Supplementary material

Colonial waterbirds provide persistent subsidies to swamp forests along an estuarine island food chain

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Methods

Brazilian Long-Term Ecological Research Program, Lagoa dos Patos estuary (PELD-ELPA) is a long-term project conducted at Lagoa dos Patos estuary aiming to monitor the responses of the fauna and flora to anthropical, climatological, and hydrological changes in the short, medium, and long terms. The project started in 1998 as an initiative of Universidade Federal do Rio Grande (FURG) to understand the ecological dynamics in the estuary. As a long-term monitoring program, PELD-ELPA has a well-documented data-base on carbon (δ^{13}C) and nitrogen (δ^{15}N) stable isotope values for primary producers, invertebrates, fish, birds, and mammals. Laboratório de Aves Aquáticas e Tartarugas Marinhas (LAATM-FURG) joined the project in 2017, monitoring the diet and ecological relationships on the Pelecaniformes colony in the estuary. This study, however, is independent and does not integrate the data-base of PELD-ELPA.

PELD-ELPA Baseline of primary producers for trophic level estimation

Using a series of 9 years on stable isotopes of nitrogen (δ^{15}N) data, Possamai et al. (2021) determined a baseline of primary producers for trophic level estimation at the Lagoa dos Patos estuary, as part of PELD-ELPA. The authors tested 4 baseline methods according to seasonality of data collection for producers and consumers, as well as the lag between them. Producers consisted in C_3 and C_4 plants, while consumers consisted in aquatic predators (fish, crabs, and shrimps). The models were designated as "Global", in which the 9 years series of δ^{15}N values were considered; "Concomitantly", in which only samples collected at the same season were considered; "Delayed", in which the δ^{15}N values for producers reflect the season before the δ^{15}N values of consumers; and "Interpolation", in which the authors used the δ^{15}N values for producers in both previous and same sampling season of consumers. Their results show that the "Delayed" model

reflects a more accurate estimation of trophic level. For additional details in the results and methods, please refer to Possamai et al. (2021).

For this reason, we used the "Delayed" model approach as the baseline for primary production in our trophic level estimation considered at the colony and control sites. Therefore, we used values of δ^{15}N for producers sampled in 2017 and 2018.

Table S1 Mean ± SD of δ^{13}C and δ^{15}N values classification and *n* of samples of soil, vegetation, invertebrates and land birds during summer and winter in the years 2018 and 2019

Source	Group	*n*	δ^{13}C (‰)	δ^{15}N (‰)
Colony Summer (2018)				
Soil		3	−26.49 ± 0.25	12.19 ± 2.81
Vegetation				
Dioscorea sp.	C_3	3	−29.56 ± 0.94	13.66 ± 2.77
Erythrina crista-galli	C_3	3	−28.39 ± 1.15	11.38 ± 8.25
Heteranthera reniformis	C_3	3	−30.82 ± 0.70	19.35 ± 3.22
Hibiscus diversifolius	C_3	3	−27.79 ± 0.34	6.75 ± 1.64
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	14	−24.15 ± 1.08	3.79 ± 1.60
Camponotus rufipes	Omnivorous	7	−24.78 ± 0.87	3.79 ± 1.60
Trichonephila clavipes	Carnivorous	3	−24.45 ± 0.25	3.99 ± 0.82
Land birds				
Basileuterus culicivorus	Insectivorous	2	−25.18 ± 0.37	10.48 ± 1.35
Coryphospingus cucullatus	Omnivorous	2	−25.72 ± 0.23	11.30 ± 0.56
Cranioleuca pyrrophia	Insectivorous	2	−25.11 ± 0.71	13.81 ± 2.42
Cyclarhis gujanensis	Insectivorous	1	−26.6	13.92
Furnarius rufus	Omnivorous	2	−26.24 ± 4.21	14.01 ± 0.65
Leptotila verreauxi	Gramnivorous	4	−24.56 ± 0.58	6.14 ± 2.34
Myiothlypis leucoblephara	Insectivorous	4	−27.36 ± 2.47	12.79 ± 0.75
Pitangus sulphuratus	Omnivorous	2	−22.45 ± 1.28	9.95 ± 2.98
Poospiza nigrorufa	Omnivorous	1	−27.36	13.3
Setophaga pitiayumi	Insectivorous	1	−25.28	9.79
Synallaxis spixi	Insectivorous	1	−25.79	13.53
Syndactila rufosuperciliata	Insectivorous	1	−27.06	12.32
Tangara sayaca	Omnivorous	1	−24.47	7.22
Thamnophilus caerulescens	Insectivorous	2	−26.7 ± 1.63	13.97 ± 1.25
Turdus albicollis	Omnivorous	1	−25.52	11.35
Turdus amaurochalinus	Omnivorous	2	−25.47 ± 1.15	13.34 ± 0.25

