feed on unselected sediment particles, which is consistent with previous findings (Meziane and Tsuchiya, 2000; Bouillon et al., 2002; Tue et al., 2012). The low $\delta^{15}N$ signature of C*erithidea quoyii* may be due to the scraping of root epiphytes with highly depleted $\delta^{15}N$ values, similarly to the littorinid snails studied by Bouillon et al. (2004). In addition, the species *C. quoyii* exhibited higher C_{18} PUFA proportion than *C. obtusa* (10.0% for *C. quoyii* and 4.9% for *C. obtusa*; Table 3), which may originate from this root epiphytes (Alfaro, 2008). We suggest that *C. Obtusa* feeds exclusively on sediment particles, while *C. quoyii* includes in its diet a substantial proportion of root epiphytes.

The pulmonate snail *Cassidula aurisfelis* FA profiles exhibited relatively high HUFA and BrFA concentrations (mean %HUFA = 37.5% and mean %BrFA = 5.3%; Table 3 and

Fig. 4a), consistent with a diet mainly constituted by SPOM and conversely to the potamid snails, despite both groups are deposit feeders. The study of Tue et al. (2012) indicated a $\delta^{13}C$ signature of -22.8‰ for *C. aurisfelis*, consistent with a potential feeding on creek SPOM with $\delta^{13}C$ values averaging -23.9‰. In our study, SPOM exhibited a mean $\delta^{13}C$ of -27.1‰ and values down to -29.2‰ when abundance of FA in SPOM was the highest (Table 1 and David et al. 2018), while *C. aurisfelis* had an average $\delta^{13}C$ signature of -26.9‰. Thus, the difference between their $\delta^{13}C$ measurements and ours on both SPOM and *C. aurisfelis*, combined to the constancy of the isotopic shift between the source and the consumer strongly suggests that *C. aurisfelis* feeds on SPOM. Although the snail is not a suspension feeder, it most probably scraps the SPOM that is deposited in thin layer on wood bark and pneumatophores during flood.

The mangrove murex snail *Chicoreus capucinus* is a predator that feeds on a variety of bivalves and gastropods, drilling holes in their shell (Tan, 2008). Its $\delta^{15}N$ signature is higher than the theoretical trophic shift that would be observed if *C. capucinus* was feeding on littorinids or *Cerithidea quoyii* (considering an isotopic $\delta^{15}N$ shift of ~2.8‰ for carnivorous species; Vanderklift and Ponsard, 2003). However, isotopic signatures suggest that *C. capucinus* could feed on a combination of neritid snails and *C. obtusa* (Fig. 2), which is consistent with observed populations preying on other potamid and neritid snails in Thailand (Tan, 2008). In addition, *C. capucinus* has a high HUFA content (mean %HUFA = 49.8; Table 3), suggesting that its trophic regime originates from microalgae. However, HUFA also tend to accumulate with increasing trophic level in aquatic food webs (Kainz et al., 2006; Hall et al., 2006) and thus, *C. capucinus* FA profiles are consistent with a predatory behaviour of the species.

Neritid snails FA profiles indicate that they mainly feed on mangrove litter (high C_{18} PUFA content; Table 3 and Fig. 4a), despite previous studies generally indicate that they feed

on microalgae (mostly diatoms) or sedimentary organic matter (Bouillon et al., 2002; Eichhorst, 2016). The low HUFA proportions (Table 3), especially FA 20:5ω3 (Appendix 3), which is considered a diatom biomarker, found in *Neripteron violaceum* (named *Dostia violecea* in the study of Tue et al., 2012) and *Nerita balteata* tissues indicate that microalgae are not their primary food source. In addition, low BrFA proportions indicate a weak contribution of sediments to the neritid snails diet (Table 3). Their $\delta^{13}C$ signature (~ -23‰; Table 1 and Fig. 2) suggests that they feed on a combination of highly $\delta^{13}C$-depleted mangrove leaves, and a $\delta^{13}C$-enriched food source. This latter could be other microalgae than diatoms or a non-sampled source, possibly macroalgae whose $\delta^{13}C$ is generally around -23 to -16‰ (Bouillon et al., 2008), but that may be lower according to the $\delta^{13}C$ of dissolved inorganic carbon (Bouillon et al., 2002), which is supposedly low in this ecosystem given the $\delta^{13}C$ signature of SPOM (David et al., 2018).

Littorinid snails, sampled on tree leaves in the bordering fringe area, exhibited slightly lower C_{18} PUFA proportions than neritid snails but still higher than most organisms (Table 3 and Fig. 4a). Their $\delta^{15}N$ signature was particularly low, which is consistent with previous observations by Christensen et al. (2001), Bouillon et al. (2002, 2004) and Alfaro (2008). These $\delta^{15}N$-depleted signatures are likely to be due to the ingestion of root epiphytes, usually exhibiting negative $\delta^{15}N$ values (Bouillon et al., 2004). Our results indicate that littorinid snails in the mangrove creek feed on a combination of mangrove litter and other scrapable items available on trees, such as root epiphytes. These results are consistent with the observations of Lee et al. (2001) in Hong Kong mangroves.

The FA profiles and isotopic compositions of the sesarmid crab *Clistocoeloma merguiense*, sampled on the sediment in the bordering fringe area, are consistent with a leaf litter-based diet. This feeding behaviour was previously observed in various species of grapsoid crabs from Australia (Bui and Lee, 2014) or Indonesia (Nordhaus et al., 2011). In

contrast, analysis of the varunid crab *Metaplax elegans* and the ocypodid crab *Tubuca paradussumieri*, both sampled on the mud bank, suggest that both species diet is essentially based on BMA, as generally observed for both *M. elegans* and most ocypodid crabs (Bouillon et al., 2002, 2004; Tue et al., 2012; Vermeiren et al., 2015). The relatively high $\delta^{15}N$ values of both crabs (~ 8‰; Table 1 and Fig. 2) indicate that they might obtain a non-negligible proportion of their nitrogen from a predator/scavenger behaviour. Fatty acid profiles and $\delta^{13}C$ values of the grapsid crab *Metopograpsus latifrons*, sampled on the trunk of the few *Rhizophora* trees located in the bordering fringe area, were intermediate compared to the other crab species (Table 2 and Fig. 4b) and suggest an omnivorous behaviour including highly $\delta^{13}C$ depleted mangrove material, and a more $\delta^{13}C$-enriched food source, such as BMA (Vermeiren et al., 2015). The high inter-individual $\delta^{13}C$ signature variability of *M. latifrons* was previously observed and attributed to its opportunistic predator/scavenger behaviour (Nordhaus et al., 2011; Vermeiren et al., 2015).

