Supplementary material

Spatial structure and potential processes linking fish and benthic communities in a protected reef ecosystem in SE Brazil

Camila R. Barreto[1]*, Juan P. Quimbayo [2], Thiago C. Mendes[3], Cesar A. M. M. Cordeiro[4], Augusto A. V. Flores[1]

[1]Center of Marine Biology, University of São Paulo, SP, São Sebastião, Brazil.

[2]Department of Evolution, Ecology and Organismal Biology, Ohio University, Columbus, Ohio, United States.

[3] Department of Marine Biology, Universidade Federal Fluminense, Niterói, Brazil.

[4] Universidade Estadual do Norte Fluminense, Campos dos Goytacazes, Rio de Janeiro, Brazil.

*camilarebarreto@hotmail.com

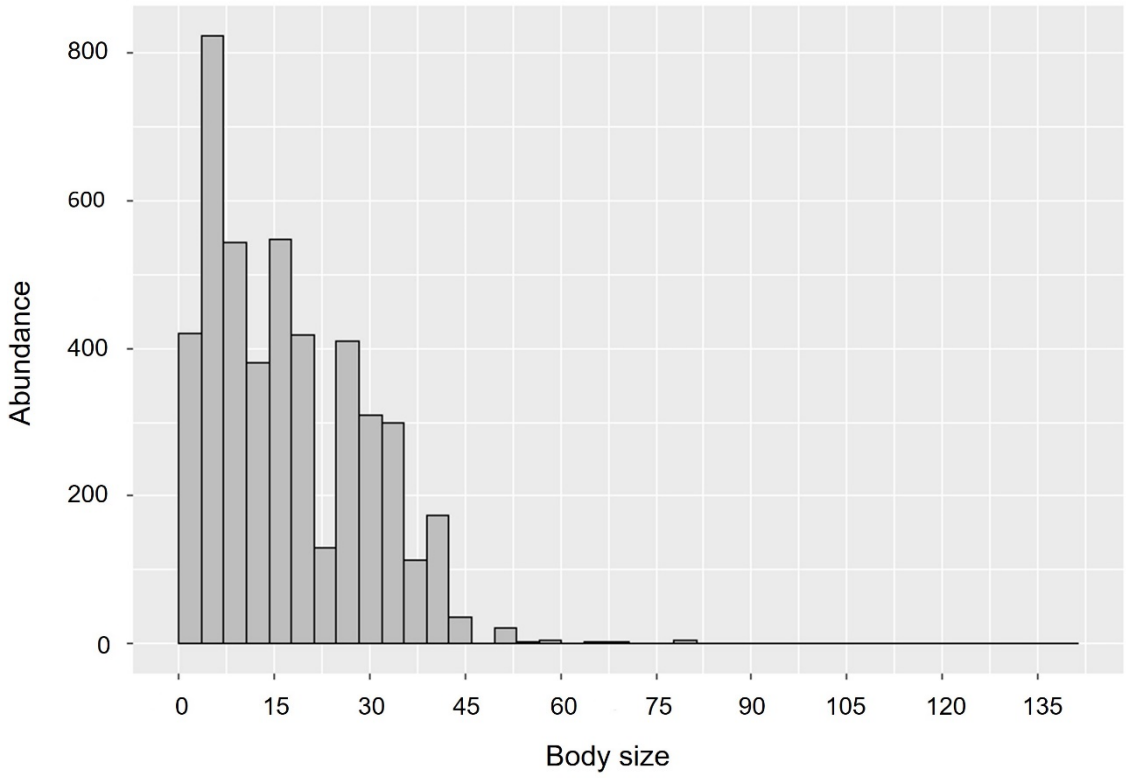

Figure S1. Histogram showing the size-frequency distributions of the whole-sampled of reef fish (in cm) to define classes of functional groups.

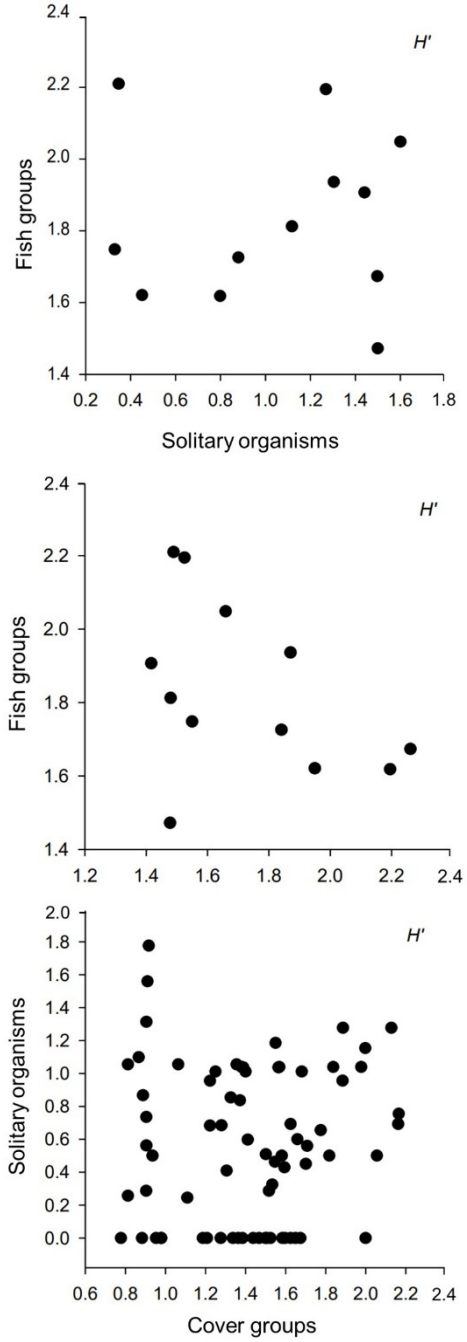

Figure S2. Scatterplots indicating no evident relationships between Shannon diversity indices (H') of solitary organisms, reef-fish and main benthic cover groups.

Table S1. Number of samples for each reef compartment in 2020 and 2021: i) benthic cover transects (15 m), ii) quadrants of solitary organisms (1 m^2) and iii) reef fish transects (20 x 2 m). FU: Saco do Funil, JC: Jardim dos Corais, ESEC: Estação Ecológica Tupinambás. High: above the thermocline, Low: below the thermocline.

