The following supplement accompanies the article

Benthic processes and overlying fish assemblages drive the composition of benthic detritus on a central Pacific coral reef

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Supplement. Additional data

Table S1. Carbon stable isotope measurements (‰) for benthic macroalgae from recent literature. SD, SE of mean values are indicated

Algal genus/functional type	$\delta^{13}C$ (‰)	Source
Halimeda	-18.5 ± 0.5 (SD)	Carassou et al. (2008)
	-18.6 ± 0.8 (SD)	Cocheret de la Morinière et al. (2003)
Caulerpa	-8.7 ± 1.0 (SD)	Kolasinski et al. (2011)
Crustose coralline algae	-3.9 ± 0.3 (SD)	Carassou et al. (2008)
Turbinaria	-9.1	Yamamuro et al. (1995)
Dictyota	-14.6 ± 1.1 (SD)	Kolasinski et al. (2011)
	-14.0 ± 0.06 (SE)	Abed-Navandi & Dworschak (2005)
	-17.3 ± 1 (SD)	Cocheret et al. (2003)
Turf algae	-4 ± 0.00 (SD)	Carassou et al. (2008)
	-17.6 ± 0.25 (SD)	Cocheret et al. (2003)
	-19.4	Frédérich et al. (2009)
	-16.8 ± 1.3 (red) (SD)	Titlyanov et al. (2008)
	-12.8 + 1.9 (green) (SD)	Titlyanov et al. (2008)

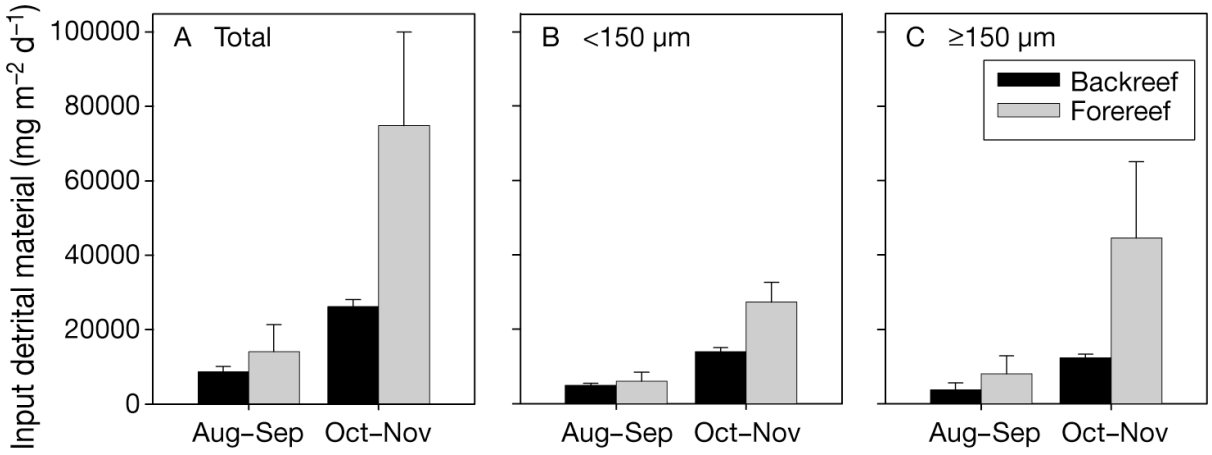
Table S2. Common species in each trophic group in backreef and forereef habitats. Mean biomass (kg per ha) and density (ind. per 100 m^2) for the 10 highest ranked species in each trophic group for each combination of habitat (forereef, backreef) and metric (biomass, density) are provided, followed by the total biomass and density for each group. Errors are provided as ±1 SE. Please note that for each trophic group (except the omnivores) less common species are not detailed, but their biomass and density are accounted for in each group total

