**SUPPLEMENTARY MATERIAL**

# Biogeographic variation on dietary aspects of a widely distributed seabird

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**Table S1** Unpublished datasets with regurgitate material of brown boobies *(Sula leucogaster*) from southwestern Atlantic Ocean colonies.

| Citation | Type of source | Reference |
|---|---|---|
| Kohlrausch, AB | Ph.D. Thesis | Kohlrausch AB (2003) Biologia reprodutiva, comportamento e ecologia de atobás (Sulidae): implicações para a evolução do dimorfismo sexual no tamanho. Universidade de São Paulo. |
| Rede Rio Doce Mar | Technical Report | Rede Rio Doce Mar (2019) Relatório Semestral – Seção 3 Programa de Monitoramento da Biodiversidade Aquática da Área Ambiental I. Fundação Espírito-Santense de Tecnologia, Vitória. http://www.ibama.gov.br/cif/notas-tecnicas/ct-bio/relatorios-da-rede-rio-doce-mar Accessed 05 May 2022 |
| Torres, FBM et al. | Conference abstract | Torres FMN, Nascimento JO, Estrella VS, Cunha LST (2012) Identificação e análise da dieta de atobá-marrom (*Sula leucogaster*) nas ilhas Cagarras. *In:* Livro de Resumos do 1º Workshop Técnico-Científico do Monumento Natural das Ilhas Cagarras. Projeto Ilhas do Rio, Rio de Janeiro. |
| Mancini, PL | Ph.D. Thesis | Mancini PL (2013) Relações tróficas de aves marinhas tropicais em ilhas oceânicas do Brasil. Universidade Federal do Rio Grande. https://ppgocbio.furg.br/dissertacoes-e-teses/63-publicacoes-de-2013/202-10316tese-patricia-luciano-mancini |
| Lanco Bertrand, S | Unpublished database | - |

**Table S2** List of *taxa* consumed by the brown booby (*Sula leucogaster*) in the southwestern Atlantic Ocean.

| TAXON | CLASS | ORDER | FAMILY | SPECIES |
|---|---|---|---|---|
| **Crustacea** | **Malacostraca** | **Decapoda** | **Solenoceridae** | *Pleoticus muelleri* |
| **Mollusca** | **Cephalopoda** | **Myopsida** | **Loliginidae** | *Doryteuthis pleii* |
| | | | | *Doryteuthis sanpaulensis* |
| | | **Oegopsida** | **Ommastrephidae** | *Ornithoteuthis antillarum* |
| | | | | *Ommastrephes bartramii* |
| **Osteichthyes** | **Actinopteri** | **Atheriniformes** | **Atherinidae** | - |
| | | **Aulopiformes** | **Synodontidae** | *Saurida brasiliensis* |
| | | | | *Synodus foetens* |
| | | | | *Synodus intermedius* |
| | | **Batrachoidiformes** | **Batrachoididae** | *Porichthys porosissimus* |
| | | **Beloniformes** | **Belonidae** | *Ablennes hians* |
| | | | | *Strongylura marina* |
| | | | | *Tylosurus* spp. |
| | | | **Exocoetidae** | *Cheilopogon cyanopterus* |
| | | | | *Exocoetus volitans* |
| | | | | *Hirundichthys affinis* |
| | | | | *Parexocoetus brachypterus* |
| | | | | *Parexocoetus hillianus* |
| | | | | *Prognichthys gibbifrons* |

| | | |
|---|---|---|
| | **Hemiramphidae** | *Euleptorhamphus velox* |
| | | *Hemiramphus balão* |
| | | *Hemiramphus brasiliensis* |
| | | *Hyporhamphus unifasciatus* |
| | | *Oxyporhamphus micropterus* |
| **Carangiformes** | **Bothidae** | **-** |
| | **Carangidae** | *Carangoides bartholomaei* |
| | | *Caranx crysos* |
| | | *Caranx hippos* |
| | | *Selar crumenophthalmus* |
| | | *Decapterus punctatus* |
| | | *Decapterus tabl* |
| | | *Selene setapinnis* |
| | | *Selene vomer* |
| | | *Trachinotus falcatus* |
| | | *Trachurus lathami* |
| | **Coryphaenidae** | *Coryphaena equiselis* |
| | | *Coryphaena hippurus* |
| | **Cyclopsettidae** | *Etropus longimanus* |
| | **Cynoglossidae** | *Symphurus diomedeanus* |
| | | *Symphurus tessellatus* |
| | **Paralichthyidae** | - |

