

Ecography

**ECOG-03506**

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**Supplementary material**

## Appendix 1

**Table A1.** List of oceanic islands analyzed within this study located in five different marine provinces. Tropical Eastern Pacific – North (TEPN), Tropical Eastern Pacific – South (TEPS), Southwestern Atlantic (SWA), Central Atlantic (CA) and Tropical Eastern Atlantic (TEA). UVCs: Underwater Visual Census.

Province	Oceanic Island	Code	Latitude	Longitude	Sites	Year	Total UVCs	Area UVCs (m <sup>2</sup> )	Total area sampled
TEPN	Clarion	RCL	18.35	-114.729	2	2006	24	250 & 50	3800
TEPN	Roca Partida	RRP	18.962	-112.052	1	2006	14	250 & 50	1800
TEPN	San Benedicto	RSB	19.3343	-110.823	2	2006	22	250 & 50	3300
TEPN	Socorro	RSO	18.729	-110.965	4	2006	27	250 & 50	3750
TEPN	Clipperton	CLP	10.2981	-109.2183	3	2008	25	50	1250
TEPS	Cocos	COC	5.5300	-87.0548	8	2014	88	40	1280
TEPS	Malpelo	MAL	3.9950	-79.6076	4	2015	101	40	2040
TEPS	Galápagos-Central	GALC	-0.5308	-90.6924	8	2014	14	250	3500
TEPS	Galápagos-South	GALS	-1.2941	-90.4379	4	2014	8	250	2000
SWA	St Paul's Rocks	SPR	0.8988	-29.3110	4	2011	65	40	2600
SWA	Rocas Atoll	ROC	-3.8552	-33.8110	11	2012	176	40	6240
SWA	Fernando de Noronha	FNO	-3.8536	-32.4054	8	2007	89	40	3560
SWA	Trindade	TRI	-20.5453	-29.1941	10	2009	272	40	10080
SWA	Martin Vaz	MVZ	-20.4741	-32.8568	1	2013	47	40	1880
CA	Ascension	ASC	-7.9333	-14.4167	3	2015	81	40	3240
TEA	Cape Verde	CVE	16.7611	-24.7340	9	2009	198	40	7920
TEA	Príncipe	PRI	1.6184	7.4038	7	2016	137	40	5480
TEA	São Tomé	STO	0.1905	7.6149	7	2006	139	40	5560

**Table A2.** Biogeographic (area, distance from nearest reef, and species richness from of the local species pool), energetic (Mean Sea Surface Temperature - SST, and primary productivity) and anthropogenic factors (human density, distance from mainland, and protection level) considered in the comparative analyses of reef fish assemblages at oceanic islands. Each superscript represents one reference a local checklist for the different islands: (1) Robertson & Allen (2016); (2) Fourrière et al. (2014); (3) Rubio et al. (1992); (4) Kulbicki et al. (2013); (5) Floeter et al. (2008); (6) Simon et al. (2013); (7) Wirtz et al. (2014); (8) Wirtz et al. (2007). Tropical Eastern Pacific – North (TEPN), Tropical Eastern – South (TEPS), Southwester Atlantic (SWA), Central Atlantic (CA) and Tropical Eastern Atlantic (TEA). Protection levels: Habitat/species management area (1), Natural monument and natural feature (2), National park (3), Wilderness area (4).