Turdus rufiventris	Omnivorous	2	−24.94 ± 1.05	13.31 ± 2.91
Control Summer (2018)				
Soil		3	−28.62 ± 0.67	2.65 ± 0.48
Vegetation				
Acrostichum danaeifolium	C_3	2	−31.80 ± 0.17	4.98 ± 1.95
Crocosmia crocosmiiflora	C_3	3	−31.77 ± 2.04	1.37 ± 0.37
Discorea sp.	C_3	3	−27.38 ± 1.29	3.58 ± 1.34
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	7	−22.40 ± 1.30	17.84 ± 1.68
Camponotus rufipes	Omnivorous	19	−25.40 ± 0.36	14.08 ± 1.42
Trichonephila clavipes	Carnivorous	3	−26.56 ± 1.05	15.47 ± 1.89
Land birds				
Basileuterus culicivorus	Insectivorous	7	−26.11 ± 2.21	6.21 ± 0.57
Furnarius rufus	Omnivorous	1	−24.85	7.47
Hylocharis chrysura	Nectarivorous	1	−25.06	5.26
Lathrotriccus euleri	Insectivorous	1	−22.62	9.53
Leptotila verreauxi	Granivorous	1	−22.34	10.6
Myiodynastes maculatus	Omnivorous	1	−24.64	9.54
Myiothlypis leucoblephara	Insectivorous	2	−25.53 ± 1.04	7.01 ± 0.42
Pitangus sulphuratus	Omnivorous	2	−22.48 ± 0.44	8.23 ± 1.15
Synallaxis spixi	Insectivorous	1	−24.0	7.99
Syndactila rufosuperciliata	Insectivorous	1	−24.67	6.80
Thamnophilus caerulescens	Insectivorous	4	−24.63 ± 0.22	8.64 ± 2.09
Turdus albicollis	Omnivorous	4	−24.82 ± 0.66	7.17 ± 0.80
Turdus rufiventris	Omnivorous	3	−26.45 ± 2.85	7.99 ± 0.91
Colony Winter (2018)				
Soil			−26.83 ± 0.14	10.75 ± 2.52
Vegetation				
Acrostichum danaeifolium	C_3	3	−28.49 ± 1.79	12.43 ± 0.38
Heteranthera reniformis	C_3	2	−28.08 ± 0.82	12.25 ± 0.08
Hibiscus diversifolius	C_3	3	−29.41 ± 2.26	14.38 ± 5.13
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	10	−24.64 ± 2.74	18.34 ± 2.30
Camponotus rufipes	Omnivorous	9	−25.64 ± 0.76	13.70 ± 4.11
Land birds				
Cyclarhis gujanensis	Insectivorous	2	−22.52 ± 2.50	13.83 ± 7.52
Geothlypis aequinoctialis	Insectivorous	5	−27.77 ± 1.36	15.45 ± 4.51
Knipolegus cyanirostris	Insectivorous	1	−24.99	15.41
Limnornis curvirotris	Insectivorous	1	−25.65	17.93
Myiophobus fasciatus	Insectivorous	1	−23.14	8.89
Myiothlypis leucoblephara	Insectivorous	1	−26.28	11.66

