

1 **Supplementary Table 1. The Gaussian fitting parameters of X_{min}/K_{max} values for the different degree distributions**

Values	μ	$se(\mu)$	δ	$se(\delta)$
X_{min}/K_{max}	0.584	0.017	0.175	0.012
$X_{min}^{in}/K_{max}^{in}$	0.484	0.018	0.189	0.013
$X_{min}^{out}/K_{max}^{out}$	0.441	0.017	0.179	0.012

2

3 **Supplementary Table 2. Detailed network parameters of the two food webs.**

Type	Parameters	Symbol	Prince Edward Island	Humboldt Current
Spatiotem poral parameters	latitude	Lat	-46.68	37.64
	longitude	Long	-12.55	-80.44
	starting time	T0	2013	2017
	ending time	T1	2013	2017
Network parameters	total node	S	37	24
	total edge	L	200	100
	edge density	edge_density	0.151	0.181
	diversity of neighbours	mean_diversity	0.709	0.687
	diameter	diameter	0.7	1.32
	eigenvector centrality	eigen centrality	2.605	2.102
Fitting parameters	alpha	α	2.934	2.861
	alpha (in-degree)	α^{in}	4.459	2.590
	alpha (out-degree)	α^{out}	1.975	3.986
	minimum degree	X_{min}	9	7
	minimum in-degree	X_{min}^{in}	7	4
	minimum out-degree	X_{min}^{out}	3	7
	logic value	$logLik$	-67.5	-40.4
	KS test statistic	$KS.stat$	0.13	0.11
	p value of KS test	$KS.p$	0.835	0.513
	p value of KS test (in-degree)	$KS.p^{in}$	0.994	0.741
	p value of KS test (out-degree)	$KS.p^{out}$	0.704	0.999
	fitting accuracy	pk	0.999	0.932
	fitting accuracy (in-degree)	pk^{in}	0.979	0.649
	fitting accuracy (out-degree)	pk^{out}	0.696	0.999

4

5

6 **Supplementary Table 3. The detailed information of 105 marine food web data (*Note: Relevant references are attached at the end).**

No.	Position	country	Lat	Long	type	Hemisphere	Latitude zone	Climate zone	T1	T0	S	L
A1-45	Genoa Harbor	Italy	44,33	8,61	A	N	Middle	NT	2013	2013	10	29
A2-66	Lvsi Fishing Ground	China	33,19	121,02	A	N	Middle	NT	2020	2020	14	70
A3-80	Parangipettai (Porto Novo)	India	10,23	79,4	A	N	Middle	TR	2009	2009	17	106
A4-88	Rudong offshore	China	32,49	121,48	A	N	Middle	NT	2018	2018	14	87
B1-3	Albatross Bay	Australia	-13,37	141,76	B	S	Low	TR	1993	1986	99	1141
B2-5	Antofagasta bays	Chile	-23,14	-70,8	B	S	Low	TR	2012	2005	25	104
B3-6	Araçá Bay	Brazil	-23,896	-45,548	B	S	Low	TR	2017	2017	34	115
B4-8	Bahia Tortugas	Mexico	27,69	-114,84	B	N	Low	NT	2008	2006	23	107
B5-11	Bay of Bengal	Sri Lanka	21,36	90,65	B	N	Low	TR	2007	2007	14	71
B6-12	Bay of Biscay	France	45,34	-1,88	B	N	Middle	NT	2013	2013	32	192
B7-13	Bay of Seine	France	49,38	-0,54	B	N	Middle	NT	2018	2018	37	238
B8-14	Bay of Somme	France	50,26	1,46	B	N	Middle	NT	2002	2002	9	24
B9-15	Bay of Sørkjord	Norway	69,58	18,79	B	N	High	NF	2007	2007	27	134
B10-19	Betty's Bay	South Africa	-34,33	18,59	B	S	Middle	ST	2020	2020	26	88
B11-28	Chwaka Bay	Tanzania	-5,67	39,46	B	S	Low	TR	2017	2017	28	234
B12-38	Daya Bay	China	22,64	114,64	B	N	Low	TR	2014	2014	32	244
B13-41	Fildes Bay	Antarctica	-63,56	-57,29	B	S	High	ST	2015	2015	17	72
B14-42	Foul and Folly Bays	Jamaica	17,78	-76,69	B	N	Low	TR	2008	2007	11	26
B15-48	Gulf of California	Mexico	23,8	-108,4	B	N	Low	TR	2001	2001	27	153
B16-49	Gulf of Gabes	Tunisia	34,06	10,64	B	N	Middle	NT	2012	2012	41	290
B17-50	Gulf of Lions	France	43,32	3,96	B	N	Middle	NT	2012	2012	40	195