Province	Oceanic Island	Area (Km <sup>2</sup> )	Distance from nearest reef (Km)	Local pool	Mean SST* (°C)	Primary productivity* (mg m <sup>-3</sup> )	Hum. Density (ind/km <sup>2</sup> )	Distance from mainland (Km)	Protection level‡
TEPN	Clarion	31.4	314	136 <sup>1</sup>	25.98	25.95	0	700	4
TEPN	Roca Partida	0.014	100	119 <sup>1</sup>	25.98	26.10	0	459	4
TEPN	San Benedicto	6.76	55.68	139 <sup>1</sup>	25.98	26.19	0	402	4
TEPN	Socorro	184.39	100	141 <sup>1</sup>	25.98	26.33	0.244	460	4
TEPN	Clipperton	12.62	945	119 <sup>2</sup>	28.29	31.62	0	1080	3
TEPS	Cocos	34.35	550	284 <sup>1</sup>	28.04	31.44	0.23	490	4
TEPS	Malpelo	3.5	380	202 <sup>1,3</sup>	26.92	47.80	2.29	395	4
TEPS	Galapagos-Central	8985	35	203 <sup>1</sup>	26.32	63.60	0.19	965	3
TEPS	Galapagos-South	281.2	55	178 <sup>1</sup>	21.25	63.59	0.36	965	3
SWA	St Paul's Rocks	0.032	630	59 <sup>4,5</sup>	27.40	31.18	0.001	1010	1
SWA	Rocas Atoll	7.036	145	123 <sup>4,5</sup>	27.23	7.41	0.57	288	4
SWA	Fernando de Noronha	33.79	145	151 <sup>4,5</sup>	27.53	23.33	89.14	345	3
SWA	Trindade	13.77	50	154 <sup>4,5</sup>	25.64	14.99	3.63	1150	2
SWA	Martin Vaz	3.93	50	64 <sup>6</sup>	25.64	15.08	12.72	1200	2
CA	Ascension	111.6	1130	107 <sup>7</sup>	25.89	23.61	7.89	1500	2
TEA	Cape Verde	58.27	10	269 <sup>5</sup>	24.46	49.13	35.45	800	1

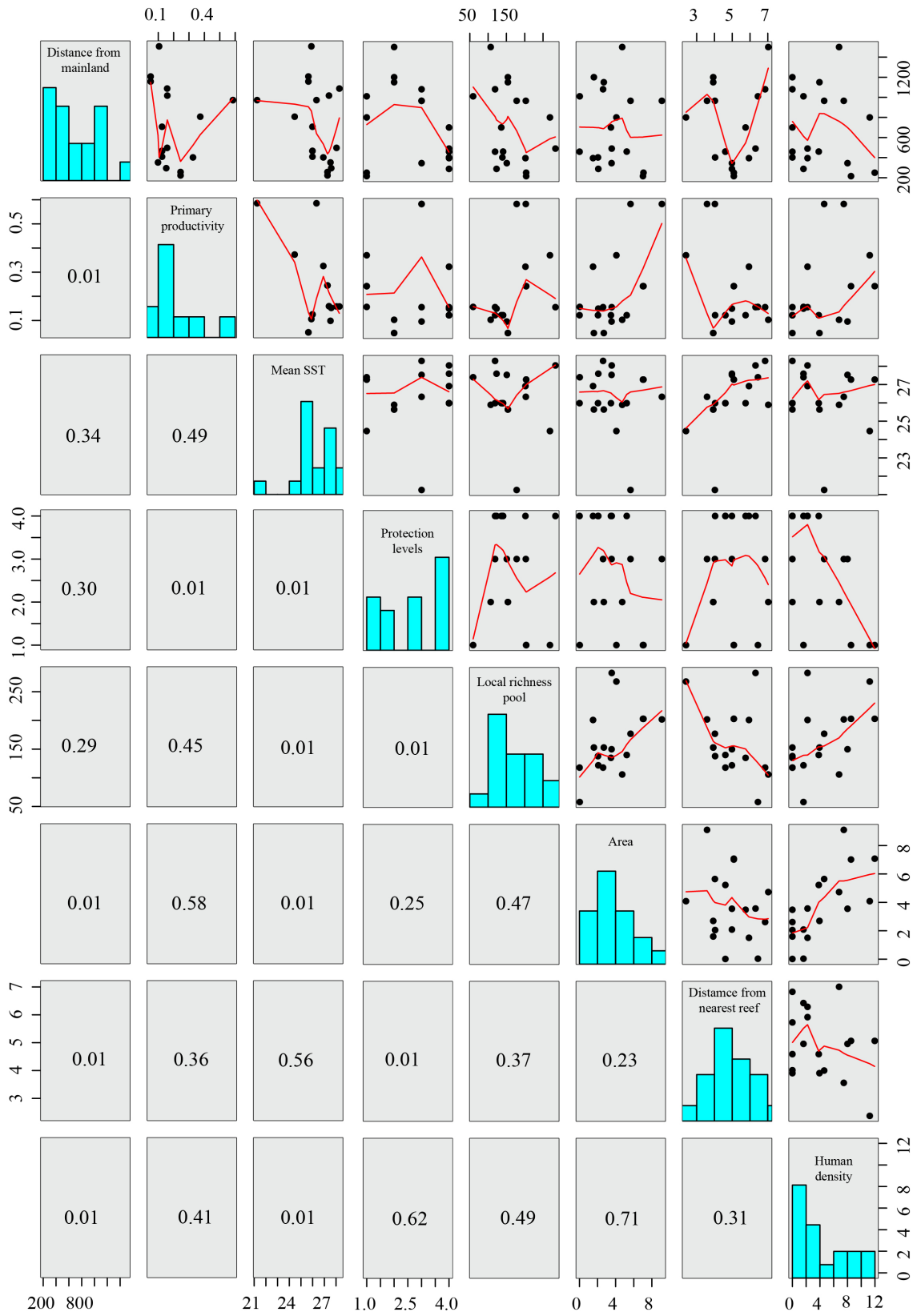
TEA	Príncipe	1111.2	161.4	204 <sup>5</sup>	27.27	40.93	45	216	1
TEA	São Tomé	11181.13	161.4	204 <sup>5,8</sup>	27.27	40.50	132.92	250	1