The two prawn species FA profiles indicate that they feed on SPOM (high C_{16} + C_{18} MUFA content; Table 3 and Fig. 4b). The SPOM $\delta^{13}C$ values (mean$\delta^{13}C$ =-27.1‰ and values down to -29.2‰; Table 1 and David et al., 2018) are consistent with these results (mean $\delta^{13}C$ of shrimps ~ -27‰). In addition, prawns were particularly $\delta^{13}C$-depleted compared to previous studies (~ -15-23‰; Rodelli et al., 1984; Stoner and Zimmerman, 1988; Abrantes and Sheaves, 2009; Tue et al., 2012) suggesting a similar effect than for *C. aurisfelis*, with exceptionally low SPOM $\delta^{13}C$ values responsible for $\delta^{13}C$-depleted consumers. The relatively high $\delta^{15}N$ values of both prawn species (~ 8‰; Table 1 and Fig. 2) indicate that they might exhibit a predator/scavenger behaviour. This behaviour was previously evidenced in various penaeid species (Stoner and Zimmerman, 1988; Willems et al. 2016). We suggest that an intermediate trophic level, not sampled in our study and potentially constituted by pericarid crustaceans, macrobenthos larvae and other meiofauna (Bouillon et al., 2008; Abrantes and

Sheaves, 2009; Willems et al., 2016) is sustained by SPOM and serve as trophic link between SPOM and higher tropic level species such as crabs and prawns (Coull, 2009).

The high $\delta^{15}N$ signature of *Cloridopsis immaculata* indicates that the species is a predator, as previously observed morphologically (Dingle and Caldwell, 1975; Prasad and Yedukondala Rao, 2015). Fatty acid composition of *C. immaculata* was relatively similar to that of the two prawn species (Fig. 4b), indicating that the species probably feeds on such food sources. The isotopic shift between *C. immaculata* and both prawn species confirm that prawns could be their primary food source ($\Delta\delta^{15}N \sim 2‰$; Fig. 2) but that other organisms probably also contribute to its diet due to the high shift in $\delta^{13}C$ signature between *C. immaculata* and prawns ($\Delta\delta^{13}C \sim 3‰$ vs. usually ~ 1‰ between the food source and the consumer, although possibly highly variable; Fig. 2 and Bui and Lee 2014).

The mullet *Planiliza sp. B* (see species details in Durand et al., 2017) FA profiles and isotopic signatures indicate that the fish feeds on microalgae and/or exhibit a predatory behaviour (Fig. 2 and 4b). These results are in accordance with previous studies that usually described mullets as non-specialised consumers feeding on microalgae, zooplankton and a variety of benthic organisms (Abrantes and Sheaves, 2009; Tue et al., 2014). Although partly carnivorous, the species most probably feeds on herbivorous species since its $\delta^{13}C$ remained lower than that of *C. immaculata*, the top-predator of this study.

4.3 Trophic web structure

According to the results of FA and stable isotopes, it is difficult to precisely define the contribution of each food source to the diet of the different species. However, our study highlights the dominant food source of each species. Clearly, the food web of the Can Gio mangrove creek and nearby areas relies on mangrove litter, SPOM (notably through phytoplankton), unselected sediment particles and other food sources that we could not sample in this study, such as BMA and root epiphytes (Fig. 5).

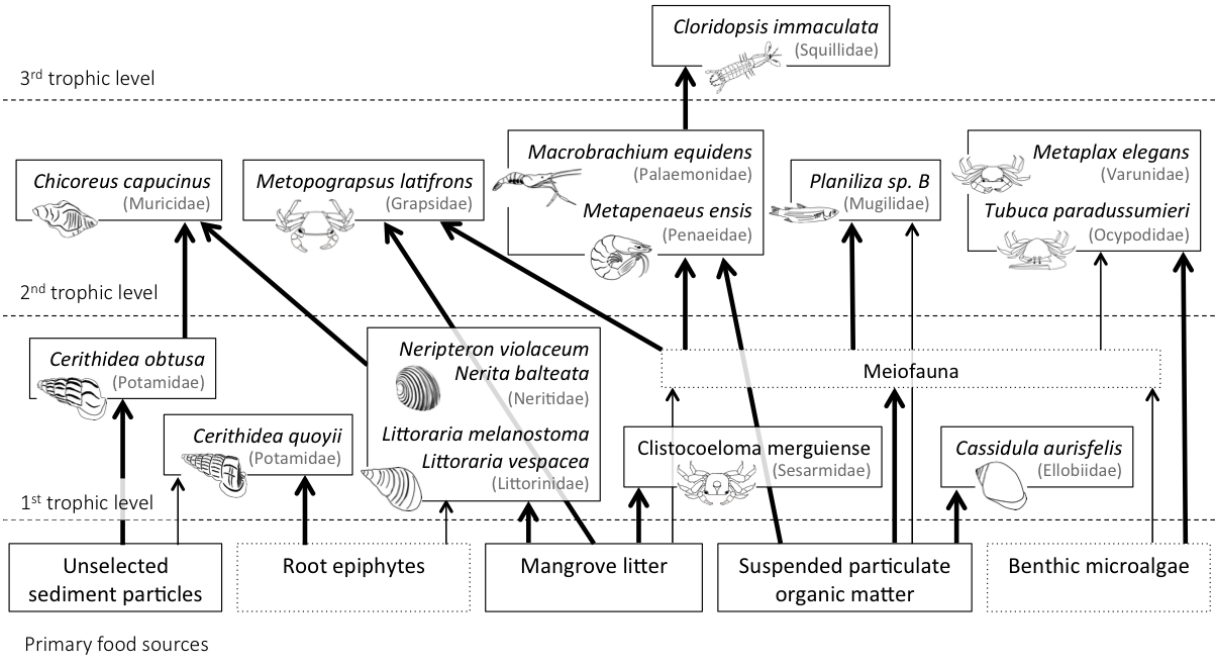

Fig. 5: Representation of the food web structure in the Can Gio mangrove tidal creek and nearby areas based on FA biomarkers, stable isotopes and available literature. Dot line boxes represent theoretic food web components that could not be sampled in our study