B18-56	Hudson Bay	Canada	59,35	-86,05	B	N	Middle	NT	2009	1970	40	427
B19-62	Kakinada Bay	India	17,05	82,22	B	N	Low	TR	2020	2020	24	213
B20-67	Magellan Strait	Chile	-53,62	-70,82	B	S	Middle	NT	2019	2019	21	117
B21-71	Nanwan Bay	China	21,85	120,71	B	N	Low	TR	2008	2008	18	110
B22-74	North Sulawesi	Indonesia	2,26	124,32	B	S	Low	TR	2019	2019	50	736
B23-77	Northern Persian Gulf	Persian Gulf	26,68	52,53	B	N	Low	NT	2020	2020	32	142
B24-84	Prydz Bay	Antarctica	-66,26	75,39	B	S	High	SF	2016	2016	22	142
B25-90	San Matías gulf	Argentina	-41,63	-64,17	B	S	Middle	ST	2015	2015	26	165
B26-91	Sanggou Bay	China	37,09	122,64	B	N	Middle	NT	2019	2019	16	57
B27-92	Sansha Bay	China	26,55	119,96	B	N	Low	NT	2021	2021	22	136
B28-94	Saronikos Gulf	Mediterranean coastal	37,73	23,78	B	N	Middle	NT	2020	2020	40	326
B29-99	Tokyo Bay	Japan	35,07	139,63	B	N	Middle	NT	2016	2016	10	18
B30-100	Tongoy Bay	Chile	-30,03	-71,57	B	S	Middle	NT	2015	2015	13	44
B31-102	Xiamen Bay	China	24,39	118,33	B	N	Low	NT	2014	2014	26	194
C1-2	Alaska-Gulf of Alaska	USA	56,09	-150,19	C	N	Middle	NT	2009	2009	49	414
C2-9	Baja California	USA	25,47	-113,76	C	N	Low	NT	2007	2004	17	114
C3-29	Coast of Benguela	Namibia	-27,03	15	C	S	Low	ST	1989	1971	17	66
C4-30	Coast of Peru	Peru	-7,07	-81,43	C	S	Low	ST	1984	1953	28	147
C5-31	Coast of Sardinia	Italy	40,87	9,65	C	N	Middle	ST	2006	1994	15	42
C6-32	Coast of Scotland	UK	57,32	-8,43	C	N	Middle	NT	2017	1985	41	446
C7-33	Coast of Sénégal	Senegal	14,08	-17,01	C	N	Low	TR	2008	2006	31	303
C8-34	Coast of Tabasco	Mexico	18,52	-93,71	C	N	Low	TR	2014	2014	33	227
C9-36	Danajon Bank	Philippines	11,06	124,22	C	N	Low	TR	2013	2013	37	351
C10-46	Great Australian Bight	Australia	-35,97	135,85	C	S	Middle	ST	2012	2012	40	316