| | | | |
|---|---|---|---|
| | **Clupeiformes** | **Clupeidae** | *Brevoortia pectinata* |
| | | | *Harengula clupeola* |
| | | | *Opisthonema oglinum* |
| | | | *Sardinella aurita* |
| | | **Engraulidae** | *Anchoa filifera* |
| | | | *Anchoa spinifer* |
| | | | *Anchoa tricolor* |
| | | | *Anchoviella lepidentostole* |
| | | | *Cetengraulis edentulus* |
| | | | *Engraulis anchoita* |
| | | | *Lycengraulis grossidens* |
| | | **Pristigasteridae** | *Chirocentrodon bleekerianus* |
| | | | *Pellona harroweri* |
| | **Gadiformes** | **Phycidae** | *Urophycis brasiliensis* |
| | **Holocentriformes** | **Holocentridae** | *Holocentrus adscensionis* |
| | **Mugiliformes** | **Mugilidae** | *Mugil curema* |
| | | | *Mugil liza* |
| | **Ophidiiformes** | **Ophidiidae** | *Raneya brasiliensis* |
| | **Perciformes(*)** | **Gerreidae*** | *Eucinostomus argenteus* |
| | | | *Eucinostomus gula* |
| | | **Haemulidae*** | *Anisotremus surinamensis* |
| | | | *Conodon nobilis* |

| | | |
|---|---|---|
| | | *Haemulon* sp. |
| | | *Orthopristis rubra* |
| | **Malacanthidae*** | *Malacanthus plumieri* |
| | **Percophidae** | *Percophis brasiliensis* |
| | **Priacanthidae*** | *Priacanthus arenatus* |
| | **Sciaenidae*** | *Bairdiella ronchus* |
| | | *Ctenosciaena gracilicirrhus* |
| | | *Cynoscion guatucupa* |
| | | *Cynoscion jamaicensis* |
| | | *Cynoscion leiarchus* |
| | | *Cynoscion microlepidotus* |
| | | *Isopisthus parvipinnis* |
| | | *Larimus breviceps* |
| | | *Macrodon ancylodon* |
| | | *Macrodon atricauda* |
| | | *Menticirrhus littoralis* |
| | | *Micropogonias furnieri* |
| | | *Paralonchurus brasiliensis* |
| | | *Stellifer brasiliensis* |
| | | *Stellifer rastrifer* |
| | | *Stellifer stellifer* |
| | **Serranidae** | *Diplectrum formosum* |

| | | |
|---|---|---|
| | | *Dules auriga* |
| | **Sparidae*** | *Pagrus pagrus* |
| | **Triglidae** | *Prionotus nudigula* |
| | | *Prionotus punctatus* |
| **Scombriformes** | **Bramidae** | *Brama brama* |
| | **Gempylidae** | *Gempylus serpens* |
| | **Nomeidae** | *Nomeus gronovii* |
| | **Scombridae** | *Katsuwonus pelamis* |
| | | *Scomber japonicus* |
| | | *Scomberomorus maculatus* |
| | | *Thunnus obesus* |
| | **Stromateidae** | *Peprilus crenulatus* |
| | **Trichiuridae** | *Trichiurus lepturus* |
| **Syngnathiformes** | **Dactylopteridae** | *Dactylopterus volitans* |
| | **Fistulariidae** | *Fistularia tabacaria* |
| | **Mullidae** | *Mullus argentinae* |
| | | *Upeneus parvus* |
| **Tetraodontiformes** | **Balistidae** | - |
| | **Diodontidae** | *Chilomycterus spinosus* |
| | **Molidae** | *Ranzania laevis* |

(*) *Incertae sedis*, order with families with unknown or undefined relationships.