Pitangus sulphuratus	Omnivorous	4	−22.21 ± 2.14	8.70 ± 1.91
Poospiza nigrorufa	Omnivorous	1	−31.8	13.52
Setophaga pitiayumi	Insectivorous	3	−29.65 ± 1.71	14.22 ± 1.45
Synallaxis spixi	Insectivorous	1	−26.23	17.94
Syndactila rufosuperciliata	Insectivorous	1	−24.06	6.74
Thamnophilus caerulescens	Insectivorous	1	−25.32	7.79
Turdus albicollis	Omnivorous	3	−24.44 ± 0.10	10.73 ± 3.54
Turdus rufiventris	Omnivorous	2	−24.41 ± 0.95	13.87 ± 2.87
Control Winter (2018)				
Soil		3	−27.20 ± 0.48	2.65 ± 1.30
Vegetation				
Acrostichum danaeifolium	C_3	3	−27.50 ± 1.56	7.05 ± 1.53
Crocosmia crocosmiiflora	C_3	3	−32.24 ± 1.17	1.92 ± 0.46
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	13	−24.08 ± 1.09	3.15 ± 1.43
Camponotus rufipes	Omnivorous	11	−24.73 ± 0.33	6.55 ± 1.64
Lycosa sp.	Carnivorous	1	−24.73	8.84
Land birds				
Basileuterus culicivorus	Insectivorous	5	−26.47 ± 1.81	8.80 ± 2.98
Coereba flaveola	Nectarivorous	1	−25.78	4.29
Cyclarhis gujanensis	Insectivorous	1	−24.04	7.18
Elaenia obscura	Frugivorous	2	−26.25 ± 1.73	6.10 ± 0.03
Furnarius rufus	Frugivorous	1	−21.75	11.2
Lathrotriccus euleri	Insectivorous	2	−25.74 ± 1.00	8.95 ± 0.25
Lepdocolaptes falcinellus	Insectivorous	1	−24.27	6.69
Myiothlypis leucoblephara	Insectivorous	2	−26.04 ± 0.57	1.90 ± 1.90
Stephanophorus diadematus	Omnivorous	1	−28.90	6.20
Turdus albicollis	Omnivorous	9	−25.07 ± 1.95	7.08 ± 1.22
Turdus amaurochalinus	Omnivorous	2	−23.23 ± 2.46	9.26 ± 0.90
Turdus rufiventris	Omnivorous	8	−25.04 ± 2.46	8.18 ± 0.51
Colony Summer (2019)				
Soil		3	−27.27 ± 0.34	9.88 ± 3.80
Vegetation				
Acrostichum danaeifolium	C_3	3	−27.99 ± 1.14	9.31 ± 2.20
Dioscorea sp.	C_3	3	−29.18 ± 1.57	14.39 ± 1.12
Erythrina crista-galli	C_3	3	−30.73 ± 0.62	7.20 ± 5.47
Hibiscus diversifolius	C_3	3	−30.94 ± 0.07	6.50 ± 4.65
Heteranthera reniformis	C_3	3	−30.54 ± 1.12	10.97 ± 1.67
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	13	−25.09 ± 1.94	11.49 ± 5.91
Camponotus rufipes	Omnivorous	15	−26.24 ± 1.13	13.74 ± 2.85