C11-51	Gulf of Mersin	Mediterranean Sea	36,44	35,08	C	N	Middle	NT	2019	2019	48	449
C12-52	Gulf of Mexico	USA	29,43	-88,28	C	N	Middle	NT	2015	2015	47	630
C13-64	KwaZulu-Natal Bight	South Africa	-29,11	32,24	C	S	Low	ST	2010	2010	17	98
C14-72	Nigerian coastal waters	Nigerian	4,09	4,95	C	N	Low	TR	2000	2000	24	150
C15-86	Ria de Arousa	Spain	42,61	-9,25	C	N	Middle	NT	2017	2017	34	217
C16-87	Ria de Aveiro	Portugal	40,2	-9,26	C	N	Middle	NT	2017	2017	26	121
C17-96	Sri Lanka Coastal	Sri Lanka	6,45	81,93	C	N	Low	TR	2007	2007	39	337
CF1-7	Australia North West Shelf	Australia	-19,71	116,48	CF	S	Low	TR	1991	1986	37	332
CF2-10	Barents Sea	Russian	68,88	41,63	CF	N	High	NF	1990	1990	41	286
CF3-44	Galapagos shelf	Ecuador	-1,18	-88,69	CF	S	Low	TR	2020	2020	72	481
CF4-59	insular shelf of Cyprus	Cyprus	35,12	32,39	CF	N	Middle	NT	2018	2018	39	310
CF5-61	Israeli Mediterranean continental shelf	Mediterranean Sea	32,07	34,36	CF	N	Middle	NT	2016	2016	41	357
CF6-63	Kerguelen Plateau	Antarctic	-50,24	73,13	CF	S	Middle	ST	2019	2019	28	169
CF7-82	Portuguese continental shelf	Atlantic	39,26	-11,59	CF	N	Middle	NT	2020	2020	35	300
CF8-101	western Antarctic Peninsula continental shelf	Antarctic	-67,79	-72,24	CF	S	High	SF	2013	2013	23	84
CS1-26	Catalan continental slope	Mediterranean Sea	40,26	2,29	CS	N	Middle	NT	2012	2012	20	126
E1-24	Canche estuary	France	45,4	-0,92	E	N	Middle	NT	2010	2010	15	64
E2-37	Danshuei River Estuary	China	25,46	121,45	E	N	Low	NT	2013	2013	16	72

E4-55	Hooghly Matla estuarine-18	India	21,98	88,08	E	N	Low	TR	2018	2018	22	119
E5-70	Mondego estuary	Portugal	40,71	-8,67	E	N	Middle	NT	2010	2010	20	81
E6-81	Pearl River Delta	China	22,69	113,65	E	N	Low	TR	2010	2010	14	41
E7-89	Saco River estuary	USA	43,03	-70,14	E	N	Middle	NT	2015	2015	20	76
E8-93	Santa Cruz Channel estuary	Brazil	-7	-33,17	E	S	Low	TR	2021	2021	32	219
E9-98	Terekhol estuary	India	15,39	72,79	E	N	Low	NT	2020	2020	22	142
E10-103	Yangtze estuary	China	31,34	122,36	E	N	Middle	NT	2006	2006	17	95
I1-22	Canarian Archipelago	Kingdom of Castile	28,04	-15,88	I	N	Low	NT	2014	2014	34	165
I2-23	Canary Islands	Kingdom of Castile	27,51	-18,19	I	N	Low	NT	2019	2019	22	101
I3-25	Caribbean coral reef	Mexico	22,55	-89,66	I	N	Low	TR	2010	2010	50	427
I4-35	Corsican coast	France	42,58	9,44	I	N	Middle	NT	2013	2012	39	162
I5-43	Galápagos Island	Ecuador	-0,91	-90,35	I	S	Low	TR	2015	2015	33	146
I6-47	Great Barrier Reef	Australia	-16,27	146,76	I	S	Low	TR	2002	2002	25	189
I7-53	Hawaiian Archipelago	USA	22,33	-161,05	I	N	Low	NT	2011	2011	33	160
I8-60	Isla Natividad	West Coast of Mexico	28,36	-115,33	I	N	Low	NT	2017	2017	40	222
I9-83	Prince Edward Island	South Africa	-46,68	37,64	I	S	Middle	ST	2013	2013	37	200
L1-4	Alvarado coastal lagoon	Mexico	19,8	-96,32	L	N	Low	TR	1994	1991	30	229
L2-27	Chilika Lagoon	India	19,79	85,43	L	N	Low	TR	2019	2019	22	203
L3-65	Laguna de Rocha lagoon	Uruguay	-35,61	-56,3	L	S	Middle	ST	2009	2009	27	151
L4-79	Orbetello Lagoon	Italy	42,49	11,14	L	N	Middle	NT	2003	2003	12	27

