

Invasive mangroves alter macrofaunal community structure and facilitate opportunistic exotics

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Supplement

Table S1. Results of nested ANOVA for (A) environmental and (B) macrofaunal variables as compared with elevations nested within mangrove and control sandflat sites (Oahu and Molokai). ns: not significant (at α -level of 0.05)

Variable	Site		Elevation (Site)	
	p	F	p	F
A. Environmental				
Aboveground properties				
Root density	0.936	0.007	0.001	6.34
Sediment properties				
Belowground plant biomass	0.011	8.16	0.003	5.371
Total organic carbon	<0.001	25.197	0.001	3.02
Total nitrogen	<0.001	37.29	<0.001	6.03
% Rubble	<0.001	40.31	ns	0.80
% Sand	<0.001	48.13	<0.001	5.77
% Silt/Clay	<0.001	58.06	<0.001	20.69
Salinity	<0.001	97.34	ns	0.30
B. Macrofaunal				
Biomass	ns	1.13	ns	1.49
Density	<0.001	78.19	<0.001	3.88
<i>S</i>	0.056	2.70	ns	1.20
<i>d</i>	<0.001	15.22	ns	0.57
<i>J'</i>	<0.001	19.24	ns	0.93
<i>H'</i>	<0.001	16.68	ns	0.90
Omnivore	<0.001	20.68	<0.001	3.14
Surface feeder	0.001	7.28	0.001	3.02
Subsurface deposit feeder	<0.001	18.73	ns	0.96
Cryptogenic/Introduced	<0.001	23.30	0.001	3.91
Native	<0.001	94.21	<0.001	3.66

Table S2. Average (± 1 SE, $n = 5$) values for sediment and environmental variables measured from each of the sampled transects in Pearl Harbor and Paiko Lagoon, Oahu. DW: dry weight

Variable	Site	Transect		
		8	2	0.5
Mangrove				
Root density (no. m ⁻²)				
	Waiawa	14.8 \pm 4.8	14.4 \pm 1.6	32.8 \pm 7.6
	Pouhala	16.8 \pm 5.5	14.8 \pm 4.3	26.8 \pm 8.5
Belowground biomass (g DW m ⁻²)				
	Waiawa	3739.4 \pm 624.1	4575.8 \pm 516.3	2666.7 \pm 789.6
	Pouhala	3551.5 \pm 272.3	3181.8 \pm 818.4	4878.8 \pm 1000.0
% Mud	Waiawa	44.5 \pm 2.8	30.0 \pm 8.9	74.3 \pm 4.6
	Pouhala	22.3 \pm 4.3	69.2 \pm 10.7	87.7 \pm 2.5
% Sand	Waiawa	55.3 \pm 2.8	70.0 \pm 8.9	25.7 \pm 4.6
	Pouhala	77.7 \pm 4.3	30.8 \pm 10.7	12.3 \pm 2.5
% Rubble	Waiawa	0.0 \pm 0.0	0.0 \pm 0.0	0.0 \pm 0.0
	Pouhala	0.0 \pm 0.0	0.0 \pm 0.0	0.0 \pm 0.0
Sandflat				
% Mud	Paiko Lagoon	3.5 \pm 0.1	4.7 \pm 0.2	7.4 \pm 0.3
% Sand	Paiko Lagoon	95.1 \pm 0.2	93.8 \pm 0.3	89.6 \pm 0.4
% Rubble	Paiko Lagoon	1.3 \pm 0.2	1.5 \pm 0.1	3.0 \pm 0.3

Table S3. Presence (+) or absence (-) of each epifaunal taxon found along sampled transects in mangroves and adjacent sandflats. Data are combined for Oahu and Molokai stations. I: introduced species; *: observed in the mangrove forest but not within the sampled transects

Taxon	Mangrove transect			Adjacent sandflat transect		
	8	2	0.5	-0.5	-2	-8
Porifera						
<i>Suberites zeteki</i> (I)	-	+	+	-	-	-
<i>Gelloides fibrosa</i> (I)	-	+	+	-	-	-
<i>Sigmatocia caerulea</i> (I)	-	+	+	-	-	-
Crustacea						
Amphipods (various)	-	-	-	+	+	+
<i>Scylla serrata</i> (I) *	-	-	-	-	-	-
<i>Metapograpsus</i> sp.	+	+	+	+	+	+
<i>Panopeus lacustris</i> (I)	+	+	+	-	-	-
Penaeid shrimp	-	-	-	+	+	-
<i>Balanus reticulatus</i> (I)	+	+	+	-	-	-
<i>Balanus amphitrite</i> (I)	+	+	+	-	-	-
<i>Cthlamalus proteus</i> (I)	+	+	+	-	-	-
Cnidaria						
Medusa	-	-	-	-	+	-
<i>Zooanthus pacificus</i>	+	+	+	-	-	-
Fish						
Goby	-	-	-	+	+	-