	2020						2021						Total
	ESEC		JC		FU		ESEC		JC		FU		
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	
Benthic cover	6	6	6	6	6	6	6	6	6	6	6	6	72
Solitary organisms	30	30	30	30	30	30	30	30	30	30	30	30	360
Reef fish	15	15	15	15	15	15	15	15	15	15	15	15	180

Table S2. Average abundance value, respective standard error, and relative contribution (%) for each functional category of reef fish species (crossing feeding habit and size) at the Alcatrazes Archipelago main island. Only the five most abundant functional groups are shown. The last three columns correspond to Family and Species totals, including other functional groups not specified in this table. MI: mobile-invertebrate feeders, OM: omnivores, PL: planktivores, HD: herbivore-detritivores. Fish size classes follow trophic groups.

		MI_0-14			MI_15-23			OM_0-14			PL_0-14			HD_0-14			total		
Family	**Species**	**mean**	**sd**	**%**	**mean**	**sd**	**%**	**mean**	**sd**	**%**	**mean**	**sd**	**%**	**mean**	**sd**	**%**	**mean**	**sd**	**%**
Acanthuridae														0.11	0.52	0.08	2.22	8.16	0.02
	Acanthurus bahianus													0.05	0.22	0.03	0.27	2.23	0.00
	Acanthurus chirurgus													0.06	0.41	0.04	1.96	6.73	0.01
Balistidae																	0.11	0.53	0.00
	Canthidermis maculata																0.11	0.53	0.00
Blenniidae		3.50	4.05	2.38				0.13	0.47	0.09							3.63	4.52	0.02
	Hypleurochilus fissicornis							0.13	0.47	0.09							0.13	0.47	0.00
	Parablennius marmoreus	1.13	2.05	0.77													1.13	2.05	0.01
	Parablennius pilicornis	2.37	3.61	1.61													2.37	3.61	0.02
Bothidae					0.02	0.13	0.01										0.02	0.13	0.00
	Bothus ocellatus				0.02	0.13	0.01										0.02	0.13	0.00
Callionymidae		0.01	0.11	0.01													0.01	0.11	0.00
	Callionymus bairdi	0.01	0.11	0.01													0.01	0.11	0.00
Carangidae											3.86	18.02	2.63				4.51	21.10	0.03
	Caranx crysos																0.06	0.55	0.00
	Caranx latus																0.19	1.16	0.00
	Decapterus macarellus										3.86	18.02	2.63				3.86	18.02	0.03
	Pseudocaranx dentex																0.14	1.07	0.00
	Seriola lalandi																0.01	0.15	0.00
	Seriola rivoliana																0.23	1.84	0.00
	Trachinotus falcatus																0.01	0.07	0.00

Chaenopsidae		0.29	0.97	0.20										0.29	0.97	0.00
	Emblemariopsis signifer	0.29	0.97	0.20										0.29	0.97	0.00
Chaetodontidae														0.27	0.94	0.00
	Chaetodon striatus													0.27	0.94	0.00
Clupeidae										6.22	68.97	4.23		6.22	68.97	0.04
	Harengula clupeola									6.22	68.97	4.23		6.22	68.97	0.04
Ephippidae														0.25	1.61	0.00
	Chaetodipterus faber													0.25	1.61	0.00
Gobiidae		1.53	2.51	1.04				9.35	12.10	6.36				10.88	14.60	0.07
	Bathygobius soporator	0.03	0.27	0.02										0.03	0.27	0.00
	Coryphopterus glaucofraenum							6.76	10.21	4.60				6.76	10.21	0.05
	Coryphopterus sp.							2.46	8.35	1.67				2.46	8.35	0.02
	Ctenogobius saepepallens	0.10	0.44	0.07										0.10	0.44	0.00
	Elacatinus figaro	1.41	2.43	0.96										1.41	2.43	0.01
	Gnatholepis thompsoni							0.13	0.48	0.09				0.13	0.48	0.00
Haemulidae		33.15	42.39	22.55	38.34	41.67	26.08							73.33	88.45	0.50
	Anisotremus surinamensis				0.02	0.15	0.02							0.13	0.68	0.00
	Anisotremus virginicus	0.14	1.64	0.09	0.37	1.87	0.25							1.30	5.34	0.01
	Haemulon aurolineatum	32.98	42.45	22.43	37.48	40.88	25.49							71.08	87.25	0.48
	Haemulon plumierii	0.01	0.15	0.01										0.09	0.58	0.00
	Haemulon atlanticus	0.02	0.13	0.01	0.48	2.80	0.32							0.73	3.61	0.00
	Orthopristis ruber	0.01	0.07	0.00										0.01	0.07	0.00
Holocentridae		0.31	3.73	0.21	0.52	1.86	0.35							3.56	12.37	0.02
	Holocentrus adscensionis	0.31	3.73	0.21	0.52	1.86	0.35							3.56	12.37	0.02
Kyphosidae														1.83	9.09	0.01
	Kyphosus sectatrix													0.83	7.71	0.01
	Kyphosus vaigiensis													1.01	3.34	0.01