Species	**Backreef biomass (kg ha^{-1})**	**Forereef biomass (kg ha^{-1})**	**Backreef density (ind. per 100 m^2)**	**Forereef density (ind. per 100 m^2)**
Piscivores				
Lutjanus bohar	95.3	384.3	0.5	2.7
Carcharinus melanopterus	70.5	237.2	0.1	0.1
Caranx melampygus	48.2	12.8	0.3	0.3
Lutjanus monostigma	39.0	0.4	0.8	0.02
Lutjanus gibbus	36.8	30.4	0.6	0.5
Cephalopholis argus	20.8	25.3	0.4	0.4
Lethrinus olivaceus	14.0	3.1	0.2	0.04
Caranx ignobilis	3.9	17.3	0.03	0.01
Fistularia commersonii	2.7	0	0.03	0
Aulostomus chinensis	0.9	0	0.1	0
Epinephelus macrospilos	0.9	0.3	0.1	0.01
Oxycheilinus unifasciatus	0.02	2.3	0.1	0.2
Carcharinus amblyrhynchos	0	241.5	0	0.1
Cephalopholis urodeta	0	16.2	0	1.1
Aphareus furca	0	7.5	0	0.9
Caranx lugubris	0	5.6	0	0.03
Piscivore totals:	**336.5 ± 133.3**	**1125.4 ± 245.1**	**4.7 ± 1.8**	**10.6 ± 5.5**
Carnivores				
Lutjanus fulvus	61.1	0	2.1	0
Myripristis sp.	7.8	2.8	0.4	0.1
Thalassoma quinquevittatum	4.6	5.7	6.5	6.7
Chaetodon auriga	3.2	0	0.3	0
Cheilinus undulatus	3.0	25.2	0.03	0.01
Mullidae	2.7	9.5	0.4	0.7
Neoniphon sp.	2.6	7.8	0.1	0.4
Chaetodon trifascialis	2.5	0	0.6	0
Epibulus insidiator	2.3	0	0.3	0
Chaetodon lunulatus	2.3	0	0.5	0
Thalassoma hardwicke	1.6	0	0.6	0
Gomphosus varius	1.5	1.5	3.8	1.9

Species	**Backreef biomass (kg ha^{-1})**	**Forereef biomass (kg ha^{-1})**	**Backreef density (ind. per 100 m^2)**	**Forereef density (ind. per 100 m^2)**
Pseudocheilinus hexataenia	1.3	2.9	1.9	7.0
Halichoeres ornatissimus	1.0	2.6	0.9	4.3
Labroides dimidiatus	0.6	0.7	0.8	1.0
Paracirrhites arcatus	0.4	10.2	0.3	8.2
Cantherines dumerili	0.4	3.9	0.1	0.4
Thalassoma lutescens	0.2	1.8	0.6	0.6
Pseudocheilinus octotaenia	0.1	16.0	0.2	11.9
Labroides rubrolabiatus	0.1	0.2	0.2	0.7
Plectroglyphidodon johnstonianus	0.04	4.6	0.1	5.5
Carnivore totals:	**114.1 ± 21.6**	**150.5 ± 87.3**	**23.7 ± 4.7**	**54.3 ± 12.1**
Omnivores				
Plectroglyphidodon dickii	10.8	4.8	6.2	3.6
Dascyllus aruanus	0.1	0	0.2	0
Gobidae	0.01	0	0.1	0
Dascyllus auripinnis	0	4.3	0	0.7
Omnivore totals:	**33.0 ± 12.7**	**9.6 ± 3.0**	**13.8 ± 2.4**	**4.3 ± 0.5**
Zooplanktivores				
Chromis margaritifer	1.7	0	3.8	73.6
Thalassoma amblycephalum	1.6	0.1	2.0	0.1
Pempheris oualensis	1.2	0	0.2	0
Chromis viridis	0.4	0	0.5	0
Pomacentrus coelestis	0.2	0	0.6	9.4
Chromis acares	0.04	10.6	0.2	49.8
Ptereleotris evides	0.01	0	0.04	0
Melichthys vidua	0	56.8	0	2.3
Melichthys niger	0	43.9	0	2.3
Chromis vanderbilti	0	31.6	0	133.8
Pseudanthias olivaceus	0	24.8	0	100.8
Pseudanthias dispar	0	17.7	0	121.8
Caesio teres	0	10.7	0	10.0
Chromis xanthura	0	11.4	0	10.8
Pseudanthias sp.	0	5.8	0	4.5
Pseudanthias bartlettorum	0	4.9	0	19.3
Zooplanktivore totals:	**7.8 ± 3.3**	**432.4 ± 144.7**	**8.0 ± 2.6**	**572.0 ± 184.5**
Detritivores				
Ctenochaetus striatus	439.7	17.3	20.9	1.8