Lycosa sp.	Carnivorous	1	−26.27	16.87
Trichonephila clavipes	Carnivorous	3	−25.14 ± 1.01	14.80 ± 3.50
Land birds				
Columbina talpacoti	Frugivorous	1	−24.48	10.58
Cyclarhis gujanensis	Insectivorous	1	−25.08	13.09
Furnarius rufus	Omnivorous	4	−23.91 ± 1.93	10.34 ± 6.39
Leptotila verreauxi	Granivorous	4	−24.49 ± 0.21	8.52 ± 3.21
Limnornis curvirotris	Insectivorous	1	−25.4	15.93
Myiothlypis leucoblephara	Insectivorous	3	−26.33 ± 4.74	10.73 ± 9.25
Pipraeidea bonariensis	Omnivorous	2	−25.51 ± 0.91	9.68 ± 3.68
Tangara sayaca	Omnivorous	1	−25.24	15.21
Turdus albicollis	Omnivorous	3	−23.59 ± 0.46	11.24 ± 3.34
Turdus amaurochalinus	Omnivorous	3	−26.88 ± 4.28	8.06 ± 6.08
Turdus rufiventris	Omnivorous	3	−24.27 ± 1.26	12.75 ± 3.96
Tyrannus melancholicus	Insectivorous	1	−23.22	12.4
Control Summer (2019)				
Soil		3	−28.09 ± 0.84	3.30 ± 0.68
Vegetation				
Acrostichum danaeifolium	C_3	3	−31.10 ± 0.48	5.48 ± 0.17
Crocosmia crocosmiiflora	C_3	3	−33.35 ± 0.20	0.99 ± 0.79
Dioscorea sp.	C_3	3	−31.06 ± 0.81	1.69 ± 1.44
Erythrina crista-galli	C_3	3	−31.26 ± 0.73	0.74 ± 0.50
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	2	−25.24 ± 0.26	12.65 ± 3.30
Camponotus rufipes	Omnivorous	4	−25.46 ± 3.3	10.38 ± 7.3
Land birds				
Basileuterus culicivorus	Insectivorous	3	−25.64 ± 0.79	11.39 ± 4.44
Coryphospingus cucullatus	Omnivorous	1	−24.37	5.74
Columbina talpacoti	Granivorous	3	−15.28 ± 0.94	8.02 ± 1.69
Elaenia flavogaster	Omnivorous	1	−24.76	17.06
Furnarius rufus	Omnivorous	3	−22.48 ± 0.70	11.65 ± 6.68
Lathrotriccus euleri	Insectivorous	2	−23.75 ± 0.52	5.59 ± 1.39
Leptotila verreauxi	Insectivorous	1	−24.45	9.79
Myiothlypis leucoblephara	Insectivorous	1	−14.59	19.32
Myiodynastes maculatus	Omnivorous	1	−24.18	9.53
Pitangus sulphuratus	Omnivorous	4	−22.40 ± 0.29	7.31 ± 2.89
Satrapa icterophrys	Insectivorous	1	−23.68	17.87
Syndactila rufosuperciliata	Insectivorous	3	−24.47 ± 0.93	8.04 ± 1.13
Turdus albicollis	Omnivorous	2	−25.00 ± 0.09	14.92 ± 3.26
Thamnophilus caerulescens	Insectivorous	1	−24.89	14.59
Tyrannus melancholicus	Insectivorous	1	−22.6	7.16