\* Data extracted from BioOracle (Tyberghein et al. 2012) ‡ Data extracted from IUCN

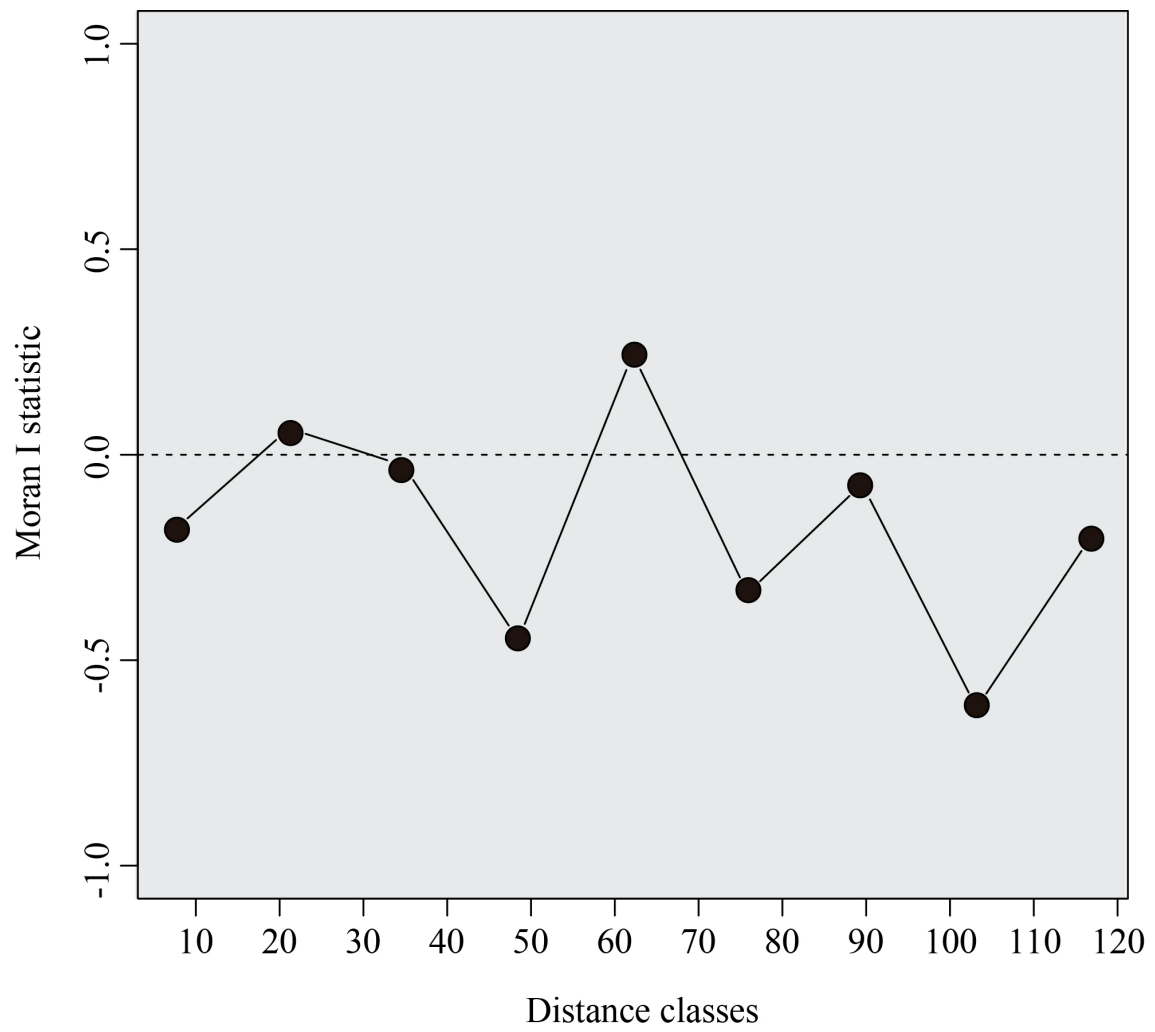
**Table A3.** Mean and standard deviation of each assemblage metric estimated for each oceanic island located in five marine provinces. Tropical Eastern Pacific – North (TEPN), Tropical Eastern Pacific – South (TEPS), Southwestern Atlantic (SWA), Central Atlantic (CA) and Tropical Eastern Atlantic (TEA).

Province	Oceanic Island	Species richness (spp/m <sup>2</sup> )	Functional dispersion	Density (ind/m <sup>2</sup> )	Biomass (g/m <sup>2</sup> )
TEPN	Clarion	11.75 ± 2.97	1.78 ± 0.16	1.46 ± 1.58	114.5 ± 64.56
TEPN	Roca Partida	14.06 ± 5.31	1.71 ± 0.06	4.19 ± 2.61	804.2 ± 562.9
TEPN	San Benedicto	12.68 ± 2.00	1.59 ± 0.11	2.22 ± 2.14	246.4 ± 190.7
TEPN	Socorro	10.21 ± 2.43	1.60 ± 0.12	1.02 ± 0.91	111 ± 65.98
TEPN	Clipperton	12.52 ± 2.76	2.17 ± 0.01	5.70 ± 5.54	880 ± 743.9