**Table S3** Species ingested by *Sula leucogaster* in colonies from the southwestern Atlantic Ocean with the highest absolute abundance (AA) and highest relative abundance (RA%). Colonies are ordered in a decreasing latitudinal gradient.SPSP = São Pedro e São Paulo.

| Colony | Family | Species | AA | RA% |
|---|---|---|---|---|
| **Moleques** | Engraulidae | *Cetengraulis edentulus* | 199 | 24.94 |
| | Sciaenidae | *Paralonchurus brasiliensis* | 179 | 22.43 |
| | Sciaenidae | *Isopisthus parvipinnis* | 65 | 8.15 |
| | Sciaenidae | *Cynoscion striatus* | 64 | 8.02 |
| | Batrachoididae | *Porichthys porosissimus* | 55 | 6.89 |
| **Currais** | Clupeidae | *Sardinella aurita* | 30 | 15.71 |
| | Sciaenidae | *Paralonchurus brasiliensis* | 26 | 13.61 |
| | Synodontidae | *Synodus foetens* | 25 | 13.09 |
| | Carangidae | *Trachurus lathami* | 24 | 12.57 |
| | Sciaenidae | *Stellifer rastifer* | 17 | 8.9 |
| **Cagarras** | Engraulidae | *Cetengraulis edentulus* | 63 | 39.62 |
| | Clupeidae | *Harengula clupeola* | 43 | 27.04 |
| | Clupeidae | *Brevoortia pectinata* | 20 | 12.58 |
| | Clupeidae | *Sardinella aurita* | 17 | 10.69 |
| | Carangidae | *Decapterus punctatus* | 6 | 3.77 |
| **Cabo Frio** | Batrachoididae | *Porichthys porosissimus* | 53 | 29.28 |
| | Carangidae | *Trachurus lathami* | 51 | 28.18 |
| | Sparidae | *Pagrus pagrus* | 15 | 8.29 |
| | Clupeidae | *Harengula clupeola* | 14 | 7.73 |
| | Engraulidae | *Cetengraulis edentulus* | 9 | 4.97 |
| **Santana** | Pristigasteridae | *Chirocentrodon bleekerianus* | 93 | 28.7 |
| | Pristigasteridae | *Pellona harroweri* | 50 | 15.43 |
| | Sciaenidae | *Cynoscion guatucupa* | 37 | 11.42 |
| | Batrachoididae | *Porichthys porosissimus* | 31 | 9.57 |
| | Sciaenidae | *Paralonchurus brasiliensis* | 29 | 8.95 |
| **Abrolhos** | Hemiramphidae | *Hemiramphus brasiliensis* | 48 | 37.5 |
| | Carangidae | *Caranx hippos* | 15 | 11.72 |
| | Clupeidae | *Opisthonema oglinum* | 13 | 10.57 |
| | Exocoetidae | *Paraexocoetus brachypterus* | 13 | 10.57 |
| | Hemiramphidae | *Hemiramphus balao* | 11 | 8.59 |
| **Noronha** | Clupeidae | *Harengula clupeola* | 57 | 83.82 |

| | | | | |
|---|---|---|---|---|
| | Hemiramphidae | *Euleptorhamphus velox* | 3 | 4.41 |
| | Hemiramphidae | *Oxyporhamphus micropterus* | 2 | 2.94 |
| | Exocoetidae | *Prognichthys gibbifrons* | 2 | 2.94 |
| | Exocoetidae | *Hirundichthys affinis* | 1 | 1.47 |
| **Rocas** | Malacanthidae | *Malacanthus plumieri* | 354 | 30.49 |
| | Clupeidae | *Harengula clupeola* | 210 | 18.09 |
| | Hemiramphidae | *Oxyporhamphus micropterus* | 198 | 17.05 |
| | Exocoetidae | *Exocoetus volitans* | 123 | 10.59 |
| | Exocoetidae | *Cheilopogon cyanopterus* | 75 | 6.46 |
| **SPSP** | Exocoetidae | *Exocoetus volitans* | 353 | 49.16 |
| | Hemiramphidae | *Oxyporhamphus micropterus* | 186 | 25.91 |
| | Exocoetidae | *Cheilopogon cyanopterus* | 115 | 16.02 |
| | Ommastrephidae | *Ommastrephes bartramii* | 24 | 3.34 |
| | Exocoetidae | *Prognichthys gibbifrons* | 10 | 1.25 |