The trophic pathway based on mangrove litter, characteristic of mangrove ecosystems, is nutritionally sustaining the sesarmid crab *Clistocoeloma merguiense*, the littorinid snails and to a lesser extent, the grapsid crab *Metopograpsus latifrons* and neritid snails (Fig. 5). Our results also highlight trophic pathways based on microalgae. The varunid crab *Metaplax*

elegans and the ocypodid crab *Tubuca paradussumieri* dominantly feed on BMA, while the pulmonate snail *Cassidula aurisfelis*, the two prawn species and the mullet *Planiliza sp. B* rather feed on SPOM (Fig. 5) wherein the most nutritive fraction is phytoplankton in this creek (David et al. 2018). Other species feed on unselected sediment particles, mostly composed of bacteria and root epiphytes, which are probably highly $\delta^{15}N$-depleted (Bouillon et al., 2004) given the isotopic signatures of their consumers, mostly snails.

Given the elevated $\delta^{15}N$ signatures of the prawn and crabs species, we suggest that an intermediate trophic level serve as link between SPOM and higher tropic level species (Bouillon et al., 2008; Abrantes and Sheaves, 2009; Coull, 2009; Willems et al., 2016). In our study, we believe that pericarid crustaceans and other meiofauna constitute this trophic link, as observed in Australian mangroves (Abrantes and Sheaves, 2009). The prawns of this food chain are themselves consumed by the stomatopod *C. immaculata* and thus, at least three trophic levels are partly sustained by SPOM in the Can Gio mangrove creek. Although *C. immaculata* seems to be a top-predator in this study, it is itself most probably consumed by fishes or cephalopods of greater size, which are also present in this mangrove creek but could not be sampled, and thus constituting additional groups possibly exporting SPOM to coastal areas.

Our study was not meant to be quantitative and further researches on species biomass and nutrient budgets (e.g. Taillardat et al., 2018) should be conducted to evaluate the importance of each basal food source on the entire ecosystem. Despite this, it appears that the most mobile species found in the water column of our mangrove creek (fish and shrimps) are mainly feeding on SPOM, suggesting that this trophic pathway is of great importance for connectivity among ecosystems. We suggest that given the low $\delta^{13}C$ value of SPOM in our mangrove creek, it does not originate from the ocean but rather from local primary production, using nutrients and carbon released by the mangrove forest (David et al., 2018;

Taillardat et al., 2018). Thus, our study supports the hypothesis that tropical mangroves fuel coastal food webs. However, instead of directly consuming mangrove tree leaves, animal species possibly migrating between the mangrove ecosystem and nearby coastal areas feed on locally produced phytoplankton using nutrients, especially carbon, released by mangrove soils through the mechanism of tidal pumping (Taillardat et al., 2018), thus confirming the hypothesis previously raised by David et al. (2018). In this representation, ecosystem engineers, mostly snails and crabs, mainly act as mineralisers, processing high quantities of detrital material to meet their nutritional needs (Lee, 2008; Harada and Lee, 2016), and thus releasing carbon and nutrients in the form of faeces that are further decomposed by microorganisms (Werry and Lee 2005) and regularly flushed by tides. The reintegration of these compounds into algal cells then constitutes a mechanism linking mobile and/or high trophic level species to mangrove litter (i.e. leaves, propagules, stems, flowers, etc.) in tidal creeks and coastal food webs.

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7. Supplementary material

Appendix 1: Complete fatty acid composition in µg g^{-1} ± SD of potential food sources in the Can Gio mangrove tidal creek and nearby areas