Table S4. Comparisons of macrofaunal assemblages from the mangrove and sandflat control transects in Oahu and Molokai. Shown are pairwise analysis of similarities (ANOSIM) probabilities (above the diagonal), percent similarity within habitat (**diagonal**), and between-site percent dissimilarities between sites (below the diagonal). Significance was set at $\alpha = 0.050$

Habitat	Mangrove-Oahu	Sandflat control-Oahu	Mangrove-Molokai	Sandflat control-Molokai
Mangrove-Oahu	50.02	0.002	0.002	0.002
Sandflat control-Oahu	59.52	77.49	0.002	0.002
Mangrove-Molokai	86.79	84.70	33.32	0.002
Sandflat control-Molokai	77.83	84.34	82.46	41.90

Table S5. Mean densities (ind. m⁻²) of macrofaunal taxa (± 1 SE, n = 3) found exclusively in mangrove transects

Taxon	8	Mangrove 2	0.5	-0.5	Adjacent sandflat -2	-8
Oahu						
<i>Pseudopolydora antennata</i>		101 \pm 101				
<i>Potamilla</i> cf. <i>linguicollaris</i>		808 \pm 267	202 \pm 202			
<i>Marionina coatesae</i>	7980 \pm 1654	2424 \pm 631	404 \pm 202			
Phallo-drilinae sp.	707 \pm 562	404 \pm 404				
Chironomidae larvae			303 \pm 303			
Insect sp. C	101 \pm 101					
<i>Metopograpsus</i> sp.		202 \pm 202				
<i>Leptocheilia dubia</i>			101 \pm 101			
Bivalve sp. 1			101 \pm 101	101 \pm 101		
Gammarid sp. A				101 \pm 101		
Insect sp. D						101 \pm 101
<i>Munna</i> sp.				101 \pm 101		
<i>Anatanaeis insularis</i>		2020 \pm 1425	4040 \pm 3312	303 \pm 303		
Molokai						
<i>Aphelocheta molinaris</i>		101 \pm 101				
<i>Monticellina</i> sp. 1			101 \pm 101			
<i>Monticellina</i> sp. 2		5051 \pm 364	404 \pm 404			
<i>Monticellina</i> sp. 3		3737 \pm 1290	101 \pm 101			
<i>Monticellina</i> sp. 4				101 \pm 101		
<i>Monticellina</i> sp. 5	101 \pm 101					
<i>Monticellina</i> sp. 6		101 \pm 101				
<i>Amphiglena mediterranea</i>	303 \pm 175					
<i>Potamilla</i> sp. 3	101 \pm 101	202 \pm 202				
<i>Caraziella reishi</i>	808 \pm 808	1515 \pm 631				
<i>Pseudopolydora corallicola</i>	7374 \pm 2672	1010 \pm 440				
<i>Lumbrineris dentata</i>		101 \pm 101				
<i>Mesochaetopterus sagittarius</i>	101 \pm 101					
<i>Paraonella</i> sp. A	303 \pm 303					
<i>Polydora</i> sp. 1	1010 \pm 404					
Enchytraeidae sp. 2	4040 \pm 3890					
<i>Myriochele oculata</i>		101 \pm 101	2424 \pm 1225		101 \pm 101	
<i>Myriochele</i> sp. 1			3434 \pm 1717	303 \pm 303		
<i>Myriochele</i> sp. 2				202 \pm 202		
<i>Polycirrus</i> sp. 1	101 \pm 101					101 \pm 101
<i>Potamilla</i> cf. <i>linguicollaris</i>	101 \pm 101	101 \pm 101		101 \pm 101		
<i>Pionosyllis spinsetosa</i>				101 \pm 101	707 \pm 707	101 \pm 101
<i>Tectidrilus bori</i>	101 \pm 101	808 \pm 202	11919 \pm 6804	2222 \pm 1927	1313 \pm 534	202 \pm 202
Tubificid sp. 1	101 \pm 101		101 \pm 101	101 \pm 101		101 \pm 101
<i>Eriopisella sechellensis upolu</i>			303 \pm 303	202 \pm 202	101 \pm 101	404 \pm 404
<i>Apseudes</i> n. sp. moniker		101 \pm 101	707 \pm 364	404 \pm 101	202 \pm 202	505 \pm 202
<i>Metopograpsus</i> sp.						101 \pm 101
Crab zoea					101 \pm 101	
Isopod sp. A						101 \pm 101