**Table S4** Relative abundance per colony of prey ingested by *Sula leucogaster* in the southwestern Atlantic Ocean at family level. RA% = relative abundance; MS = Moleques; CU = Currais; CA = Cagarras; CF = Cabo Frio; ST = Santana; AB = Abrolhos; FN= Noronha; RO = Rocas; SPSP = São Pedro e São Paulo.

| **ORDER** | **FAMILIES** | **RA%** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **MS** | **CU** | **CA** | **CF** | **ST** | **AB** | **FN** | **RO** | **SPSP** |
| **Decapoda** | Solenoceridae | 0.40 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Myopsida** | Loliginidae | 5.19 | 0.52 | 0.00 | 2.48 | 0.50 | 0.00 | 0.00 | 0.08 | 0.00 |
| **Oegopsida** | Ommastrephidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 3.49 |
| **Atheriniformes** | Atherinidae | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Aulopiformes** | Synodontidae | 0.10 | 13.02 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Batrachoidiformes** | Batrachoididae | 5.49 | 0.00 | 0.00 | 26.24 | 7.77 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Beloniformes** | Belonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.03 | 0.00 | 0.08 | 0.13 |
| | Exocoetidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 18.78 | 15.38 | 19.80 | 68.50 |
| | Hemiramphidae | 0.10 | 0.00 | 3.14 | 0.00 | 0.00 | 44.67 | 10.26 | 23.06 | 25.47 |
| **Carangiformes** | Bothidae | 0.00 | 0.00 | 0.00 | 1.98 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Carangidae | 4.90 | 13.54 | 3.77 | 25.74 | 0.00 | 16.75 | 1.28 | 0.00 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coryphaenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | 0.80 |
| | Cyclopsettidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cynoglossidae | 1.00 | 0.52 | 0.00 | 0.50 | 1.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Paralichthyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Clupeiformes** | Clupeidae | 1.40 | 17.19 | 50.31 | 9.90 | 0.50 | 8.12 | 73.08 | 17.11 | 0.00 |
| | Engraulidae | 29.27 | 9.38 | 39.62 | 4.46 | 2.01 | 5.58 | 0.00 | 0.00 | 0.00 |
| | Pristigasteridae | 1.30 | 2.08 | 0.00 | 0.00 | 35.84 | 2.54 | 0.00 | 0.00 | 0.00 |
| **Gadiformes** | Phycidae | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Holocentriformes** | Holocentridae | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.51 | 0.00 | 1.87 | 0.00 |
| **Mugiliformes** | Mugilidae | 1.70 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Ophidiiformes** | Ophidiidae | 0.00 | 0.00 | 0.00 | 0.99 | 4.51 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Perciformes** | Gerreidae | 0.10 | 9.90 | 0.63 | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Haemulidae | 0.70 | 2.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 |
| | Malacanthidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.85 | 0.00 |
| | Percophidae | 0.00 | 0.00 | 0.63 | 1.98 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Priacanthidae | 0.00 | 0.00 | 0.63 | 0.99 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Sciaenidae | 44.16 | 28.65 | 0.63 | 11.88 | 40.60 | 0.51 | 0.00 | 0.00 | 0.00 |
| | Serranidae | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Sparidae | 0.00 | 0.00 | 0.00 | 7.43 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Triglidae | 0.20 | 0.00 | 0.00 | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Scombriformes** | Bramidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 |
| | Gempylidae | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 2.53 | 0.27 |
| | Nomeidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.73 | 0.40 |
| | Scombridae | 1.10 | 2.60 | 0.00 | 0.00 | 0.25 | 0.51 | 0.00 | 0.57 | 0.94 |
| | Stromateidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Trichiuridae | 2.00 | 0.00 | 0.00 | 0.50 | 2.51 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Syngnathiformes** | Dactylopteridae | 0.00 | 0.00 | 0.63 | 1.49 | 0.00 | 0.00 | 0.00 | 0.49 | 0.00 |
| | Fistulariidae | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Mullidae | 0.20 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Tetraodontiformes** | Balistidae | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Diodontidae | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Molidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.99 | 0.00 |