Fatty acids (µg g^{-1})	Suspended matter (n = 56)	Sediment Maf (n = 4)	Sediment Bof (n = 4)	Sediment Mub (n = 4)	Leaves Ava (n = 4)	Leaves Soa (n = 4)	Leaves Rha (n = 4)
Saturated							
12:0	27.3 ± 67.7	3.6 ± 1.0	1.7 ± 0.7	1.8 ± 1.0	17.3 ± 2.1	11.0 ± 5.2	91.6 ± 24.0
13:0	3.6 ± 1.8	0.8 ± 0.2	0.4 ± 0.1	0.5 ± 0.2	-	-	-
14:0	75.4 ± 54.1	14.5 ± 0.6	7.5 ± 1.1	9.2 ± 1.9	348.1 ± 46.6	348.4 ± 125.3	427.2 ± 97.2
15:0	23.1 ± 9.4	6.5 ± 0.4	2.8 ± 0.6	4.6 ± 0.7	25.7 ± 6.5	31.9 ± 6.8	35.9 ± 8.8
16:0	283.4 ± 165.4	50.8 ± 2.1	30.0 ± 4.5	32.1 ± 4.1	2740.0 ± 281.1	2599.3 ± 348.2	2933.2 ± 746.5
17:0	11.0 ± 4.5	3.1 ± 0.3	1.5 ± 0.3	1.9 ± 0.2	49.2 ± 15.8	42.9 ± 9.5	93.9 ± 28.0
18:0	65.1 ± 29.5	9.4 ± 0.3	6.5 ± 0.7	6.7 ± 0.8	298.9 ± 35.2	261.1 ± 44.0	311.7 ± 91.4
19:0	3.9 ± 1.6	0.8 ± 0.1	0.5 ± 0.0	0.5 ± 0.0	25.7 ± 10.5	9.1 ± 2.7	6.7 ± 2.6
20:0	3.6 ± 1.7	3.6 ± 0.5	1.7 ± 0.3	1.6 ± 0.1	219.8 ± 34.5	187.7 ± 37.8	87.3 ± 20.1
21:0	0.0 ± 0.0	2.5 ± 0.5	0.4 ± 0.1	0.4 ± 0.0	33.2 ± 9.8	62.2 ± 15.1	16.4 ± 7.2
22:0	3.1 ± 1.2	5.0 ± 0.6	1.7 ± 0.3	1.6 ± 0.1	82.6 ± 12.2	179.7 ± 40.8	55.8 ± 17.0
24:0	-	8.6 ± 1.9	2.7 ± 0.3	2.7 ± 0.3	99.7 ± 12.3	53.0 ± 9.4	48.4 ± 9.6
25:0	-	1.0 ± 0.2	0.4 ± 0.1	0.5 ± 0.1	28.1 ± 7.7	12.9 ± 5.6	18.1 ± 3.2
26:0	-	8.5 ± 2.4	2.3 ± 0.1	2.3 ± 0.4	93.4 ± 13.1	26.3 ± 7.2	12.3 ± 5.8
27:0	-	0.4 ± 0.1	0.3 ± 0.0	0.3 ± 0.1	9.4 ± 1.3	6.1 ± 1.7	-
28:0	-	4.5 ± 1.1	2.0 ± 0.4	1.7 ± 0.5	80.4 ± 13.0	23.6 ± 4.1	-
29:0	-	0.2 ± 0.1	0.2 ± 0.1	0.2 ± 0.0	17.5 ± 19.4	-	-
30:0	-	1.2 ± 0.8	1.2 ± 0.5	0.8 ± 0.4	37.2 ± 13.3	-	-
∑SFA	**499.4 ± 273.3**	**125.0 ± 10.0**	**63.7 ± 9.5**	**69.3 ± 9.3**	**4206.3 ± 325.6**	**3855.4 ± 598.3**	**4138.4 ± 965.1**
Monounsaturated							
15:1ω1	-	-	-	-	41.0 ± 8.7	26.1 ± 3.9	23.3 ± 4.3
16:1ω7	135.2 ± 79.5	15.6 ± 1.8	10.0 ± 0.9	12.4 ± 1.4	72.7 ± 8.0	25.7 ± 6.6	22.1 ± 6.7
16:1ω5	-	3.1 ± 0.3	1.8 ± 0.2	2.0 ± 0.2	-	-	-
17:1ω9	2.0 ± 1.6	1.4 ± 0.3	0.7 ± 0.2	1.1 ± 0.2	-	-	-
17:1ω7	6.7 ± 3.1	3.1 ± 0.4	1.3 ± 0.2	1.3 ± 0.2	24.2 ± 7.9	15.2 ± 1.5	18.8 ± 6.4
18:1ω9	101.3 ± 41.6	7.6 ± 0.7	6.4 ± 1.8	5.5 ± 1.2	577.5 ± 196.4	557.3 ± 141.0	434.8 ± 117.8
18:1ω7	93.4 ± 43.4	15.9 ± 1.2	10.2 ± 1.0	10.7 ± 1.2	82.7 ± 8.6	49.9 ± 19.4	81.3 ± 24.1
19:1ω9	-	2.9 ± 0.3	2.4 ± 0.2	2.4 ± 0.4	-	-	-
20:1ω9	0.5 ± 0.7	0.4 ± 0.0	0.4 ± 0.2	0.3 ± 0.0	7.1 ± 1.9	8.6 ± 3.1	3.3 ± 0.5
22:1ω9	1.4 ± 1.4	8.0 ± 0.8	4.5 ± 1.9	3.8 ± 1.0	-	-	-
∑MUFA	**363.7 170.6**	**58.0 ± 3.8**	**37.8 ± 6.1**	**39.5 ± 4.2**	**805.4 ± 194.3**	**682.8 ± 171.9**	**583.6 ± 155.4**
Polyunsaturated							
16:2ω6	-	0.3 ± 0.0	0.2 ± 0.0	0.3 ± 0.1	-	-	-
16:2ω4	7.2 10.9	0.7 ± 0.1	0.5 ± 0.0	0.6 ± 0.2	-	-	-
16:3ω4	12.0 18.3	0.3 ± 0.1	0.3 ± 0.0	0.5 ± 0.1	-	-	-
16:4ω3	3.3 5.5	-	-	-	-	-	-
18:2ω6	15.8 13.2	3.0 ± 0.7	2.3 ± 1.0	1.4 ± 0.2	1048.8 ± 193.0	936.4 ± 216.8	1237.4 ± 449.6
18:3ω6	-	0.5 ± 0.1	0.2 ± 0.1	0.1 ± 0.1	-	-	-
18:3ω3	10.1 ± 21.6	1.3 ± 0.4	0.6 ± 0.4	0.3 ± 0.0	3047.5 ± 666.5	2506.6 ± 299.3	2420.2 ± 693.3
18:4ω3	8.5 ± 17.5	-	-	-	-	-	-
20:4ω6	5.5 ± 4.6	1.4 ± 0.1	1.3 ± 0.1	1.6 ± 0.3	-	-	-
20:5ω3	25.8 ± 36.4	1.7 ± 0.1	1.2 ± 0.2	2.1 ± 0.3	-	-	-
22:6ω3	7.7 ± 14.5	-	-	-	-	-	-
∑PUFA	**95.8 ± 137.9**	**9.1 ± 1.2**	**6.6 ± 1.6**	**6.8 ± 1.0**	**4096.3 ± 769.3**	**3443.1 ± 455.9**	**3657.7 ± 1049.0**
Branched							
13:0iso	-	0.6 ± 0.0	0.4 ± 0.1	0.4 ± 0.1	-	-	-
13:0anteiso	-	0.3 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	-	-	-
14:0iso	5.8 ± 3.1	5.8 ± 0.7	2.4 ± 0.4	2.8 ± 0.5	-	-	-
15:0iso	17.8 ± 5.7	19.2 ± 1.8	9.1 ± 1.3	10.5 ± 1.4	-	-	-
15:0anteiso	10.7 ± 3.9	16.1 ± 1.8	5.4 ± 0.8	6.3 ± 0.9	-	-	-
16:0iso	5.2 ± 2.0	7.3 ± 1.2	3.3 ± 0.5	3.7 ± 0.5	-	-	-
10-methyl 16	-	10.6 ± 0.9	6.3 ± 0.5	6.4 ± 1.0	-	-	-
17:0iso	7.5 5.1	4.1 ± 0.3	2.4 ± 0.3	2.5 ± 0.3	-	-	-
17:0anteiso	6.2 2.6	3.9 ± 0.5	1.8 ± 0.2	2.0 ± 0.2	-	-	-
18:0iso	-	0.4 ± 0.1	0.2 ± 0.0	0.3 ± 0.0	-	-	-
∑BrFA	**53.2 ± 19.0**	**68.3 ± 6.7**	**31.5 ± 4.0**	**35.0 ± 4.6**	**-**	**-**	**-**
∑FA (µg g^{-1})	**1012.1 ± 560.4**	**260.5 ± 18.1**	**139.6 ± 19.3**	**150.6 ± 17.4**	**9108.0 ± 1250.2**	**7981.2 ± 1048.9**	**8379.7 ± 2131.3**