TEPS	Cocos	14.78 ± 3.12	2.33 ± 0.05	4.85 ± 3.85	850 ± 254.36
TEPS	Malpelo	22.86 ± 3.55	1.96 ± 0.14	6.79 ± 5.59	879 ± 674.89
TEPS	Galapagos-Central	12.05 ± 3.25	1.36 ± 0.06	5.89 ± 3.89	710 ± 269.4
TEPS	Galapagos-South	23-37 ± 5.52	2.07 ± 0.17	5.92 ± 4.68	1087 ± 358.9
SWA	St Paul's Rocks	9.58 ± 2.57	1.99 ± 0.05	6.98 ± 7.0	559 ± 311.1
SWA	Rocas Atoll	9.23 ± 2.58	1.69 ± 0.04	6.94 ± 6.92	289 ± 360.9
SWA	Fernando de Noronha	11.17 ± 3.32	1.71 ± 0.05	2.24 ± 2.24	199 ± 155.4
SWA	Trindade	11.82 ± 3.29	1.88 ± 0.06	2.32 ± 2.32	496 ± 349.5
SWA	Martin Vaz	11.34 ± 2.80	2.17 ± 0.02	2.19 ± 2.19	559 ± 350.9
CA	Ascension	14.28 ± 5.38	2.05 ± 0.05	10.13 ± 10.13	545 ± 866.7
TEA	Cape Verde	13.88 ± 3.05	1.82 ± 0.01	1.57 ± 1.57	223 ± 496.76
TEA	Príncipe	13.40 ± 3.59	1.49 ± 0.07	6.96 ± 6.96	247 ± 218.03
TEA	São Tomé	12.64 ± 3.45	1.37 ± 0.07	7.12 ± 7.12	173 ± 230.63