**Table S5** Distance matrix based on the beta-sim index ($\beta_{sim}$) of the species consumed by brown boobies (*Sula leucogaster*) from regurgitated material data in colonies located in the southwestern Atlantic Ocean. Values range from 0 (low dissimilarity, identical community) to 1 (high dissimilarity, no species in common). SPSP = São Pedro e São Paulo.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Moleques** | | | | | | | | |
| 0.59 | **Currais** | | | | | | | |
| 0.82 | 0.55 | **Cagarras** | | | | | | |
| 0.37 | 0.74 | 0.55 | **Cabo Frio** | | | | | |
| 0.45 | 0.73 | 0.82 | 0.63 | **Santana** | | | | |
| 0.71 | 0.79 | 0.82 | 0.86 | 0.79 | **Abrolhos** | | | |
| 1.00 | 0.88 | 0.88 | 0.88 | 1.00 | 0.88 | **Noronha** | | |
| 1.00 | 0.93 | 0.73 | 0.87 | 1.00 | 0.86 | 0.13 | **Rocas** | |
| 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.86 | 0.25 | 0.40 | **SPSP** |

**Table S6** Mean ± 1 standard deviation (SD), minimum and maximum values of carbon ($\delta^{13}$C) and nitrogen ($\delta^{15}$N) isotopic ratios from blood samples of *Sula leucogaster* from each colony in the southwestern Atlantic Ocean, ordered on a latitudinal gradient, from south to north. SPSP = São Pedro e São Paulo.

| **Colony** | **n** | **$\delta^{13}$C (‰)** | | | **$\delta^{15}$N (‰)** | | |
|---|---|---|---|---|---|---|---|
| | | **Mean ± SD** | **Min** | **Max** | **Mean ± SD** | **Min** | **Max** |
| **Moleques** | 18 | -16.99 ± 0.22 | -17.38 | -16.55 | 14.12 ± 0.29 | 13.23 | 14.67 |
| **Cagarras** | 27 | -17.67 ± 0.41 | -18.21 | -16.72 | 13.03 ± 0.34 | 12.25 | 13.71 |
| **Santana** | 102 | -17.25 ± 0.34 | -17.96 | -16.68 | 14.32 ± 0.31 | 13.41 | 14.97 |
| **Abrolhos** | 43 | -16.89 ± 0.52 | -18.56 | -15.93 | 10.80 ± 0.95 | 8.63 | 12.21 |
| **Noronha** | 27 | -16.49 ± 0.24 | -17.00 | -15.79 | 9.91 ± 0.19 | 9.59 | 10.41 |
| **Rocas** | 28 | -16.81 ±0.30 | -17.41 | -16.17 | 9.98 ± 0.29 | 9.59 | 10.67 |
| **SPSP** | 127 | -17.11 ± 0.19 | -17.52 | -16.62 | 11.88 ± 0.88 | 10.01 | 13.33 |