L5-85	Rhode Island	USA	41,26	-71,25	L	N	Middle	NT	2010	2010	16	61
L6-97	Tampamachoco lagoon	Mexico	22,82	-97,44	L	N	Low	TR	1998	1998	23	100
O1-75	Northeast Atlantic	Atlantic	45,83	-23,39	O	N	Middle	NT	2008	2008	37	286
O2-95AP	Southern Ocean	Southern Ocean	-64,36	-68,53	O	S	High	SF	2020	2020	24	86
O2-95PE	Southern Ocean	Southern Ocean	-46,85	37,12	O	S	Middle	ST	2020	2020	37	248
O2-95RS	Southern Ocean	Southern Ocean	-72,93	176,65	O	S	High	ST	2020	2020	38	194
O2-95SG	Southern Ocean	Southern Ocean	55,03	-59,77	O	S	Middle	ST	2020	2020	33	189
S1-1	Alaska-Chukchi Sea	USA	76,66	-159,21	S	N	High	NF	2009	2009	52	374
S2-18	Bering Sea	USA	63,58	-167,95	S	N	High	NT	2007	2007	29	101
S3-20	Black Sea	Middle East	43,62	32,64	S	N	Middle	NT	2013	2013	11	21
S4-21	Bohai Sea	China	38,77	119,84	S	N	Middle	NT	2016	2016	23	160
S5-39	East China Sea	China	28,54	122,82	S	N	Low	NT	2009	2009	21	121
S6-40	eastern Mediterranean Sea	Mediterranean Sea	32,63	33,55	S	N	Middle	NT	2019	2019	21	51
S7-68	Malangen fjord	Arctic deep-sea	71,66	22,89	S	N	High	NF	2019	2019	36	197
S8-69	Mediterranean deep-sea	Mediterranean Sea	34,67	20,56	S	N	Middle	NT	2014	2014	20	122
S9-73	North Sea	Europe	63,75	0,699	S	N	High	NT	2017	2017	7	28
S10-76	Northern Ionian Sea	Ionian Sea	36,21	17,24	S	N	Middle	NT	2020	2020	57	709
S11-78	Norwegian sea	Norwegian	72,89	18,52	S	N	High	NT	2016	2016	34	207

		sea										
U1-16	Benguela northern	upwelling	-22,43	12,45	U	S	Low	TR	1999	1999	24	94
U2-17	Benguela southern	South Africa	-30,41	15,48	U	S	Low	ST	2003	2003	33	230
U3-57	Humboldt Current	Peru	-12,55	-80,44	U	S	Low	TR	2017	2017	24	100
U4-58	Humboldt upwelling	Chile	-35,84	-76,89	U	S	Middle	ST	2004	2004	22	78

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212

213 **Supplementary Table 4. Descriptions of marine ecosystem types**

Marine ecosystem type	Description
Anthropogenic (A)	Human-dominated and affected marine ecosystems, mainly distributed in coastal areas, including ports, mariculture areas, and other artificial structures
Bay/Fjord (B)	A bay or fjord area affected by the coastline of a continent (i.e., Bohai Bay, Albatross Bay)
Coastal (C)	Coastal ecosystems, are nonhuman-dominated and do not belong to islands, reefs, and estuaries
Continental Shelf (CF)	It is indicated that it is a continental shelf ecosystem
Continental Slope (CS)	It is indicated that it is a continental slope ecosystem
Estuary (E)	River estuary area
Island/Coral reef (I)	Coastal areas of islands and coral reef
Lagoon (L)	A lagoon formed at the edge of the sea
Ocean (O)	Pelagic region
Sea (S)	Other sea ecosystems
Upwelling (U)	Special marine areas affected by upwelling