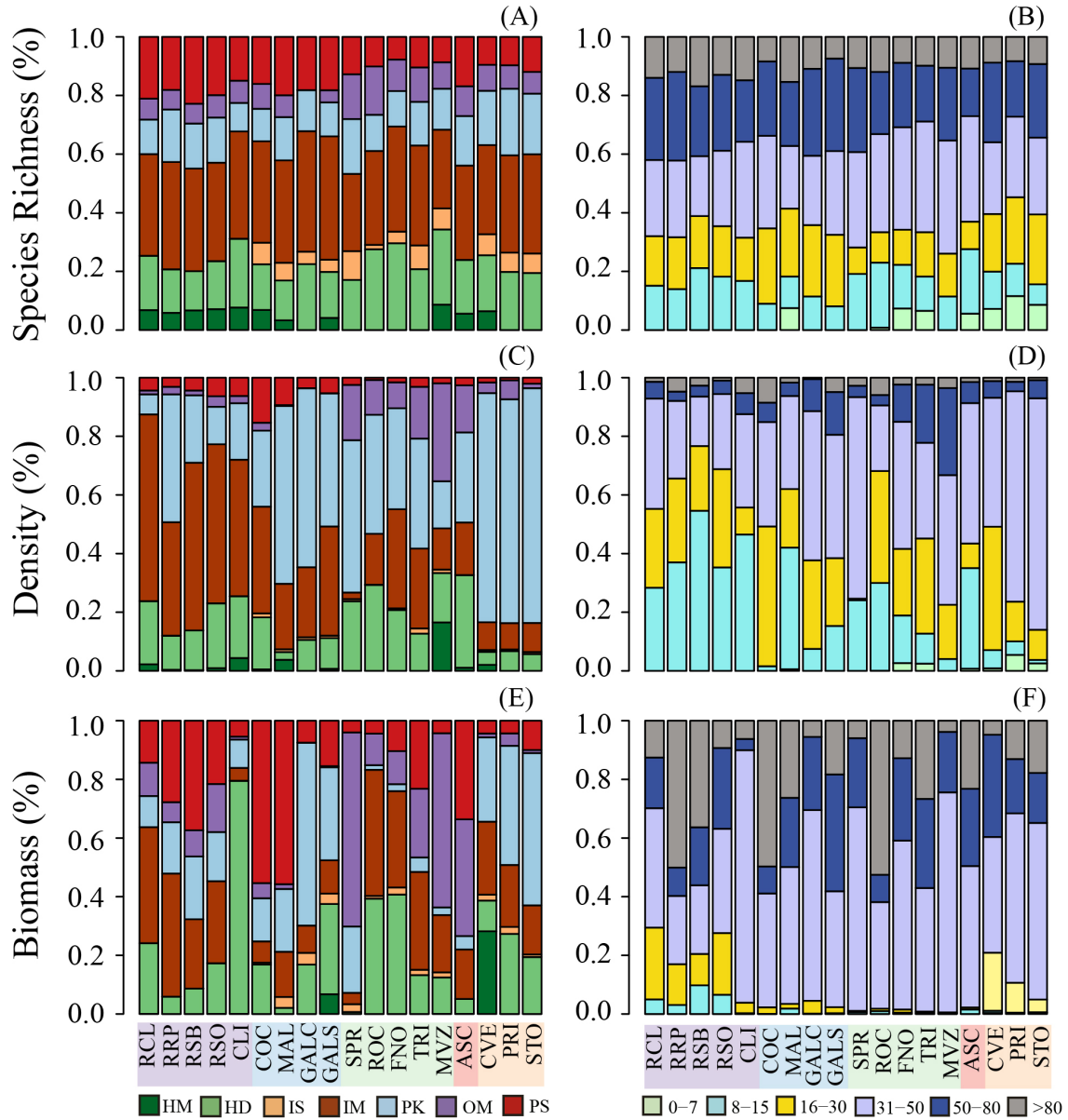
**Figure A1.** Correlation plot of candidate continuous covariates before accounting for collinearity