Labridae		0.63	0.99	0.43	0.82	1.21	0.56	2.58	6.15	0.02
	Bodianus pulchellus	0.01	0.11	0.01	0.14	0.41	0.09	0.28	1.05	0.00
	Bodianus rufus	0.01	0.07	0.00	0.12	0.48	0.08	0.45	1.46	0.00
	Clepticus brasiliensis							0.03	0.38	0.00
	Halichoeres brasiliensis	0.21	0.66	0.14	0.32	0.72	0.22	1.15	4.69	0.01
	Halichoeres dimidiatus							0.01	0.11	0.00
	Halichoeres poeyi	0.41	0.75	0.28	0.21	0.56	0.14	0.63	1.39	0.00
	Halichoeres sazimai				0.02	0.22	0.01	0.02	0.22	0.00
	Thalassoma noronhanum				0.01	0.15	0.01	0.01	0.15	0.00
Labrisomidae		1.96	2.32	1.33	0.01	0.11	0.01	1.97	2.43	0.01
	Gobioclinus kalisherae	0.11	0.38	0.08				0.11	0.38	0.00
	Labrisomus nuchipinnis	0.15	0.40	0.10	0.01	0.11	0.01	0.16	0.51	0.00
	Malacoctenus delalandii	0.54	1.04	0.37				0.54	1.04	0.00
	Paraclinus marmoratus	1.13	2.05	0.77				1.13	2.05	0.01
	Paraclinus spectator	0.02	0.17	0.01				0.02	0.17	0.00
Lutjanidae		0.54	3.01	0.37	0.34	2.18	0.23	1.06	6.04	0.01
	Lutjanus analis							0.10	0.53	0.00
	Rhomboplites aurorubens	0.54	3.01	0.37	0.34	2.18	0.23	0.96	5.72	0.01
Malacanthidae								0.11	0.47	0.00
	Malacanthus plumieri							0.11	0.47	0.00
Monacanthidae								0.29	1.07	0.00
	Cantherhines macrocerus							0.11	0.53	0.00
	Cantherhines pullus							0.19	0.67	0.00
Mugilidae								0.09	0.73	0.00
	Mugil curema							0.09	0.73	0.00
Mullidae		0.20	0.66	0.14	0.34	1.51	0.23	0.74	3.86	0.01
	Pseudupeneus maculatus	0.20	0.66	0.14	0.34	1.51	0.23	0.74	3.86	0.01
Muraenidae								0.06	0.23	0.00

	Gymnothorax moringa																0.06	0.23	0.00
Ogcocephalidae					0.01	0.07	0.00										0.01	0.15	0.00
	Ogcocephalus vespertilio				0.01	0.07	0.00										0.01	0.15	0.00
Ophichthidae																	0.01	0.11	0.00
	Myrichthys ocellatus																0.01	0.11	0.00
Ostraciidae																	0.02	0.24	0.00
	Acanthostracion polygonius																0.02	0.24	0.00
Pempheridae											0.84	5.19	0.57				1.16	7.13	0.01
	Pempheris schomburgkii										0.84	5.19	0.57				1.16	7.13	0.01
Pomacanthidae																	1.57	3.07	0.01
	Holacanthus ciliaris																0.01	0.07	0.00
	Holacanthus tricolor																0.03	0.16	0.00
	Pomacanthus paru																1.54	3.01	0.01
Pomacentridae		0.07	0.33	0.05				9.05	13.87	6.15	0.96	4.08	0.65	5.65	8.89	3.84	23.78	45.88	0.16
	Abudefduf saxatilis							9.05	13.87	6.15							13.88	21.27	0.09
	Chromis jubauna										0.23	1.70	0.15				0.23	1.70	0.00
	Chromis limbata										0.02	0.18	0.02				0.02	0.18	0.00
	Azurina multilineata										0.71	3.67	0.48				1.76	9.45	0.01
	Stegastes fuscus													5.54	8.75	3.77	7.72	14.27	0.05
	Stegastes pictus	0.07	0.33	0.05													0.07	0.33	0.00
	Stegastes variabilis													0.11	0.68	0.08	0.11	0.68	0.00
Pomatomidae																	0.01	0.07	0.00
	Pomatomus saltatrix																0.01	0.07	0.00
Scaridae														0.89	2.68	0.60	1.87	5.30	0.01
	Cryptotomus roseus													0.19	0.95	0.13	0.19	0.95	0.00
	Scarus zelindae													0.01	0.15	0.01	0.23	1.53	0.00
	Sparisoma amplum													0.03	0.25	0.02	0.07	0.61	0.00
	Sparisoma axillare													0.22	1.01	0.15	0.58	2.18	0.00

	Sparisoma frondosum												0.01	0.11	0.01	0.31	1.29	0.00
	Sparisoma radians												0.02	0.24	0.02	0.02	0.24	0.00
	Sparisoma sp.												0.38	2.16	0.26	0.38	2.16	0.00
	Sparisoma tuiupiranga												0.02	0.18	0.02	0.08	0.51	0.00
Sciaenidae		0.46	3.12	0.31	0.38	1.33	0.26									0.93	5.23	0.01
	Equetus lanceolatus	0.01	0.11	0.01												0.01	0.11	0.00
	Odontoscion dentex	0.29	3.06	0.20	0.37	1.32	0.25									0.76	5.17	0.01
	Pareques lineatus	0.15	0.47	0.10	0.01	0.15	0.01									0.16	0.62	0.00
Serranidae		0.02	0.18	0.02	0.03	0.26	0.02									0.67	2.92	0.00
	Epinephelus marginatus				0.03	0.26	0.02									0.21	0.93	0.00
	Mycteroperca acutirostris															0.43	1.80	0.00
	Rypticus saponaceus															0.01	0.07	0.00
	Serranus baldwini	0.02	0.17	0.01												0.02	0.17	0.00
	Serranus flaviventris	0.01	0.07	0.00												0.01	0.07	0.00
Sparidae					0.01	0.11	0.01	0.30	1.53	0.20						2.63	9.64	0.02
	Calamus penna				0.01	0.11	0.01									0.24	1.42	0.00
	Diplodus argenteus							0.30	1.53	0.20						2.39	8.22	0.02
Sphyraenidae																0.01	0.15	0.00
	Sphyraena guachancho															0.01	0.15	0.00
Synodontidae																0.12	0.69	0.00
	Synodus intermedius															0.01	0.15	0.00
	Synodus synodus															0.11	0.66	0.00
Tetraodontidae		0.12	0.46	0.08												0.21	0.86	0.00
	Canthigaster figueiredoi	0.12	0.46	0.08												0.12	0.46	0.00
	Sphoeroides camila															0.08	0.38	0.00
	Sphoeroides testudineus															0.01	0.07	0.00
Total		42.81	72.01	29.11	40.82	55.92	27.76	18.83	34.91	12.80	11.89	97.72	8.09	6.65	15.09	4.52	147.04	369.40	1.00

Table S3. SIMPER analyses results showing the relative contribution (%) of each benthic cover group to pairwise differences between sites in year and depth combinations with significant dissimilarity. ESEC: Estação Ecológica Tupinambás, FU: Saco do Funil, JC: Jardim dos Corais. Bare: Bare rock, Can Oth: Other canopy macroalgae, Can Sar: Canopy *Sargassum* spp, Cor Mad: Coral *Madracis decactis*, Cor Mus: coral *Mussismilia hispida*, Enc: Encrusting macroalgae, Ere Oth: Other erect macroalgaee, Ere Sar: *Sargassum* spp. Erect, Sand: Turf Art: Artculate turf, Tur Fil: Filamentous algae turf, Zoa Pal: Zoanthid *Palythoa caribaeorum*.