Appendix 2: Complete fatty acid composition (% ± SD) of gastropods in the Can Gio mangrove tidal creek and nearby areas

Fatty acids (%)	Cassidula aurisfelis (n = 2)	Cerithidea obtusa (n = 4)	Cerithidea quoyii (n = 4)	Chicoreus capucinus (n = 4)	Littoraria melanostoma (n = 4)	Littoraria vespacea (n = 4)	Neripteron violaceum (n = 4)	Nerita balteata (n = 4)
Saturated								
12:0	0.0 ± 0.0	0.3 ± 0.4	0.1 ± 0.0	0.5 ± 0.5	0.2 ± 0.1	0.1 ± 0.1	0.1 ± 0.0	0.1 ± 0.1
13:0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.2 ± 0.1	0.1 ± 0.1	0.1 ± 0.1	0.1 ± 0.0
14:0	2.2 ± 0.9	3.8 ± 0.3	4.2 ± 0.7	3.8 ± 0.7	6.4 ± 1.7	5.1 ± 2.9	5.6 ± 0.5	3.9 ± 0.3
15:0	2.1 ± 0.5	2.2 ± 0.3	1.4 ± 0.1	1.1 ± 0.5	1.3 ± 0.1	0.7 ± 0.3	1.1 ± 0.2	1.1 ± 0.1
16:0	13.6 ± 1.1	21.0 ± 0.9	24.4 ± 1.0	9.7 ± 1.5	21.2 ± 3.6	19.3 ± 5.7	20.5 ± 0.9	20.5 ± 1.4
17:0	3.4 ± 0.2	2.7 ± 0.2	2.5 ± 0.4	1.8 ± 0.2	1.9 ± 0.1	1.7 ± 0.3	1.4 ± 0.1	1.2 ± 0.2
18:0	8.6 ± 0.5	7.9 ± 0.8	7.4 ± 1.9	7.7 ± 0.6	7.3 ± 0.6	7.8 ± 1.3	4.5 ± 0.3	4.0 ± 0.7
19:0	0.2 ± 0.0	0.3 ± 0.0	0.3 ± 0.0	0.2 ± 0.1	0.2 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
20:0	0.3 ± 0.1	0.2 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
22:0	0.2 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.4 ± 0.2	0.1 ± 0.0	0.1 ± 0.1	0.1 ± 0.0	0.1 ± 0.0
24:0	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.2 ± 0.1	0.1 ± 0.1	0.3 ± 0.1	0.1 ± 0.1
26:0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.2 ± 0.1	0.0 ± 0.0	0.1 ± 0.1	0.0 ± 0.0
∑SFA	**30.8 ± 1.8**	**38.7 ± 1.2**	**40.6 ± 2.6**	**25.5 ± 1.6**	**39.2 ± 4.6**	**35.3 ± 7.4**	**34.1 ± 1.8**	**31.1 ± 0.7**
Monounsaturated								
16:1ω7	2.6 ± 0.2	2.4 ± 0.2	1.8 ± 0.6	1.9 ± 1.5	1.1 ± 0.4	0.9 ± 0.2	1.6 ± 0.3	1.8 ± 0.8
16:1ω5	1.0 ± 0.1	1.6 ± 0.5	0.4 ± 0.2	0.1 ± 0.1	0.4 ± 0.1	0.3 ± 0.1	0.3 ± 0.1	0.3 ± 0.1
18:1ω11	0.2 ± 0.0	0.5 ± 0.1	0.2 ± 0.2	0.3 ± 0.2	0.2 ± 0.0	0.2 ± 0.1	0.2 ± 0.0	2.1 ± 1.8
18:1ω9	4.4 ± 0.2	5.0 ± 0.5	8.3 ± 0.8	2.3 ± 0.6	4.5 ± 1.2	5.1 ± 0.7	8.2 ± 1.4	5.5 ± 0.9
18:1ω7	6.1 ± 0.3	7.8 ± 1.7	6.0 ± 0.6	1.4 ± 0.6	5.6 ± 2.0	3.7 ± 0.7	4.6 ± 0.5	5.8 ± 0.9
18:1ω5	0.4 ± 0.0	0.7 ± 0.1	0.2 ± 0.0	0.1 ± 0.1	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.3 ± 0.1
19:1ω9	0.2 ± 0.1	0.2 ± 0.0	0.2 ± 0.0	0.2 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.3 ± 0.1
20:1ω11	4.4 ± 0.4	3.9 ± 0.2	4.1 ± 0.8	9.5 ± 0.4	4.6 ± 0.1	4.3 ± 1.0	4.6 ± 0.7	4.2 ± 0.8
20:1ω9	0.8 ± 0.0	0.5 ± 0.1	0.9 ± 0.1	0.5 ± 0.1	0.5 ± 0.1	1.2 ± 0.2	1.9 ± 0.5	1.7 ± 0.4
20:1ω7	0.9 ± 0.1	0.5 ± 0.1	0.2 ± 0.0	0.3 ± 0.1	0.8 ± 0.2	0.4 ± 0.1	0.2 ± 0.1	0.4 ± 0.1
22:1ω11	0.4 ± 0.1	0.5 ± 0.1	0.3 ± 0.1	0.7 ± 0.2	0.4 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.1 ± 0.0
∑MUFA	**21.4 ± 0.2**	**23.6 ± 2.1**	**22.7 ± 1.5**	**17.4 ± 2.2**	**18.5 ± 2.9**	**16.6 ± 1.2**	**22.0 ± 0.7**	**22.6 ± 2.0**
Polyunsaturated								
16:2ω6	0.0 ± 0.0	0.1 ± 0.0	0.6 ± 0.2	0.0 ± 0.0	0.4 ± 0.2	0.5 ± 0.3	0.9 ± 0.4	0.7 ± 0.1
16:2ω4	0.1 ± 0.0	0.2 ± 0.0	0.1 ± 0.1	0.0 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.2 ± 0.1