Turdus rufiventris	Omnivorous	2	−24.02 ± 1.10	8.94 ± 1.61
Colony Winter (2019)				
Soil		3	−27.96 ± 1.33	8.70 ± 2.03
Vegetation				
Acrostichum danaeifolium	C_3	3	−28.55 ± 0.33	15.09 ± 2.04
Diascorea sp.	C_3	3	−29.81 ± 0.64	18.80 ± 3.40
Erythrina crista-galli	C_3	3	−29.46 ± 1.97	10.60 ± 6.12
Heteranthera reniformis	C_3	3	−32.24 ± 0.80	12.88 ± 1.70
Hibiscus diversifolius	C_3	3	−28.89 ± 0.15	11.77 ± 0.89
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	7	−24.02 ± 1.26	20.49 ± 2.21
Camponotus rufipes	Omnivorous	17	−25.76 ± 0.29	12.92 ± 1.40
Lycosa sp.	Carnivorous	1	−26.47	18.11
Trichonephila clavipes	Carnivorous	2	−27.61 ± 0.22	10.87 ± 0.22
Land birds				
Basileuterus culicivorus	Insectivorous	1	−26.0	14.3
Camptostoma obsoletum	Omnivorous	1	−26.2	14.4
Coereba flaveola	Nectarivorous	2	−25.0 ± 0.4	2.8 ± 0.5
Cyclarhis gujanensis	Insectivorous	2	−25.0 ± 0.1	16.9 ± 3.2
Elaenia obscura	Omnivorous	1	−25.9	8.0
Geothlypis aequinoctialis	Insectivorous	1	−26.2	18.5
Knipolegus cyanirostris	Insectivorous	1	−25.2	10.7
Limnornis curvirotris	Insectivorous	3	−25.2 ± 0.4	16.5 ± 3.1
Myiothlypis leucoblephara	Insectivorous	1	−26.1	2.8
Pitangus sulphuratus	Omnivorous	1	−21.0	17.0
Saltator similis	Omnivorous	2	−25.1 ± 0.3	10.5 ± 7.5
Setophaga pitiayumi	Insectivorous	1	−25.2	19.2
Thamnophilus caerulescens	Omnivorous	2	−25.2 ± 0.1	10.5 ± 6.6
Turdus albicollis	Omnivorous	3	−24.2 ± 0.3	13.0 ± 7.5
Turdus amaurochalinus	Omnivorous	3	−21.9 ± 0.7	7.8 ± 2.0
Turdus rufiventris	Omnivorous	3	−23.8 ± 1.9	14.6 ± 3.0
Control Winter (2019)				
Soil		3	−28.35 ± 0.33	2.68 ± 0.36
Vegetation				
Acrostichum danaeifolium	C_3	3	−30.91 ± 1.89	5.48 ± 1.38
Crocosmia crocosmiiflora	C_3	3	−34.09 ± 0.36	1.39 ± 0.17
Dioscorea sp.	C_3	3	−30.25 ± 3.20	2.08 ± 1.58
Invertebrates				
Armadillidium sp.	Omnivorous-detritivorous	20	−23.98 ± 1.19	3.15 ± 3.27
Camponotus rufipes	Omnivorous	4	−25.75 ± 0.06	4.73 ± 0.93
Scolopendridae	Carnivorous	2	−26.38 ± 0.49	8.54 ± 3.90

Trichonephila clavipes	Carnivorous	1	−24.84	8.15
Land birds				
Basileuterus culicivorus	Insectivorous	2	−26.59 ± 0.90	9.54 ± 0.24
Cranioleuca pyrrophia	Insectivorous	1	−31.8	2.06
Elaenia obscura	Frugivorous	2	−26.09 ± 0.91	6.97 ± 1.38
Myiothlypis leucoblephara	Insectivorous	1	−24.89	12.12
Syndactila rufosuperciliata	Insectivorous	2	−28.10 ± 5.24	9.35 ± 10.46
Thamnophilus caerulescens	Insectivorous	1	−26.11	8.55
Turdus albicollis	Omnivorous	17	−26.34 ± 3.15	9.35 ± 5.42
Turdus amaurochalinus	Omnivorous	3	−31.83 ± 0.13	2.08 ± 0.11
Turdus rufiventris	Omnivorous	3	−26.75 ± 4.44	10.42 ± 9.66

Table S2 List of land bird species sampled at Marinheiros Island, Lagoa dos Patos estuary in southern Brazil, and their trophic guilds, according to the bibliography