2020 High
FU vs ESEC - average dissimilarity = 54.91%

Group	Av. dissim	Contrib. %	Cumulative %	Mean ESEC	Mean FU
Zoa Pal	18.61	33.90	33.90	0.00	37.20
Can Sar	16.30	29.68	63.57	45.00	17.80
Tur Art	6.85	12.48	76.05	32.80	24.40
Tur Fil	3.89	7.08	83.14	2.78	7.78
Cor Mus	2.78	5.06	88.20	6.67	1.67
Enc	2.78	5.06	93.25	6.11	6.67
Ere Oth	1.94	3.54	96.80	3.33	3.89
Ere Sar	0.93	1.69	98.48	1.67	0.56
Cor Mad	0.56	1.01	99.49	1.11	0.00
Bare	0.28	0.51	100.00	0.56	0.00
Sand	0.00	0.00	100.00	0.00	0.00
Can Oth	0.00	0.00	100.00	0.00	0.00

2020 High
FU vs JC - average dissimilarity = 55.44%

Group	Av. dissim	Contrib. %	Cumulative %	Mean JC	Mean FU
Zoa Pal	18.61	33.57	33.57	0.00	37.20
Can Sar	13.44	24.25	57.82	35.30	17.80
Tur Art	7.67	13.83	71.64	35.30	24.40
Cor Mus	4.83	8.72	80.36	11.30	1.67
Tur Fil	3.67	6.61	86.97	1.33	7.78
Enc	3.67	6.61	93.59	10.00	6.67
Ere Oth	1.83	3.31	96.89	3.33	3.89
Ere Sar	1.39	2.51	99.40	2.67	0.56
Bare	0.33	0.60	100.00	0.67	0.00
Sand	0.00	0.00	100.00	0.00	0.00
Cor Mad	0.00	0.00	100.00	0.00	0.00
Can Oth	0.00	0.00	100.00	0.00	0.00

2021 High
JC vs ESEC - average dissimilarity = 59.17%

Group	Av. dissim	Contrib. %	Cumulative %	Mean ESEC	Mean JC
Zoa Pal	22.78	38.50	38.50	47.20	1.67
Tur Art	18.98	32.08	70.58	26.70	64.40
Cor Mus	4.17	7.04	77.62	3.89	9.44
Enc	3.80	6.42	84.04	6.11	6.67
Ere Sar	2.78	4.70	88.73	4.44	3.33
Tur Fil	2.59	4.38	93.11	8.89	5.56
Ere Oth	1.39	2.35	95.46	1.67	3.89
Can Sar	0.93	1.57	97.03	0.56	1.67
Bare	0.65	1.10	98.12	0.56	1.11
Sand	0.56	0.94	99.06	0.00	1.11
Can Oth	0.56	0.94	100.00	0.00	1.11
Cor Mad	0.00	0.00	100.00	0.00	0.00

2021 High
FU vs JC - average dissimilarity = 52.22%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
Tur Art	17.87	34.22	34.22	30.00	64.40
Zoa Pal	15.65	29.96	64.18	32.80	1.67
Enc	4.54	8.69	72.87	7.78	6.67
Cor Mus	4.35	8.33	81.21	8.89	9.44
Ere Sar	2.78	5.32	86.52	5.56	3.33
Tur Fil	2.13	4.08	90.60	8.33	5.56
Ere Oth	1.67	3.19	93.79	4.44	3.89
Sand	1.02	1.95	95.74	1.67	1.11
Can Sar	0.83	1.60	97.34	0.00	1.67
Bare	0.56	1.06	98.40	0.00	1.11
Can Oth	0.56	1.06	99.47	0.00	1.11
Cor Mad	0.28	0.53	100.00	0.56	0.00

2020 Low
FU vs ESEC - average dissimilarity = 60.00%

Group	Av. dissim	Contrib. %	Cumulative %	Mean ESEC	Mean FU
Can Sar	24.07	40.12	40.12	61.10	13.30
Tur Art	10.09	16.82	56.94	7.78	25.00
Ere Oth	5.74	9.57	66.51	8.89	16.10
Cor Mus	5.65	9.41	75.93	5.00	14.40
Tur Fil	3.89	6.48	82.41	6.67	8.33
Ere Sar	3.89	6.48	88.89	2.22	7.78
Enc	2.78	4.63	93.52	7.22	7.22
Zoa Pal	2.50	4.17	97.69	0.00	5.00
Cor Mad	0.83	1.39	99.07	1.11	1.67
Bare	0.28	0.46	99.54	0.00	0.56
Can Oth	0.28	0.46	100.00	0.00	0.56
Sand	0.00	0.00	100.00	0.00	0.00

2020 Low
FU vs JC - average dissimilarity = 59.00%

Group	Av. dissim	Contrib. %	Cumulative %	Mean JC	Mean FU
Can Sar	23.67	40.11	40.11	60.70	13.30
Tur Art	9.28	15.72	55.84	10.70	25.00
Ere Oth	5.83	9.89	65.73	7.33	16.10
Cor Mus	4.78	8.10	73.82	8.67	14.40
Ere Sar	4.11	6.97	80.79	1.33	7.78
Tur Fil	3.61	6.12	86.91	5.33	8.33
Enc	3.17	5.37	92.28	4.00	7.22
Zoa Pal	2.50	4.24	96.52	0.00	5.00
Cor Mad	1.50	2.54	99.06	2.00	1.67
Bare	0.28	0.47	99.53	0.00	0.56
Can Oth	0.28	0.47	100.00	0.00	0.56
Sand	0.00	0.00	100.00	0.00	0.00