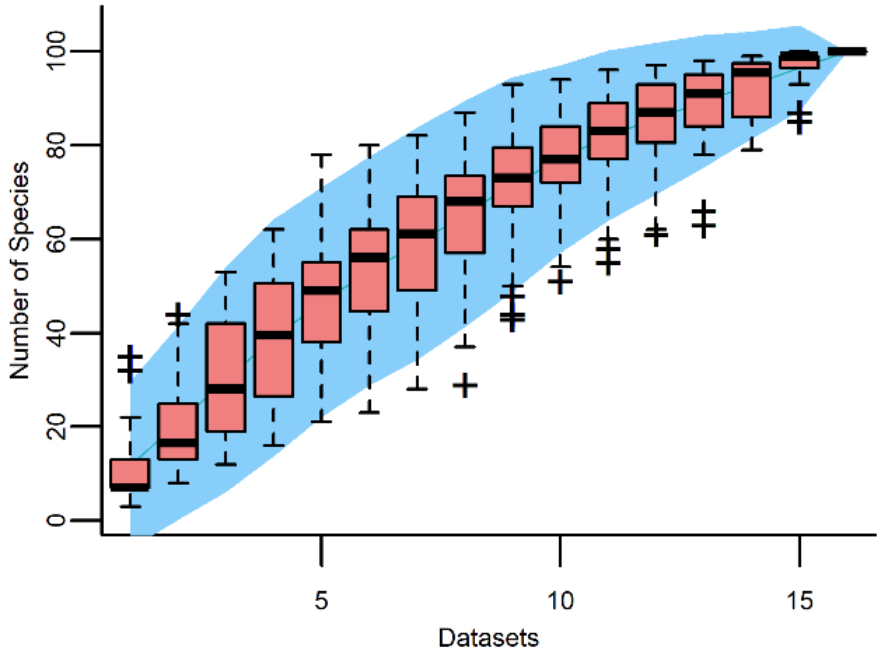


**Fig. S1** Accumulation curve of prey species consumed by *Sula leucogaster* in the southwestern Atlantic Ocean, considering all data sources obtained for each colony.

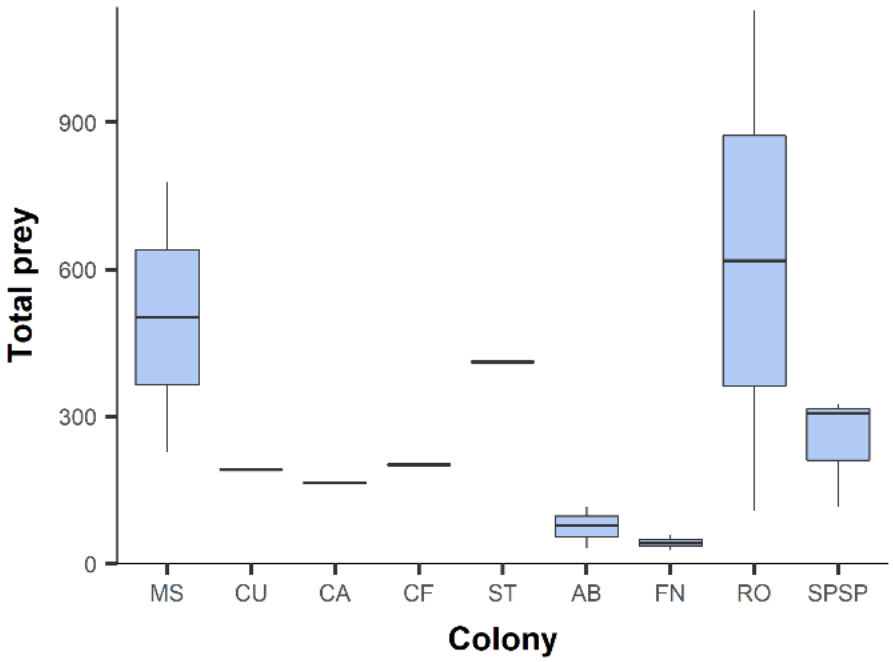


**Fig. S2** Number of prey items consumed by *Sula leucogaster* obtained for each colony in the southwest Atlantic Ocean after literature review. Colonies are arranged in decreasing latitudinal order. MS = Moleques; CU = Currais; CA = Cagarras; CF = Cabo Frio; ST = Santana; AB = Abrolhos; FN= Noronha; RO = Rocas; SPSP = São Pedro e São Paulo.