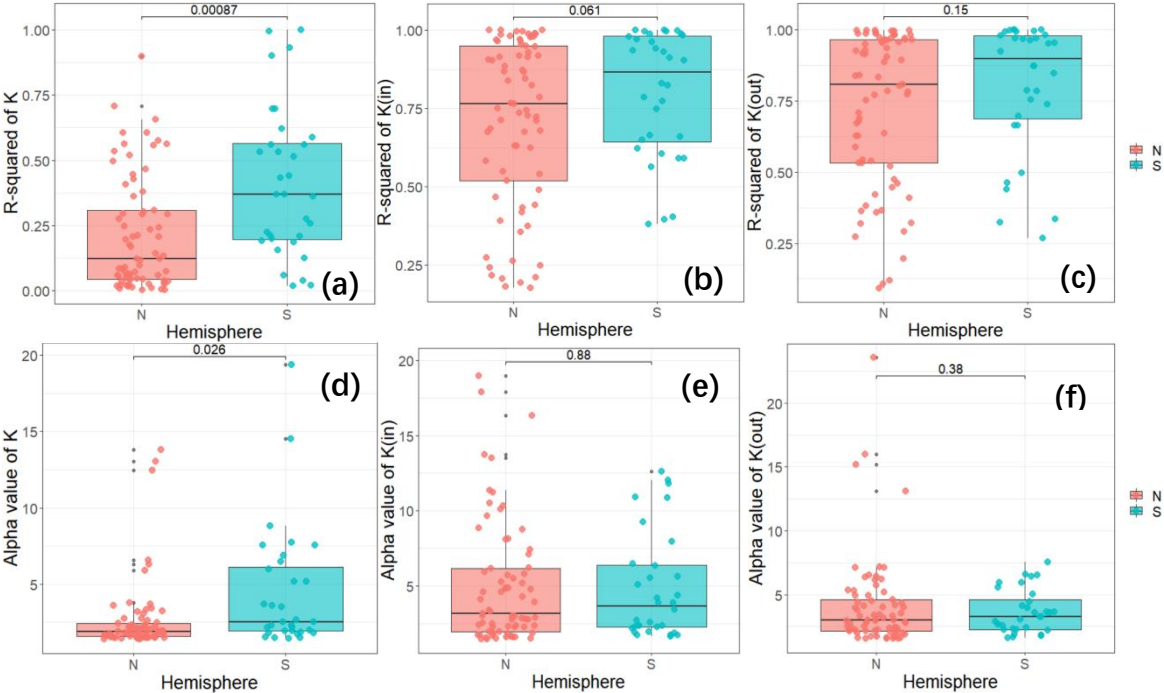
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215 **Supplementary Table 5. The requirement of classification for scale-free networks in the marine food web**

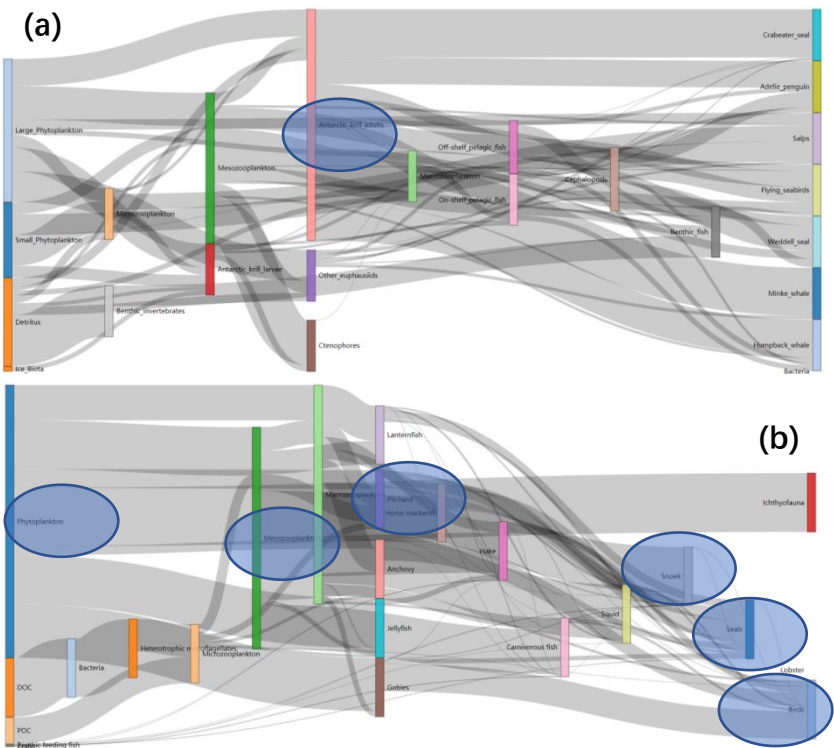
Levels	R-squared value	n_f	α
i	0.3	-	-
ii	0.5	-	-
iii	0.5	$n_f \geq 14$	-
iv	0.6	$n_f \geq 14$	$2 \leq \alpha \leq 3$
v	0.9	$n_f \geq 14$	$2 \leq \alpha \leq 3$