2021 Low
JC vs ESEC - average dissimilarity = 46.39%

Group	Av. dissim	Contrib. %	Cumulative %	Mean JC	Mean ESEC
Ere Sar	10.83	23.35	23.35	28.90	8.89
Sand	7.04	15.17	38.52	10.00	13.90
Tur Art	6.30	13.57	52.10	29.40	20.60
Tur Fil	5.83	12.57	64.67	7.78	17.20
Can Sar	4.82	10.38	75.05	7.22	15.00
Enc	3.52	7.59	82.63	2.22	7.78
Ere Oth	3.33	7.19	89.82	11.70	7.78
Cor Mus	2.50	5.39	95.21	0.56	5.00
Can Oth	1.11	2.40	97.60	2.22	1.67
Zoa Pal	0.83	1.80	99.40	0.00	1.67

Cor Mad	0.28	0.60	100.00	0.00	0.56
Bare	0.00	0.00	100.00	0.00	0.00

2021 Low

FU vs JC - average dissimilarity = 59.63%

Group	Av. dissim	Contrib. %	Cumulative %	Mean JC	Mean FU
Tur Fil	13.70	22.98	22.98	7.78	33.90
Ere Sar	11.85	19.88	42.86	28.90	5.56
Tur Art	11.30	18.94	61.80	29.40	23.90
Sand	7.78	13.04	74.84	10.00	15.60
Ere Oth	3.52	5.90	80.75	11.70	5.00
Can Sar	3.33	5.59	86.34	7.22	1.67
Cor Mus	2.96	4.97	91.30	0.56	6.11
Enc	1.67	2.80	94.10	2.22	2.78
Cor Mad	1.39	2.33	96.43	0.00	2.78
Can Oth	1.30	2.17	98.60	2.22	1.11
Zoa Pal	0.83	1.40	100.00	0.00	1.67
Bare	0.00	0.00	100.00	0.00	0.00

Table S4. SIMPER analyses results showing the relative contribution (%) of each solitary organism to pairwise differences between sites in year and depth combinations with significant dissimilarity. ESEC: Estação Ecológica Tupinambás, FU: Saco do Funil, JC: Jardim dos Corais.

2020 High

FU vs. ESEC - average dissimilarity 67.83%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean ESEC
urchins	47.08	69.40	69.40	9.40	1.87
ascidians	8.66	12.76	82.17	1.37	0.97
snails	8.00	11.80	93.97	1.10	0.07
crabs	1.21	1.78	95.75	0.07	0.13
anemones	0.98	1.44	97.19	0.20	0.00
seastars	0.88	1.30	98.49	0.00	0.13
cucumbers	0.59	0.87	99.36	0.00	0.07
hermits	0.29	0.43	99.79	0.00	0.03
bivalves	0.14	0.21	100.00	0.03	0.00
nudibranchs	0.00	0.00	100.00	0.00	0.00

2021 High

FU vs. JC - average dissimilarity 44.14%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
urchins	25.54	57.86	57.86	5.80	6.27
ascidians	11.69	26.48	84.35	1.80	1.37
snails	5.98	13.54	97.88	0.87	0.77
anemones	0.49	1.11	98.99	0.00	0.07
seastars	0.28	0.64	99.63	0.00	0.03
crabs	0.16	0.37	100.00	0.00	0.03
nudibranchs	0.00	0.00	100.00	0.00	0.00

hermits	0.00	0.00	100.00	0.00	0.00
bivalves	0.00	0.00	100.00	0.00	0.00
cucumbers	0	0	100	0	0

2021 High

JC vs. ESEC - average dissimilarity

Group	Av. dissim	Contrib. %	Cumulative %	Mean ESEC	Mean JC
urchins	39.71	63.47	63.47	2.80	6.27
ascidians	13.09	20.92	84.39	0.77	1.37
snails	6.66	10.64	95.03	0.00	0.77
hermits	1.00	1.60	96.63	0.10	0.00
anemones	0.75	1.20	97.83	0.00	0.07
crabs	0.71	1.14	98.97	0.07	0.03
seastars	0.64	1.03	100.00	0.03	0.03
nudibranchs	0.00	0.00	100.00	0.00	0.00
bivalves	0.00	0.00	100.00	0.00	0.00
cucumbers	0.00	0.00	100.00	0.00	0.00

2020 Low

FU vs. JC - average dissimilarity 75.74%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
urchins	35.30	46.61	46.61	3.50	0.57
ascidians	28.09	37.09	83.70	1.97	0.57
snails	4.37	5.77	89.47	0.37	0.07
hermits	2.67	3.53	93.00	0.27	0.03
crabs	2.16	2.86	95.85	0.03	0.13
seastars	1.27	1.68	97.53	0.03	0.07
cucumbers	1.01	1.34	98.87	0.00	0.07
nudibranchs	0.86	1.13	100.00	0.03	0.00
bivalves	0.00	0.00	100.00	0.00	0.00
anemones	0.00	0.00	100.00	0.00	0.00

2020 Low

FU vs. ESEC - average dissimilarity 79.79%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean ESEC
urchins	38.09	47.74	47.74	3.50	0.17
ascidians	26.76	33.54	81.28	1.97	0.40
snails	5.51	6.90	88.19	0.37	0.20
seastars	2.66	3.33	91.52	0.03	0.17
hermits	2.55	3.19	94.71	0.27	0.00
crabs	2.23	2.80	97.51	0.03	0.13
nudibranchs	0.88	1.10	98.60	0.03	0.00
cucumbers	0.59	0.74	99.34	0.00	0.03
bivalves	0.52	0.66	100.00	0.00	0.03
anemones	0	0	100	0	0

2021 Low
JC vs. FU - average dissimilarity 72.84%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
urchins	39.1	53.6	53.6	4.6	1.6
ascidians	25.6	35.2	88.8	2.4	0.5
crabs	2.7	3.7	92.4	0.2	0.1
hermits	2.5	3.4	95.8	0.0	0.2
snails	1.7	2.4	98.2	0.1	0.0
seastars	0.9	1.2	99.4	0.0	0.1
anemones	0.5	0.6	100.0	0.0	0.0
nudibranchs	0.0	0.0	100.0	0.0	0.0
bivalves	0.0	0.0	100.0	0.0	0.0
cucumbers	0.0	0.0	100.0	0.0	0.0