Table S6. Macrofaunal taxon richness (S , d), Shannon-Weiner diversity index (H'), evenness (J') in introduced and native mangroves. S : number of species per core; $d = S - 1/\log(N)$. Samples were sieved on 0.5 mm mesh sieves. nd: no data available

Location	Introduction status	S	d	J'	H' (\log_2)	Core area (cm^2)	Source
Oahu	Introduced	8.7–16.0	1.43–2.51	0.56–0.65	1.77–2.46	33	Present study
Molokai	Introduced	12.3–16.0	2.57–2.90	0.66–0.71	2.39–2.77	33	Present study
Florida	Native	38–56	4–8	nd	nd	78.5	Sheridan 1997
New Zealand	Native	2.2–5.8	0.97–2.58	nd	nd	78.5	Morrisey et al. 2003
New Zealand	Native	3.0–10.3	1.59–6.03	nd	nd	133	Ellis et al. 2004
India	Native	23–52	1.26–4.5	0.43–1.03	1.34–3.03	400	Kumar 1995

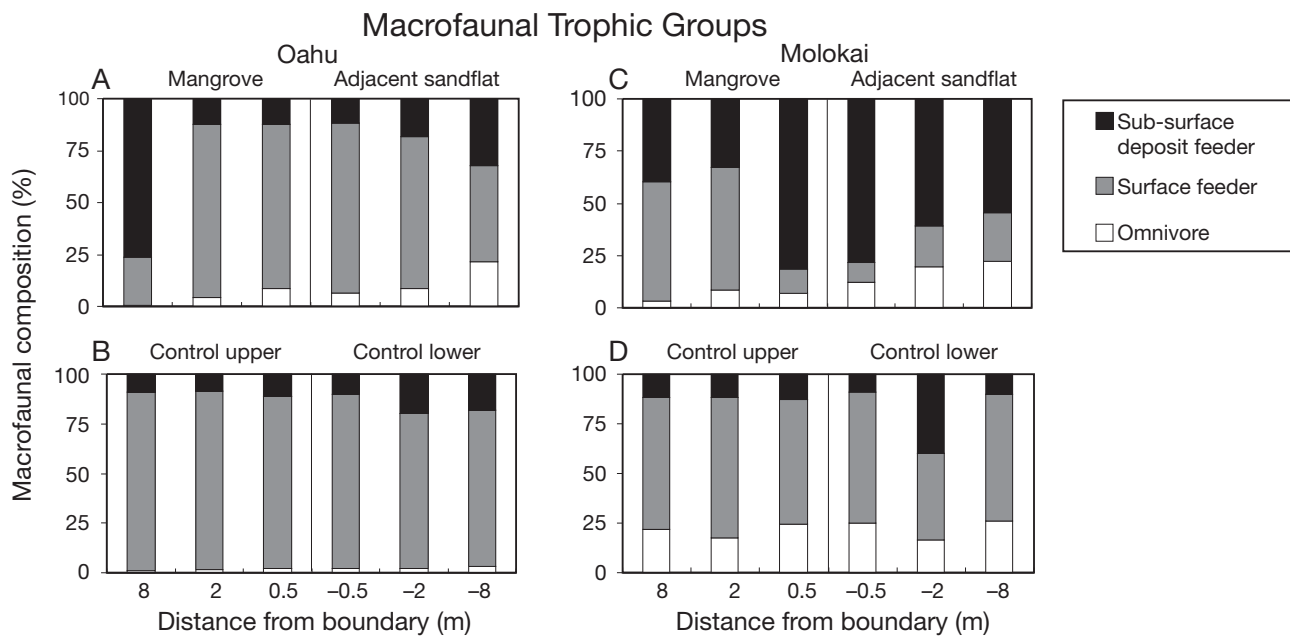


Fig. S1. Percent composition of macrofaunal trophic groups from mangrove, adjacent sandflat and control sandflat transects in (A,B) Oahu and (C,D) Molokai