Species of land birds	**Guild**	***Reference***
Basileuterus culicivorus	Insectivorous	Lima and Manhães 2009
Camptostoma obsoletum	Omnivorous	Sainz-Borgo 2016
Coereba flaveola	Nectarivorous	Mata and Bosque 2004
Columbina talpacoti	Granivorous	Fontoura and Orsi 2013
Coryphospingus cucullatus	Omnivorous	Foster 1987
Cranioleuca pyrrhophia	Insectivorous	Malizia et al. 2005
Cyclarhis gujanensis	Insectivorous	Telino-Júnior et al. 2005
Elaenia flavogaster	Omnivorous	Quilarque et al. 2010
Elaenia obscura	Frugivorous	Oliveira et al. 2015
Euphonia chlorotica	Omnivorous	Oliveira et al. 2015
Furnarius rufus	Omnivorous	Tampson and Petry 2008
Geothlypis aequinoctialis	Insectivorous	Sabino et al. 2017
Hylocharis chrysura	Nectarivorous	Schuchmann et al. 2020
Knipolegus cyanirostris	Insectivorous	Marateo and Arturi 2013
Lathrotriccus euleri	Insectivorous	Durães and Marini 2005
Lepidocolaptes falcinellus	Insectivorous	Bodrati and Cockle 2011
Leptotila verreauxi	Granivorous	Marateo and Arturi 2013
Limnornis curvirostris	Insectivorous	Remsen 2020
Myiodynastes maculatus	Omnivorous	Marateo and Arturi 2013
Myiophobus fasciatus	Insectivorous	Marateo and Arturi 2013
Myiothlypis leucoblephara	Insectivorous	Curson and Kirwan 2020
Pipraeidea bonariensis	Omnivorous	Hilty et al. 2020
Pitangus sulphuratus	Omnivorous	Oliveira et al. 2015
Poospiza nigrorufa	Omnivorous	Scherer et al. 2010
Saltator similis	Omnivorous	Oliveira et al. 2015
Satrapa icterophrys	Insectivorous	Farnsworth and Langham 2020
Setophaga pitiayumi	Omnivorous	Regelski and Moldenhauer 2020
Stephanophorus diadematus	Omnivorous	Manhães 2003
Synallaxis spixi	Insectivorous	Pegan, 2020

Syndactila rufosuperciliata	Insectivorous	Remsen 2020
Tangara sayaca	Omnivorous	Oliveira et al. 2015
Thamnophilus caerulescens	Insectivorous	Durães and Marini 2005
Troglodytes musculus	Insectivorous	Tampson and Petry 2008
Turdus albicollis	Omnivorous	Oliveira et al. 2015
Turdus amaurochalinus	Omnivorous	Oliveira et al. 2015
Turdus rufiventris	Omnivorous	Oliveira et al. 2015
Tyrannus melancholicus	Omnivorous	Oliveira et al. 2015

Table S3 Values table used in the mixing models. Samples collected in the years 2017 and 2018 from the Brazilian Long-Term Ecological Research program (PELD-ELPA; www.peld.furg.br)

Source	Year	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
Particulate Organic Matter	2017	-18.45	5.50
Particulate Organic Matter	2017	-18.79	4.67
Particulate Organic Matter	2017	-19.22	6.19
Particulate Organic Matter	2017	-23.06	5.82
Particulate Organic Matter	2017	-23.11	7.47
Particulate Organic Matter	2017	-22.87	8.04
Particulate Organic Matter	2017	-19.97	8.42
Particulate Organic Matter	2017	-20.50	7.84
Particulate Organic Matter	2017	-20.35	8.56
Particulate Organic Matter	2017	-23.13	5.31
Particulate Organic Matter	2017	-23.40	6.39
Particulate Organic Matter	2017	-23.40	6.28
Rhizoclonium sp.	2017	-12.72	5.86
Rhizoclonium sp.	2017	-11.92	6.36
Soil Organic Matter	2017	-16.54	6.41
Soil Organic Matter	2017	-15.82	5.80
Soil Organic Matter	2017	-15.49	7.82
Soil Organic Matter	2017	-18.25	10.51
Soil Organic Matter	2017	-17.86	8.50
Soil Organic Matter	2017	-17.97	9.33
Soil Organic Matter	2017	-17.43	9.15
Soil Organic Matter	2017	-16.72	5.48
Soil Organic Matter	2017	-16.58	9.14
Soil Organic Matter	2017	-21.09	12.31
Soil Organic Matter	2017	-21.08	11.96
Soil Organic Matter	2017	-17.95	13.28
Ulva sp.	2017	-10.48	6.75
Ulva sp.	2017	-11.13	6.78
Ulva sp.	2017	-10.53	6.51