2021 Low
FU vs. ESEC - average dissimilarity 63.45%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean ESEC
urchins	29.82	47.00	47.00	4.63	1.43
ascidians	25.57	40.30	87.29	2.37	0.30
crabs	3.26	5.14	92.43	0.20	0.23
snails	1.66	2.61	95.04	0.13	0.03
hermits	1.59	2.51	97.55	0.03	0.13
cucumbers	0.74	1.16	98.71	0.00	0.07
anemones	0.46	0.72	99.43	0.03	0.00
seastars	0.36	0.57	100.00	0.00	0.03
nudibranchs	0.00	0.00	100.00	0.00	0.00
bivalves	0.00	0.00	100.00	0.00	0.00

2021 Low
JC vs. ESEC - average dissimilarity

Group	Av. dissim	Contrib. %	Cumulative %	Mean JC	Mean ESEC
urchins	33.7	55.0	55.0	1.6	1.4
ascidians	10.8	17.7	72.7	0.5	0.3
crabs	6.2	10.1	82.8	0.1	0.2
hermits	6.2	10.1	92.8	0.2	0.1
seastars	2.2	3.6	96.4	0.1	0.0
cucumbers	1.6	2.5	99.0	0.0	0.1
snails	0.6	1.1	100.0	0.0	0.0
nudibranchs	0.0	0.0	100.0	0.0	0.0
bivalves	0.0	0.0	100.0	0.0	0.0
anemones	0.0	0.0	100.0	0.0	0.0

Table S5. SIMPER analyses results showing the relative contribution (%) of each functional group reef fish to pairwise differences between sites in year and depth combinations with significant dissimilarity. ESEC: Estação Ecológica Tupinambás, FU: Saco do Funil, JC: Jardim dos Corais. HD: herbivore-detritivores MI: mobile-invertebrate feeders, OM: omnivores, PL: planktivores, SI: sessile invertebrate carnivores, PI: piscivores. Fish size classes follow trophic groups.

2020 High

FU vs. JC - average dissimilarity 57.73%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
MI (15-23)	11.70	20.26	20.26	20.90	41.60
MI (0-14)	8.60	14.89	35.15	33.30	27.40
OM (0-14)	6.49	11.24	46.39	21.80	28.10
PL (0-14)	6.22	10.77	57.17	1.07	65.50
MI (24-35)	4.57	7.92	65.09	4.73	14.50
HD (0-14)	3.71	6.42	71.51	7.13	9.07
HD (15-23)	3.43	5.94	77.45	10.70	2.73
OM (15-23)	3.24	5.61	83.05	8.80	10.40
PL (15-23)	2.68	4.65	87.70	0.47	6.40
HD (24-35)	2.06	3.57	91.27	1.20	8.07
HD (>35)	0.72	1.25	92.52	0.73	1.93
MI (>35)	0.71	1.23	93.75	0.33	1.87
OM (24-35)	0.54	0.94	94.69	0.13	1.40
MA (24-35)	0.52	0.90	95.59	0.13	1.27
SI (24-35)	0.50	0.86	96.45	1.00	1.47
SI (>35)	0.40	0.69	97.14	0.33	1.00
SI (0-14)	0.35	0.61	97.75	0.53	1.00
SI (15-23)	0.31	0.54	98.29	0.47	0.60
PI (24-35)	0.25	0.43	98.72	0.13	0.67
MA (>35)	0.25	0.43	99.14	0.13	0.53
PI (15-23)	0.19	0.32	99.46	0.13	0.47
MA (15-23)	0.15	0.26	99.73	0.40	0.00
PI (>35)	0.14	0.24	99.97	0.27	0.20
PI (0-14)	0.02	0.03	100.00	0.00	0.07
OM (>35)	0.00	0.00	100.00	0.00	0.00
PL (24-35)	0.00	0.00	100.00	0.00	0.00

2020 High

FU vs. ESEC - average dissimilarity 53.29%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean ESEC
MI (0-14)	11.28	21.18	21.18	33.30	39.40
MI (15-23)	10.88	20.41	41.59	20.90	36.30
OM (0-14)	8.67	16.28	57.86	21.80	30.90
HD (15-23)	3.80	7.14	65.00	10.70	11.10
OM (15-23)	3.18	5.97	70.97	8.80	10.20
HD (0-14)	2.79	5.23	76.20	7.13	5.00
MI (24-35)	2.60	4.88	81.08	4.73	6.73
MA (15-23)	2.45	4.59	85.67	0.40	5.40
HD (24-35)	1.60	3.00	88.67	1.20	4.67
PL (0-14)	1.14	2.13	90.80	1.07	2.53
PL (15-23)	0.76	1.42	92.22	0.47	1.87
MA (24-35)	0.65	1.22	93.44	0.13	1.60
MI (>35)	0.48	0.91	94.35	0.33	1.27
SI (0-14)	0.39	0.72	95.07	0.53	0.93
SI (24-35)	0.38	0.72	95.79	1.00	0.60
MA (>35)	0.37	0.69	96.49	0.13	0.93
PI (24-35)	0.34	0.64	97.13	0.13	0.93
HD (>35)	0.34	0.63	97.76	0.73	0.40
SI (>35)	0.33	0.62	98.38	0.33	0.80
OM (24-35)	0.27	0.50	98.88	0.13	0.67
SI (15-23)	0.26	0.49	99.36	0.47	0.33
PI (>35)	0.13	0.24	99.60	0.27	0.13
PL (24-35)	0.12	0.23	99.84	0.00	0.33
PI (15-23)	0.09	0.16	100.00	0.13	0.13
OM (>35)	0.00	0.00	100.00	0.00	0.00
PI (0-14)	0.00	0.00	100.00	0.00	0.00