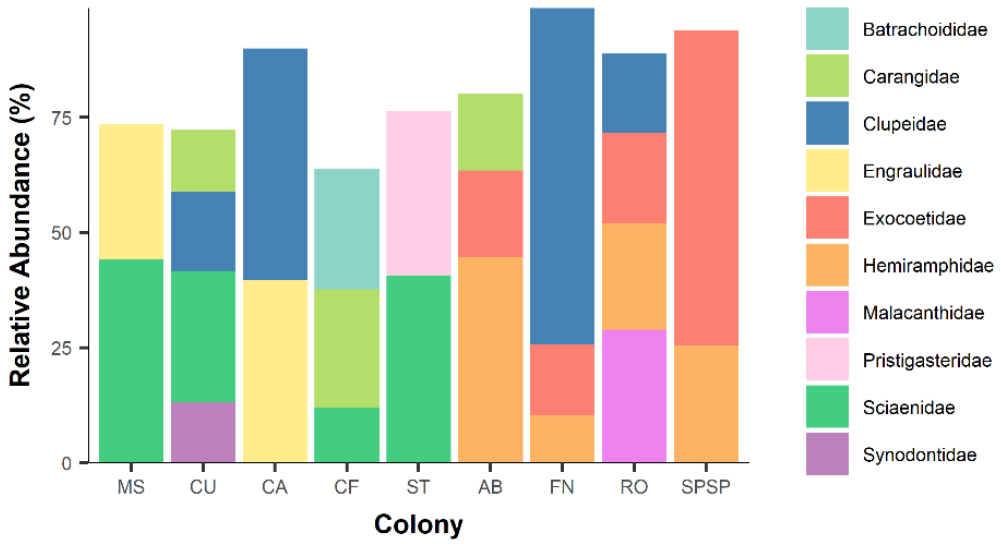


**Fig. S3** Families consumed by *Sula leucogaster* in southwestern Atlantic Ocean with relative abundance (RA) higher than 10% in each colony. Colonies are ordered in a decreasing latitudinal gradient. MS = Moleques; CU = Currais; CA = Cagarras; CF = Cabo Frio; ST = Santana; AB = Abrolhos; FN= Noronha; RO = Rocas; SPSP = São Pedro e São Paulo.