Ulva sp.	2017	-9.11	7.48
Particulate Organic Matter	2018	-17.69	9.09
Particulate Organic Matter	2018	-16.39	11.21
Particulate Organic Matter	2018	-17.96	9.68
Particulate Organic Matter	2018	-20.30	13.71
Particulate Organic Matter	2018	-21.20	15.59
Particulate Organic Matter	2018	-20.51	8.74
Rhizoclonium sp.	2018	-20.88	8.43
Rhizoclonium sp.	2018	-21.49	8.98
Rhizoclonium sp.	2018	-20.95	8.90
Soil Organic Matter	2018	-14.64	9.65
Soil Organic Matter	2018	-14.83	20.71
Soil Organic Matter	2018	-14.99	15.20
Soil Organic Matter	2018	-16.98	10.73
Soil Organic Matter	2018	-16.03	7.72
Soil Organic Matter	2018	-16.40	8.13
Ulva sp.	2018	-10.68	1.01
Ulva sp.	2018	-13.14	1.83
Ulva sp.	2018	-12.17	8.02
Ulva sp.	2018	-12.64	7.46
Ulva sp.	2018	-12.53	7.64

Table S4 Trophic discrimination factors (TDF) of carbon and nitrogen isotopic values used in the mixture models, for consumer tissues from control and colony environments

Group	Foraging guild	Consumer	Diet composition	Discrimination		Reference
				$\Delta^{13}C$	$\Delta^{15}N$	
Invertebrates	Omnivorous-generalist	Generalist consumers	Plants and protein grains	0.5 ± 0.13	2.3 ± 0.18	McCutchan et al. 2003
Invertebrates	Omnivorous	*Camponotus floridanus*	Bhatkar-agar, cockroaches and honey water *ad*	1.1	3	Feldhaar et al. 2009
Invertebrates	Carnivorous	*Pardosa lugubris*	Fruit fly *Drosophila melanogaster*	0.44 ± 0.1	2.16 ± 0.1	Oelbermann and Scheu 2002
Land birds	Omnivorous	*Habia fuscicauda*	Plants, protein grains and fruits	2.2 ± 0.1	2.6 ± 0.2	Herrera and Reyna 2007
Land birds	Insectivorous	*Dendroica coronata*	Mealworm	2.2	2.7	Pearson and Levey 2003

Table S5 Summary of ANOVA results of soil, vegetation, invertebrates, and land birds, with δ^{15}N and δ^{13}C values from generalized linear models (GLMs) (Table 1)

Source of variation	df	Deviance	% explained	df of residuals	Residual deviance	*F*	*P*
Soil δ^{15}N							
Null model							
Main effects				23	441.89		
Site	**1**	**349.23**	**79.03**	**22**	**92.67**	**822.04**	**<0.001**
Season	1	3.31	0.74	21	89.36	0.78	0.388
Year	1	4.39	0.99	20	84.96	10.35	0.321
Total	4	356.93	80.76				
Plants δ^{15}N							
Main effects				84	3036.4		
Species	**5**	**976.24**	**32.15**	**79**	**2060.1**	**11.53**	**<0.001**
Site	**1**	**678.51**	**22.34**	**78**	**1381.6**	**40.05**	**<0.001**
Season	1	15.13	0.49	77	1366.5	0.89	0.348
Year	1	78.98	2.60	76	1287.5	4.66	0.340
Total	8	1748.86	57.58				
Invertebrates							
Main effects				192	6794.2		
Site	**1**	**4176.70**	**61.4**	**191**	**2617.7**	**319.82**	**<0.001**
Season	1	0.80	0.01	190	2616.7	0.06	0.804
Year	1	36.20	0.24	189	2580.5	2.77	0.098
Guild	1	16.90	0.03	187	2563.7	0.65	0.526
Site:Season	**1**	**134.60**	**1.98**	**186**	**2429.1**	**10.31**	**0.002**
Total	5	4365.20	63.66				
Land birds							
Null model							
Main effects				242	4886.5		
Site	**1**	**725.31**	**14.80**	**241**	**4161.2**	**46.72**	**<0.001**
Season	1	0.50	0.01	240	4160.7	0.03	0.857
Year	1	33.01	0.67	239	4127.7	2.13	0.146
Guild	**4**	**363.85**	**7.44**	**235**	**3763.8**	**5.86**	**<0.001**
Habitat	**3**	**161.90**	**3.31**	**232**	**3601.9**	**3.50**	**<0.001**
Soil δ^{13}C							
Null model							
Main effects				23	19.10		
Site	**1**	**5.12**	**26.83**	**22**	**13.98**	**8.87**	**<0.001**
Season	1	0.01	0.04	21	13.97	0.01	0.913
Year	1	0.84	4.40	20	11.56	4.18	0.054