2021 High
FU vs. JC - average dissimilarity 54.90%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
MI (0-14)	23.33	42.50	42.50	72.40	43.10
MI (15-23)	6.84	12.45	54.95	19.70	22.30
HD (0-14)	6.34	11.54	66.50	14.40	7.07
OM (0-14)	6.10	11.12	77.61	16.10	12.30
OM (15-23)	3.18	5.80	83.41	8.20	4.07
MI (24-35)	2.21	4.03	87.44	5.13	4.93
PL (0-14)	2.13	3.88	91.32	4.40	0.13
SI (24-35)	0.61	1.12	92.43	1.53	0.60
HD (24-35)	0.47	0.86	93.29	0.73	0.80
MI (>35)	0.45	0.83	94.12	0.40	0.80
OM (24-35)	0.45	0.81	94.93	0.93	0.60
SI (0-14)	0.43	0.79	95.72	0.27	1.00
PI (24-35)	0.36	0.66	96.38	0.53	0.53
MA (24-35)	0.35	0.64	97.02	0.33	0.80
SI (15-23)	0.32	0.58	97.60	0.33	0.67
MA (15-23)	0.27	0.50	98.10	0.07	0.60
SI (>35)	0.25	0.45	98.55	0.27	0.60
HD (>35)	0.25	0.45	99.00	0.53	0.13
HD (15-23)	0.18	0.33	99.33	0.13	0.33
PI (>35)	0.10	0.18	99.51	0.20	0.07
PI (15-23)	0.10	0.18	99.69	0.13	0.13
MA (>35)	0.08	0.15	99.83	0.07	0.13
PL (15-23)	0.06	0.12	99.95	0.20	0.00
PI (0-14)	0.03	0.05	100.00	0.07	0.00
OM (>35)	0.00	0.00	100.00	0.00	0.00
PL (24-35)	0.00	0.00	100.00	0.00	0.00

2021 High
JC vs ESEC - average dissimilarity 53.31%

Group	Av. dissim	Contrib. %	Cumulative %	Mean JC	Mean ESEC
MI (0-14)	21.21	39.78	39.78	43.10	80.90
MI (15-23)	8.52	15.98	55.76	22.30	31.30
OM (0-14)	5.97	11.21	66.96	12.30	22.10
HD (0-14)	4.93	9.26	76.22	7.07	15.70
OM (15-23)	3.56	6.68	82.90	4.07	10.10
PL (0-14)	3.15	5.91	88.81	0.13	9.00
MI (24-35)	1.47	2.75	91.56	4.93	3.00
PI (24-35)	0.51	0.95	92.51	0.53	0.93
SI (24-35)	0.48	0.91	93.42	0.60	1.20
MA (24-35)	0.48	0.89	94.31	0.80	0.93
MI (>35)	0.42	0.78	95.09	0.80	0.47
SI (0-14)	0.41	0.77	95.87	1.00	0.53
HD (24-35)	0.37	0.69	96.56	0.80	0.47

MA (15-23)	0.36	0.68	97.24	0.60	0.53
SI (15-23)	0.33	0.62	97.85	0.67	0.47
HD (15-23)	0.23	0.43	98.29	0.33	0.40
OM (24-35)	0.22	0.42	98.71	0.60	0.07
SI (>35)	0.22	0.41	99.12	0.60	0.33
HD (>35)	0.14	0.27	99.39	0.13	0.27
PI (>35)	0.12	0.23	99.62	0.07	0.33
PI (15-23)	0.09	0.17	99.78	0.13	0.13
MA (>35)	0.07	0.14	99.92	0.13	0.07
PL (15-23)	0.04	0.08	100.00	0.00	0.13
OM (>35)	0.00	0.00	100.00	0.00	0.00
PL (24-35)	0.00	0.00	100.00	0.00	0.00
PI (0-14)	0.00	0.00	100.00	0.00	0.00

2020 Low

FU vs. JC - average dissimilarity 52.74%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
MI (15-23)	20.2	38.3	38.3	48.9	82.3
MI (0-14)	6.7	12.7	51.0	14.5	16.1
OM (0-14)	5.6	10.7	61.6	18.6	12.1
PL (0-14)	4.9	9.2	70.9	0.1	21.9
MI (24-35)	2.9	5.5	76.4	6.6	7.8
HD (0-14)	2.3	4.3	80.7	4.3	5.3
OM (15-23)	2.0	3.7	84.4	2.4	4.3
HD (15-23)	1.4	2.6	87.0	2.2	2.2
MI (>35)	1.2	2.2	89.2	0.7	2.5
HD (24-35)	1.0	1.8	91.0	0.1	3.0
PL (15-23)	0.7	1.4	92.4	0.0	1.8
PI (>35)	0.6	1.2	93.5	0.4	1.3
HD (>35)	0.5	0.9	94.4	0.2	1.1
PI (24-35)	0.4	0.8	95.3	0.1	1.3
SI (24-35)	0.4	0.8	96.1	0.5	1.1
OM (24-35)	0.4	0.7	96.8	0.1	1.0
SI (>35)	0.4	0.7	97.5	0.3	0.8
SI (15-23)	0.4	0.7	98.2	0.0	0.9
SI (0-14)	0.3	0.6	98.8	0.3	0.5
MA (>35)	0.3	0.5	99.3	0.3	0.6
MA (24-35)	0.2	0.3	99.7	0.0	0.5
PI (15-23)	0.1	0.2	99.8	0.1	0.1
MA (15-23)	0.1	0.1	99.9	0.0	0.2
PI (0-14)	0.0	0.0	100.0	0.1	0.0
OM (>35)	0.0	0.0	100.0	0.0	0.1
PL (24-35)	0.0	0.0	100.0	0.0	0.0

2020 Low

FU vs. ESEC - average dissimilarity 52.13%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean ESEC
MI (15-23)	24.17	46.36	46.36	48.90	98.30
OM (0-14)	6.92	13.27	59.63	18.60	12.70
MI (0-14)	5.92	11.36	70.99	14.50	8.27
MI (24-35)	2.82	5.41	76.40	6.60	7.00
HD (24-35)	2.51	4.81	81.21	0.13	6.80
HD (0-14)	1.85	3.56	84.77	4.27	3.20
PL (15-23)	1.53	2.94	87.70	0.00	5.13
HD (15-23)	1.12	2.14	89.85	2.20	0.73
OM (15-23)	0.98	1.89	91.74	2.40	0.67
PL (0-14)	0.72	1.39	93.13	0.13	1.73
MI (>35)	0.61	1.18	94.30	0.67	1.47
MA (>35)	0.54	1.04	95.34	0.27	1.13
MA (24-35)	0.50	0.97	96.30	0.00	1.33
SI (24-35)	0.33	0.64	96.94	0.47	0.60
HD (>35)	0.29	0.55	97.49	0.20	0.33
PI (24-35)	0.27	0.51	98.00	0.13	0.60
SI (>35)	0.26	0.49	98.49	0.27	0.60
PI (>35)	0.23	0.44	98.93	0.40	0.27
OM (24-35)	0.19	0.37	99.30	0.13	0.40
SI (0-14)	0.14	0.27	99.57	0.33	0.00
SI (15-23)	0.08	0.15	99.72	0.00	0.20
PI (15-23)	0.06	0.12	99.83	0.13	0.00
MA (15-23)	0.05	0.09	99.93	0.00	0.13
PI (0-14)	0.02	0.04	99.97	0.07	0.00
PL (24-35)	0.02	0.03	100.00	0.00	0.07
OM (>35)	0.00	0.00	100.00	0.00	0.00