**Figure A2.** Plot exploring spatial autocorrelation of our analysis using Moran's I index



**Figure A3.** Comparison among the proportion of trophic groups (A, C, E) and size classes (B, D, F) observed at each oceanic island. Revillagigedos-Clarion (RCL), Revillagigedos-Roca Partida (RRP), Revillagigedos-San Benedicto (RSB), Revillagigedos-Socorro (RSO), Clipperton (CLI), Cocos (COC), Malpelo (MAL), Galápagos-Central (GALC) Galápagos-South (GALS), St Paul’s Rocks (SPR), Rocas Atoll (ROC), Fernando de Noronha (FNO), Trindade (TRI), Martin Vaz (MVZ), Ascension (ASC), Cape Verde (CVE), Príncipe (PRI), São Tomé (STO).





## Supplementary References

- Floeter, S. R. et al. 2008. Atlantic reef fish biogeography and evolution. – *J. Biogeogr.* 35: 22–47.
- Fourrière, B. M. et al. 2014. Fishes of Clipperton Atoll , Eastern Pacific : Checklist , endemism and analysis of completeness of the inventory. – *Pac. Sci.* 68: 375–395.
- Kulbicki, M. et al. 2013. Global Biogeography of Reef Fishes: A Hierarchical Quantitative Delineation of Regions. – *PLoS One.* 8: e81847.
- Robertson, D. R. and Allen, G. R. 2016. Shore fishes of the Tropical Eastern Pacific online information system. Version 1.0. Smithsonian Tropical Research Institute, Balaboa, Panama.
- Rubio, E. A. R. et al. 1992. Los Recurso Ictiologicos de la Isla Malpelo: Una Revisión de su Conocimiento y Nuevos Reportes para la Ictiofauna de la Isla. In: Seminario Nacional de Ciencias y Tecnologías del Mar. Tomo II. Santa Marta. pp. 642–657.
- Simon, T. et al. 2013. The shore fishes of the Trindade-Martin Vaz insular complex: an update. – *J. Fish Biol.* 82: 2113–27.
- Tyberghein, L. et al. 2012. Bio-ORACLE: A global environmental dataset for marine species distribution modelling. – *Global Ecol. Biogeogr.* 21: 272–281.
- Wirtz P. et al. 2014. The fishes of Ascension Island, central Atlantic Ocean – new records and an annotated check-list. – *J. Mar. Biol. Assoc. UK.* 1–23.
- Wirtz, P. et al. 2007. Coastal fishes of São Tomé and Príncipe islands, Gulf of Guinea ( Eastern Atlantic Ocean ) an update. – *Zootaxa.* 48: 1–48.