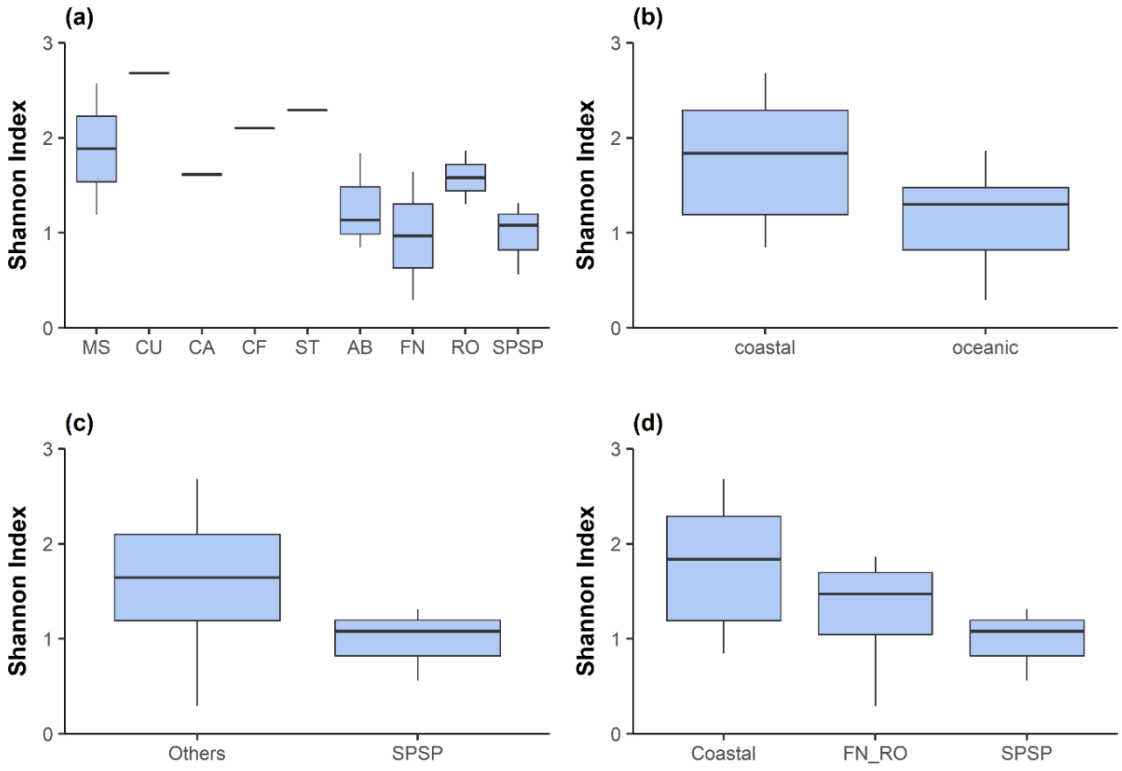


**Fig. S4** Shannon diversity index of species consumed by *Sula leucogaster* in: (a) each colony of the southwest Atlantic Ocean; (b) coastal and oceanic colonies; (c) assuming two and (d) three genetic clusters. MS = Moleques; CU = Currais; CA = Cagarras; CF = Cabo Frio; ST = Santana; AB = Abrolhos; FN= Noronha; RO = Rocas; SPSP = São Pedro e São Paulo.

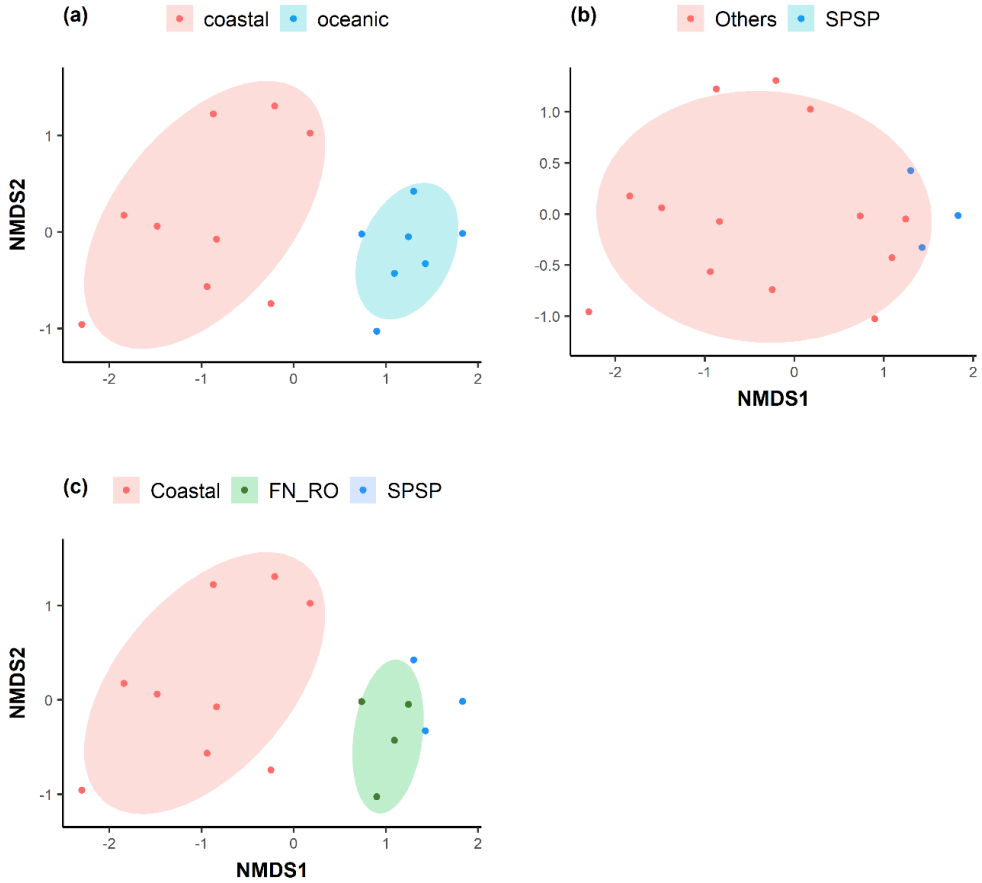


**Fig. S5** Two-dimensional NMDS plots considering a binary matrix of the prey community consumed by *Sula leucogaster* in the southwestern Atlantic Ocean in relation to (a) positioning of colonies on the continental shelf; genetic groupings K=2 (b) and K=3 (c) defined by Nunes and Bugoni (2018).