2021 Low

FU vs JC - average dissimilarity 63.77%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean JC
MI (0-14)	22.39	35.11	35.11	53.90	12.50
MI (15-23)	13.05	20.46	55.57	23.10	23.30
OM (0-14)	8.06	12.64	68.21	17.40	9.73
OM (15-23)	5.73	8.98	77.19	1.67	10.20
PL (0-14)	4.98	7.81	85.00	10.70	0.33
HD (0-14)	2.36	3.70	88.70	3.53	1.87
MI (24-35)	2.36	3.69	92.39	2.73	3.20
MI (>35)	0.98	1.54	93.94	1.27	1.00
OM (24-35)	0.96	1.51	95.44	0.53	1.60
MA (24-35)	0.61	0.95	96.39	0.07	1.00
PI (24-35)	0.37	0.58	96.97	0.33	0.40
MA (>35)	0.35	0.54	97.51	0.00	0.53

PI (>35)	0.29	0.46	97.97	0.27	0.40
SI (24-35)	0.27	0.43	98.40	0.33	0.27
SI (>35)	0.25	0.39	98.80	0.40	0.20
SI (15-23)	0.17	0.27	99.07	0.07	0.20
PI (15-23)	0.16	0.25	99.32	0.13	0.20
PL (15-23)	0.12	0.19	99.51	0.13	0.13
PI (0-14)	0.10	0.15	99.66	0.13	0.00
HD (15-23)	0.07	0.11	99.77	0.20	0.00
SI (0-14)	0.06	0.10	99.88	0.07	0.07
OM (>35)	0.04	0.07	99.94	0.00	0.07
HD (24-35)	0.04	0.06	100.00	0.00	0.07
MA (15-23)	0.00	0.00	100.00	0.00	0.00
PL (24-35)	0.00	0.00	100.00	0.00	0.00
HD (>35)	0.00	0.00	100.00	0.00	0.00

2021 Low
FU vs ESEC - average dissimilarity 52.55%

Group	Av. dissim	Contrib. %	Cumulative %	Mean FU	Mean ESEC
MI (0-14)	21.03	40.02	40.02	53.90	98.30
MI (15-23)	10.05	19.13	59.14	23.10	41.90
PL (0-14)	8.04	15.30	74.44	10.70	25.30
OM (0-14)	5.93	11.29	85.72	17.40	24.10
HD (0-14)	1.35	2.56	88.29	3.53	3.27
OM (15-23)	1.31	2.49	90.77	1.67	4.27
MI (24-35)	0.97	1.85	92.62	2.73	3.33
PI (>35)	0.62	1.18	93.81	0.27	2.07
MI (>35)	0.53	1.00	94.81	1.27	1.40
MA (24-35)	0.35	0.66	95.46	0.07	1.27
MA (15-23)	0.31	0.59	96.05	0.00	1.07
SI (24-35)	0.30	0.57	96.63	0.33	1.00
HD (24-35)	0.28	0.52	97.15	0.00	0.87
HD (15-23)	0.25	0.47	97.62	0.20	0.67
SI (>35)	0.21	0.41	98.02	0.40	0.47
PI (24-35)	0.21	0.41	98.43	0.33	0.53
SI (0-14)	0.21	0.40	98.83	0.07	0.73
OM (24-35)	0.18	0.33	99.17	0.53	0.13
SI (15-23)	0.15	0.29	99.46	0.07	0.53
HD (>35)	0.14	0.27	99.73	0.00	0.47
PI (0-14)	0.08	0.15	99.87	0.13	0.13
PI (15-23)	0.04	0.07	99.94	0.13	0.00
PL (15-23)	0.03	0.06	100.00	0.13	0.00
OM (>35)	0.00	0.00	100.00	0.00	0.00

PL (24-35)	0.00	0.00	100.00	0.00	0.00
MA (>35)	0.00	0.00	100.00	0.00	0.00

2021 Low

JC vs ESEC - average dissimilarity 69.53%

Group	Av. dissim	Contrib. %	Cumulative %	Mean JC	Mean ESEC
MI (0-14)	31.55	45.38	45.38	12.50	98.30
MI (15-23)	11.58	16.66	62.04	23.30	41.90
PL (0-14)	7.24	10.41	72.45	0.33	25.30
OM (0-14)	6.84	9.84	82.30	9.73	24.10
OM (15-23)	4.02	5.78	88.08	10.20	4.27
HD (0-14)	1.43	2.05	90.13	1.87	3.27
MI (24-35)	1.36	1.96	92.09	3.20	3.33
PI (>35)	0.75	1.07	93.16	0.40	2.07
MA (24-35)	0.67	0.96	94.12	1.00	1.27
MI (>35)	0.66	0.94	95.06	1.00	1.40
OM (24-35)	0.60	0.86	95.93	1.60	0.13
MA (15-23)	0.36	0.51	96.44	0.00	1.07
SI (24-35)	0.35	0.51	96.95	0.27	1.00
HD (24-35)	0.32	0.47	97.41	0.07	0.87
HD (15-23)	0.28	0.40	97.81	0.00	0.67
PI (24-35)	0.26	0.38	98.19	0.40	0.53
SI (0-14)	0.24	0.35	98.54	0.07	0.73
SI (15-23)	0.22	0.32	98.87	0.20	0.53
MA (>35)	0.21	0.31	99.17	0.53	0.00
SI (>35)	0.21	0.30	99.47	0.20	0.47
HD (>35)	0.16	0.24	99.71	0.00	0.47
PI (15-23)	0.08	0.11	99.82	0.20	0.00
PL (15-23)	0.05	0.08	99.89	0.13	0.00
PI (0-14)	0.05	0.07	99.96	0.00	0.13
OM (>35)	0.03	0.04	100.00	0.07	0.00
PL (24-35)	0.00	0.00	100.00	0.00	0.00