16:3ω6	0.1 ± 0.0	0.1 ± 0.0	0.6 ± 0.1	0.1 ± 0.1	0.4 ± 0.2	0.8 ± 0.3	1.6 ± 0.4	1.2 ± 0.2
16:4ω3	0.0 ± 0.0	0.1 ± 0.1	0.0 ± 0.0	0.1 ± 0.1	0.3 ± 0.1	0.3 ± 0.1	0.3 ± 0.1	0.4 ± 0.1
18:2ω6	3.8 ± 0.0	3.5 ± 0.6	8.9 ± 1.2	4.0 ± 0.4	8.9 ± 1.7	13.1 ± 1.9	18.3 ± 2.5	17.6 ± 2.3
18:2ω3	0.1 ± 0.0	0.2 ± 0.1	0.1 ± 0.0	0.0 ± 0.0	0.1 ± 0.1	0.0 ± 0.0	0.1 ± 0.1	0.0 ± 0.0
18:3ω6	0.1 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
18:3ω3	0.9 ± 0.2	0.8 ± 0.1	0.8 ± 0.2	0.6 ± 0.2	1.6 ± 0.3	1.6 ± 0.3	0.8 ± 0.0	1.5 ± 0.5
18:4ω3	0.0 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
20:2ω9 (NMI)	0.1 ± 0.0	0.4 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.1 ± 0.0	0.2 ± 0.1	0.3 ± 0.1	1.1 ± 0.7
20:2ω7 (NMI)	0.1 ± 0.0	0.1 ± 0.1	0.0 ± 0.0	0.6 ± 0.4	0.2 ± 0.1	0.1 ± 0.0	0.0 ± 0.0	0.3 ± 0.3
20:2ω6	2.5 ± 0.5	2.4 ± 0.4	2.3 ± 0.3	2.0 ± 0.3	4.2 ± 0.6	3.7 ± 0.5	1.3 ± 0.2	1.1 ± 0.2
20:3ω6,9,15 (NMI)	0.2 ± 0.0	0.8 ± 0.3	0.7 ± 0.3	0.6 ± 0.2	0.6 ± 0.1	0.3 ± 0.1	0.2 ± 0.0	0.4 ± 0.3
20:3ω6	1.0 ± 0.1	1.0 ± 0.1	1.4 ± 0.7	0.3 ± 0.1	0.9 ± 0.0	1.1 ± 0.2	0.6 ± 0.1	0.7 ± 0.2
20:4ω6	8.5 ± 0.5	8.1 ± 1.2	7.0 ± 1.3	19.6 ± 0.8	9.9 ± 0.7	10.9 ± 2.7	9.3 ± 1.5	10.4 ± 2.1
20:4ω3	0.3 ± 0.0	0.1 ± 0.0	0.4 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.2 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
20:5ω3	5.7 ± 0.2	2.6 ± 0.3	2.0 ± 0.8	1.6 ± 0.1	2.4 ± 0.8	2.0 ± 0.8	0.7 ± 0.5	1.5 ± 0.6
22:2ω9 (NMI)	2.1 ± 0.1	1.3 ± 0.2	1.2 ± 0.3	7.2 ± 0.7	1.7 ± 0.2	3.6 ± 1.8	2.2 ± 1.6	2.2 ± 0.7
22:2ω6	0.9 ± 0.0	0.7 ± 0.1	0.2 ± 0.0	4.1 ± 1.2	1.0 ± 0.4	0.5 ± 0.1	0.8 ± 1.3	0.1 ± 0.0
22:3ω6	0.6 ± 0.1	0.8 ± 0.2	1.0 ± 0.1	2.8 ± 0.7	2.4 ± 0.3	0.9 ± 0.2	0.4 ± 0.1	0.3 ± 0.0
22:4ω6	8.0 ± 0.8	2.8 ± 0.6	1.8 ± 0.3	5.9 ± 0.6	1.7 ± 0.4	2.9 ± 1.0	2.3 ± 0.4	2.2 ± 0.6
22:5ω6	0.8 ± 0.2	2.0 ± 0.4	0.9 ± 0.6	0.2 ± 0.1	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
22:5ω3	3.6 ± 0.4	0.9 ± 0.1	0.4 ± 0.1	4.1 ± 0.9	1.9 ± 0.4	3.1 ± 1.9	0.3 ± 0.3	0.6 ± 0.5
22:6ω3	3.0 ± 0.1	2.5 ± 0.5	1.0 ± 0.7	0.6 ± 0.2	0.2 ± 0.2	0.1 ± 0.0	0.1 ± 0.1	0.0 ± 0.0
∑PUFA	**42.4 ± 3.1**	**31.6 ± 2.6**	**31.9 ± 2.6**	**54.8 ± 2.0**	**39.3 ± 1.6**	**45.8 ± 7.7**	**40.7 ± 1.9**	**42.9 ± 2.7**
Branched								
15:0iso	1.1 ± 0.3	1.1 ± 0.1	0.4 ± 0.1	0.3 ± 0.3	0.3 ± 0.1	0.2 ± 0.2	0.6 ± 0.3	0.6 ± 0.1
15:0anteiso	0.5 ± 0.0	0.3 ± 0.0	0.2 ± 0.1	0.1 ± 0.1	0.2 ± 0.1	0.1 ± 0.0	0.2 ± 0.0	0.1 ± 0.0
16:0iso	1.4 ± 0.3	0.7 ± 0.0	1.0 ± 0.2	0.3 ± 0.2	0.5 ± 0.1	0.3 ± 0.1	0.6 ± 0.1	0.9 ± 0.2
10-methyl 16	0.2 ± 0.1	0.2 ± 0.0	0.2 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
17:0iso	0.6 ± 0.9	2.7 ± 0.2	1.7 ± 0.3	0.8 ± 0.3	1.2 ± 0.2	1.0 ± 0.2	1.0 ± 0.0	0.9 ± 0.2
17:0anteiso	0.9 ± 0.0	0.7 ± 0.1	0.6 ± 0.1	0.7 ± 0.5	0.4 ± 0.1	0.2 ± 0.0	0.3 ± 0.1	0.3 ± 0.0
18:0iso	0.5 ± 0.0	0.2 ± 0.1	0.7 ± 0.3	0.2 ± 0.1	0.3 ± 0.1	0.3 ± 0.1	0.2 ± 0.0	0.4 ± 0.1
∑BrFA	**5.3 ± 1.5**	**6.1 ± 0.2**	**4.9 ± 0.4**	**2.4 ± 1.4**	**3.1 ± 0.6**	**2.2 ± 0.4**	**3.2 ± 0.5**	**3.4 ± 0.2**
∑FA (mg g^{-1})	**25.0 ± 6.1**	**40.7 ± 3.3**	**68.6 ± 21.4**	**14.3 ± 3.5**	**44.2 ± 7.8**	**48.1 ± 32.7**	**54.2 ± 17.6**	**72.3 ± 27.5**