Species	**Backreef biomass (kg ha^{-1})**	**Forereef biomass (kg ha^{-1})**	**Backreef density (ind. per 100 m^2)**	**Forereef density (ind. per 100 m^2)**
Acanthurus blochii	12.0	6.0	0.3	0.2
Acanthurus xanthopterus	10.6	9.9	0.2	0.3
Ctenochaetus cyanocheilus	6.9	56.6	0.6	3.9
Ctenochaetus sp.	5.9	3.2	0.2	0.4
Cirripectes sp.	1.4	9.2	3.0	11.3
Acanthurus leucocheilus	0.9	0.8	0.03	0.02
Ctenochaetus binotatus	0.4	0.01	0.2	0.04
Ctenochaetus flavicauda	0.3	0.1	0.3	0.1
Ctenochaetus marginatus	0	45.8	0	2.3
Acanthurus olivaceus	0	2.7	0	0.1
Detritivore totals:	**194.2 ± 86.9**	**50.2 ± 2.1**	**25.7 ± 4.5**	**20.4 ± 3.3**
Herbivores				
Chlorurus sordidus	125.3	42.8	13.3	2.0
Acanthurus lineatus	58.4	0	3.0	0
Chlorurus microrhinos	44.3	0	1.1	0
Acanthurus nigricans	40.2	53.5	5.5	7.5
Scarus frenatus	27.5	13.3	2.6	0.7
Zebrasoma scopas	21.8	0	0.9	0
Calotomus carolinus	14.0	6.0	0.2	0.1
Acanthurus nigroris	10.5	0	0.9	0
Centropyge flavissimus	7.6	49.7	0.4	1.2
Hipposcarus longiceps	7.3	0	0.1	0
Naso lituratus	5.7	1.4	0.1	0.02
Stegastes nigricans	3.7	0	2.4	0
Stegastes aureus	1.8	11.8	1.6	5.9
Scarus oviceps	1.5	1.2	0.2	0.1
Scarus psittacus	1.3	6.5	0.1	0.3
Kyphosus cinerascens	0.9	8.7	0.1	0.3
Centropyge loricula	0.2	17.2	0.04	0.7
Scarus rubroviolaceus	0	8.9	0	0.1
Herbivore totals:	**632.9 ± 202.1**	**249.1 ± 43.5**	**46.9 ± 21.0**	**7.9 ± 3.9**

Fig. S1. Input rate (mean ±1 SE) of detrital material into sediment traps deployed on backreef (black bars) and forereef (gray bars) habitats on Palmyra Atoll, separated by collection date. a) Total deposition rates, b) deposition rates of the <150 µm size fraction and c) deposition rates of the >150 µm size fraction. Mean total deposition rates were calculated using individual sediment trap totals, rather than summing the size fraction means. Mean deposition rates are higher in forereef relative to backreef areas for all size fractions for all collections, with overall higher flux rates recorded for the October/November samples



LITERATURE CITED

Abed-Navandi D, Dworschak PC (2005) Food sources of tropical thalassinidean shrimps: a stable-isotope study. Mar Ecol Prog Ser 291:159–168

Carassou L, Kulbicki M, Nicola TJR, Polunin NVC (2008) Assessment of fish trophic status and relationships by stable isotope data in the coral reef lagoon of New Caledonia, southwest Pacific. Aquat Living Resour 21:1−12

Cocheret de la Morinière E, Pollux BJA, Nagelkerken I, Hemminga MA, Huiskes AHL, van der Velde G (2003) Ontogenic dietary changes of coral reef fishes in the mangrove-seagrass-reef continuum: stable isotopes and gut contents analysis. Mar Ecol Prog Ser 246:279−289

Frédérich B, Fabri G, Lepoint G, Vandewalle P, Parmentier E (2009) Trophic niches of thirteen damselfishes (Pomacentridae) at the Grand Récif of Toliara, Madagascar. Ichthyol Res 56: 10−17

Kolasinski J, Rogers K, Cuet P, Barry B, Frouin P (2011) Sources of particulate organic matter at the ecosystem scale: a stable isotope and trace element study in a tropical coral reef. Mar Ecol Prog Ser 443:77−93

Titlyanov EA, Kiyashko SI, Titlyanova TV, Kalita TL, Raven JA (2008) $\delta^{13}C$ and $\delta^{15}N$ values in reef corals *Porites lutea* and *P. cylindrical* and in their epilithic and endolithic algae. Mar Biol 155:353−361

Yamamuro M, Kayanne H, Minagawa M (1995) Carbon and nitrogen stable isotopes of primary producers in coral reef ecosystems. Limnol Oceanogr 40:617−621