Total explained	3	5.97	31.27				
Invertebrates							
Null model							
Main effects				192	436.99		
Guild	**2**	**96.16**	**22.00**	**190**	**340.83**	**28.20**	**<0.001**
Site	**1**	**10.52**	**2.40**	**189**	**330.31**	**6.17**	**0.014**
Season	1	0.25	<0.06	188	330.07	0.14	0.705
Year	**1**	**11.26**	**2.57**	**187**	**318.81**	**6.60**	**0.011**
Total explained	5	118.18	63.66				
Land birds							
Null model							
Main effects				242	1732.4		
Guild	**4**	**140.79**	**8.12**	**238**	**1591.6**	**5.88**	**<0.001**
Site	1	2.05	0.11	237	1589.6	0.34	0.559
Season	**1**	**37.38**	**2.15**	**236**	**1552.2**	**6.25**	**0.013**
Year	1	6.31	0.36	235	1545.9	1.05	0.306
Habitat	**3**	**59.03**	**3.23**	**232**	**1486.8**	**3.29**	**0.021**
	1	**104.84**	**6.05**	**231**	**1382.0**	**17.52**	**<0.001**
Total explained	11	350.38	20.02				

Table S6 Summary of the results of the Bayesian mixture models, with average probability of assimilation (values ± SD) for the different guilds (group) and the estuarine and terrestrial contribution in each season and site

Group	Site	Season	Estuarine assimilation	Terrestrial assimilation
Carnivorous Invertebrates	Colony	Winter	31.0 ± 16.1	69.0 ± 16.1
Carnivorous Invertebrates	Colony	Summer	35.2 ± 4.4	64.8 ± 4.4
Carnivorous Invertebrates	Control	Winter	38.7 ± 9.8	61.3 ± 9.8
Carnivorous Invertebrates	Control	Summer	43.0 ± 11.5	57.0 ± 11.5
Omnivorous Invertebrates	Colony	Winter	30.8 ± 2.5	69.2 ± 2.5
Omnivorous Invertebrates	Colony	Summer	31.2 ± 2.2	68.8 ± 2.2
Omnivorous Invertebrates	Control	Winter	32.2 ± 3.4	67.8 ± 3.4
Omnivorous Invertebrates	Control	Summer	37.4 ± 5.1	62.6 ± 5.1
Omnivorous-detritivorous Invertebrates	Colony	Winter	46.1 ± 4.7	53.9 ± 4.7
Omnivorous-detritivorous Invertebrates	Colony	Summer	48.3 ± 4.1	51.7 ± 4.1
Omnivorous-detritivorous Invertebrates	Control	Winter	44.2 ± 2.8	55.8 ± 2.8
Omnivorous-detritivorous Invertebrates	Control	Summer	42.8 ± 3.6	57.2 ± 3.6
Omnivorous Birds	Colony	Winter	27.8 ± 2.5	72.2 ± 2.5
Omnivorous Birds	Colony	Summer	29.6 ± 2.8	70.4 ± 2.8
Omnivorous Birds	Control	Winter	22.7 ± 3.0	77.3 ± 3.0
Omnivorous Birds	Control	Summer	35.2 ± 3.4	64.8 ± 3.4
Insectivorous Birds	Colony	Winter	18.9 ± 2.7	81.1 ± 2.7
Insectivorous Birds	Colony	Summer	25.1 ± 4.0	74.9 ± 4.0
Insectivorous Birds	Control	Winter	20.5 ± 4.1	79.5 ± 4.1
Insectivorous Birds	Control	Summer	34.3 ± 3.2	65.7 ± 3.2

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