Appendix 3: Complete fatty acid composition (% ± SD) of crustaceans and fish in the Can Gio mangrove tidal creek and nearby areas

Fatty acids (%)	Clistocoeloma merguiense (n = 4)	Metaplax elegans (n = 4)	Metopograpsus latifrons (n = 4)	Tubuca paradussumieri (n = 4)	Macrobrachium equidens (n = 4)	Metapenaeus ensis (n = 4)	Cloridopsis immaculata (n = 3)	Planiliza sp. B (n = 4)
Saturated								
12:0	0.2 ± 0.1	0.1 ± 0.1	0.1 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.1 ± 0.1	0.5 ± 0.1	0.1 ± 0.1
13:0	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.1	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.0 ± 0.0
14:0	0.6 ± 0.2	0.5 ± 0.4	0.6 ± 0.2	1.2 ± 0.5	2.3 ± 0.3	1.5 ± 0.3	4.7 ± 0.7	1.5 ± 0.4
15:0	0.8 ± 0.1	1.6 ± 0.5	0.7 ± 0.1	2.3 ± 0.8	1.2 ± 0.1	2.1 ± 0.3	1.8 ± 0.1	1.2 ± 0.4
16:0	14.9 ± 1.2	17.2 ± 2.0	14.7 ± 0.4	15.9 ± 0.8	23.5 ± 0.9	16.2 ± 0.7	24.7 ± 0.9	26.1 ± 0.4
17:0	2.3 ± 0.1	1.6 ± 0.3	1.7 ± 0.1	2.1 ± 0.6	1.6 ± 0.4	3.6 ± 0.2	2.0 ± 0.3	0.7 ± 0.1
18:0	11.0 ± 0.3	12.0 ± 1.3	10.9 ± 0.4	11.6 ± 0.3	8.6 ± 0.9	11.1 ± 0.7	9.7 ± 0.5	10.3 ± 0.5
19:0	0.4 ± 0.1	0.3 ± 0.0	0.2 ± 0.1	0.2 ± 0.0	0.2 ± 0.0	0.4 ± 0.0	0.4 ± 0.0	0.3 ± 0.0
20:0	0.3 ± 0.1	0.5 ± 0.1	0.2 ± 0.0	0.2 ± 0.0	0.3 ± 0.0	0.3 ± 0.0	0.7 ± 0.1	0.2 ± 0.0
22:0	0.1 ± 0.0	0.5 ± 0.1	0.2 ± 0.1	0.4 ± 0.1	0.2 ± 0.0	0.5 ± 0.0	0.7 ± 0.2	0.2 ± 0.0
24:0	0.0 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.3 ± 0.1
∑SFA	**30.9 ± 1.7**	**34.4 ± 0.6**	**29.3 ± 0.8**	**34.0 ± 0.7**	**38.3 ± 1.3**	**35.8 ± 0.9**	**45.4 ± 1.2**	**41.1 ± 0.9**
Monounsaturated								
16:1ω7	3.6 ± 0.6	4.4 ± 0.5	1.8 ± 0.5	8.8 ± 1.1	6.8 ± 1.2	3.9 ± 0.7	9.0 ± 1.1	4.0 ± 0.9
16:1ω5	0.1 ± 0.0	0.1 ± 0.1	0.1 ± 0.0	0.0 ± 0.0	0.2 ± 0.1	0.3 ± 0.2	0.2 ± 0.1	0.3 ± 0.1
17:1ω9	0.6 ± 0.2	1.1 ± 0.4	0.2 ± 0.1	4.4 ± 0.5	0.9 ± 0.2	1.0 ± 0.2	1.0 ± 0.3	0.6 ± 0.2
17:1ω7	0.1 ± 0.0	0.1 ± 0.1	0.1 ± 0.1	0.2 ± 0.1	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.1	0.1 ± 0.0
18:1ω11	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.2 ± 0.0	0.3 ± 0.2	0.0 ± 0.0
18:1ω9	13.9 ± 0.5	5.7 ± 0.6	8.2 ± 1.6	6.0 ± 1.2	18.1 ± 2.4	6.6 ± 0.9	7.0 ± 0.8	4.5 ± 0.9
18:1ω7	3.6 ± 0.4	3.6 ± 0.3	3.7 ± 1.0	2.2 ± 0.4	3.4 ± 0.6	4.7 ± 0.2	3.8 ± 0.2	2.7 ± 0.2
18:1ω5	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.1	0.3 ± 0.1	0.2 ± 0.1	0.1 ± 0.0
19:1ω9	0.1 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.2 ± 0.0
20:1ω11	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.1	0.0 ± 0.0	0.2 ± 0.0	0.7 ± 0.1	0.6 ± 0.4	0.1 ± 0.0
20:1ω9	0.3 ± 0.1	1.1 ± 0.2	0.2 ± 0.0	1.1 ± 0.1	0.2 ± 0.0	0.6 ± 0.2	0.5 ± 0.0	0.6 ± 0.1
20:1ω7	0.0 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.2 ± 0.1	0.2 ± 0.0	0.1 ± 0.0
22:1ω11	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.0 ± 0.0
22:1ω9	0.0 ± 0.0	0.4 ± 0.0	0.0 ± 0.0	0.4 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
∑MUFA	**22.5 ± 1.4**	**16.5 ± 1.2**	**14.7 ± 1.7**	**23.0 ± 2.1**	**30.3 ± 2.2**	**18.8 ± 1.8**	**23.2 ± 0.7**	**13.4 ± 0.3**
Polyunsaturated								
16:2ω6	0.0 ± 0.0	0.1 ± 0.1	0.1 ± 0.1	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
16:2ω4	0.0 ± 0.0	0.4 ± 0.2	0.0 ± 0.0	0.5 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.3 ± 0.1	0.4 ± 0.2
16:3ω6	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.0 ± 0.0
16:3ω4	0.0 ± 0.0	0.7 ± 0.7	0.0 ± 0.0	0.2 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.4 ± 0.2	0.4 ± 0.3
16:4ω3	0.0 ± 0.0	0.1 ± 0.1	0.1 ± 0.0	0.2 ± 0.1	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
18:2ω6	15.5 ± 2.6	4.3 ± 0.9	15.8 ± 2.4	3.0 ± 0.2	5.7 ± 1.0	3.6 ± 0.5	4.0 ± 0.3	0.7 ± 0.1
18:2ω3	0.2 ± 0.1	0.2 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.3 ± 0.0
18:3ω6	0.0 ± 0.0	0.4 ± 0.0	0.1 ± 0.0	0.8 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.2 ± 0.0
18:3ω3	6.8 ± 0.4	1.4 ± 1.1	0.9 ± 0.2	0.2 ± 0.1	2.3 ± 0.8	0.8 ± 0.2	1.2 ± 0.5	0.2 ± 0.1
18:4ω3	0.0 ± 0.0	0.4 ± 0.0	0.1 ± 0.0	0.4 ± 0.1	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.1	0.2 ± 0.1
20:2ω6	1.1 ± 0.2	1.0 ± 0.2	1.4 ± 0.2	0.5 ± 0.1	0.4 ± 0.1	1.3 ± 0.3	0.9 ± 0.2	0.3 ± 0.1
20:3ω6,9,15 (NMI)	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.4 ± 0.1	0.1 ± 0.1	0.1 ± 0.0
20:3ω6	0.1 ± 0.0	0.2 ± 0.0	0.1 ± 0.0	0.5 ± 0.1	0.1 ± 0.0	0.6 ± 0.1	0.2 ± 0.1	0.3 ± 0.0
20:3ω3	0.5 ± 0.1	0.3 ± 0.1	0.1 ± 0.1	0.2 ± 0.1	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.0 ± 0.0
20:4ω6	5.5 ± 0.3	7.2 ± 0.5	9.1 ± 1.6	11.5 ± 0.9	8.0 ± 0.5	15.9 ± 1.0	6.7 ± 0.7	10.6 ± 0.6
20:4ω3	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0
20:5ω3	8.5 ± 0.9	18.0 ± 2.4	17.7 ± 2.4	13.2 ± 1.0	7.5 ± 0.4	8.2 ± 1.4	7.3 ± 0.5	12.7 ± 0.8
22:2ω9 (NMI)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.3 ± 0.3	0.1 ± 0.0
22:3ω6	0.1 ± 0.0	0.7 ± 0.2	0.2 ± 0.0	0.5 ± 0.1	0.1 ± 0.0	0.2 ± 0.0	0.3 ± 0.1	0.3 ± 0.0
22:4ω6	0.1 ± 0.0	0.2 ± 0.0	0.4 ± 0.2	0.1 ± 0.1	0.6 ± 0.1	1.8 ± 0.3	0.9 ± 0.3	1.2 ± 0.2
22:5ω6	0.6 ± 0.1	0.8 ± 0.1	0.4 ± 0.1	0.6 ± 0.1	0.6 ± 0.1	1.9 ± 0.2	0.6 ± 0.1	2.0 ± 0.2
22:5ω3	0.3 ± 0.0	0.5 ± 0.1	0.5 ± 0.1	0.4 ± 0.0	0.4 ± 0.0	1.1 ± 0.2	0.7 ± 0.1	3.7 ± 0.3
22:6ω3	6.5 ± 0.9	10.1 ± 1.6	8.1 ± 0.8	8.4 ± 0.9	3.6 ± 0.1	5.3 ± 0.5	4.5 ± 1.1	10.3 ± 1.0
∑PUFA	**46.0 ± 2.7**	**47.4 ± 1.7**	**55.2 ± 0.8**	**41.5 ± 2.2**	**29.9 ± 1.3**	**41.8 ± 1.6**	**29.5 ± 1.6**	**44.6 ± 1.2**
Branched								
15:0iso	0.1 ± 0.0	0.2 ± 0.1	0.1 ± 0.0	0.1 ± 0.0	0.3 ± 0.0	0.4 ± 0.0	0.4 ± 0.0	0.1 ± 0.0
15:0anteiso	0.0 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.0 ± 0.0
16:0iso	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.2	0.2 ± 0.1	0.5 ± 0.1	0.2 ± 0.0	0.1 ± 0.0
10-methyl 16	0.0 ± 0.0	0.2 ± 0.1	0.1 ± 0.0	0.2 ± 0.1	0.1 ± 0.0	0.2 ± 0.1	0.1 ± 0.0	0.2 ± 0.0
17:0iso	0.3 ± 0.1	0.4 ± 0.1	0.3 ± 0.0	0.2 ± 0.1	0.4 ± 0.1	1.3 ± 0.3	0.6 ± 0.1	0.3 ± 0.0
17:0anteiso	0.1 ± 0.0	0.1 ± 0.1	0.1 ± 0.1	0.1 ± 0.0	0.2 ± 0.0	0.7 ± 0.1	0.2 ± 0.1	0.1 ± 0.0
18:0iso	0.1 ± 0.0	0.2 ± 0.1	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.3 ± 0.2	0.1 ± 0.0	0.0 ± 0.0
∑BrFA	**0.7 ± 0.2**	**1.3 ± 0.3**	**0.7 ± 0.1**	**1.1 ± 0.4**	**1.5 ± 0.2**	**3.6 ± 0.7**	**1.9 ± 0.3**	**0.9 ± 0.1**
∑FA (mg g^{-1})	**19.8 ± 3.7**	**26.6 ± 21.4**	**18.2 ± 3.6**	**17.0 ± 2.8**	**49.1 ± 5.4**	**29.7 ± 3.0**	**73.0 ± 10.7**	**29.7 ± 1.5**

8. Glossary

BrFA: Branched Fatty Acids

FA: Fatty acids

FAME: Fatty Acid Methyl Esters

HUFA: Highly Unsaturated Fatty Acids

MUFA: MonoUnsaturated Fatty Acids

OM: Organic Matter

PCA: Principal Component Analysis

PUFA: PolyUnsaturated Fatty Acids

SPOM: Suspended Particulate Organic Matter

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Highlights

- Tissues of 16 species from Can Gio mangrove were analysed to identify organisms' diet
- Mangrove litter is the dominant food source for various gastropods and crabs
- Suspended organic matter, mostly phytoplankton, fuels the most mobile species