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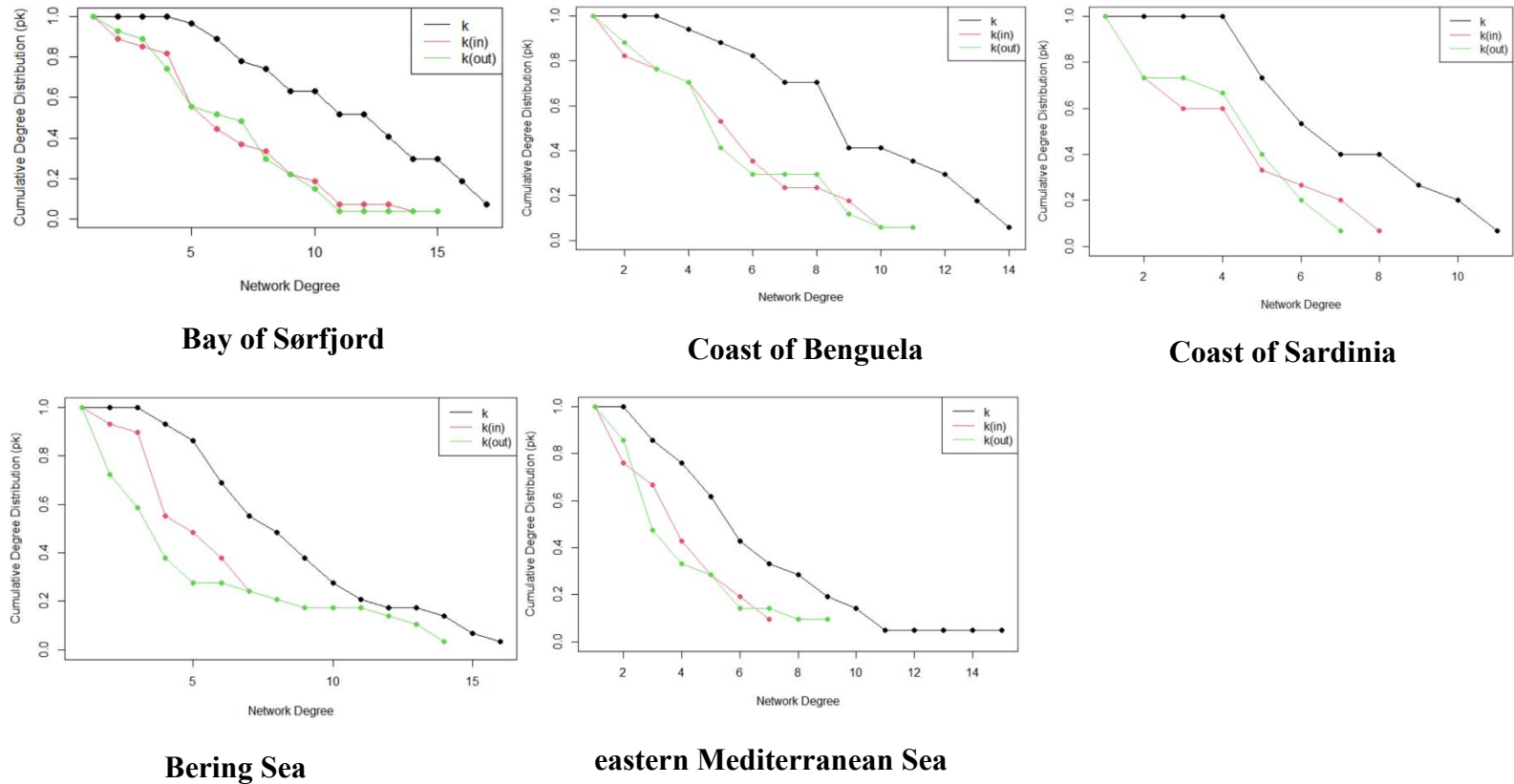
Supplementary Figure 1. The geospatial features of KS test parameters in the different hemispheres. (a) pk ; (b) pk^{in} ; (c) pk^{out} ; (d) α ; (e) α^{in} ; (f) α^{out}



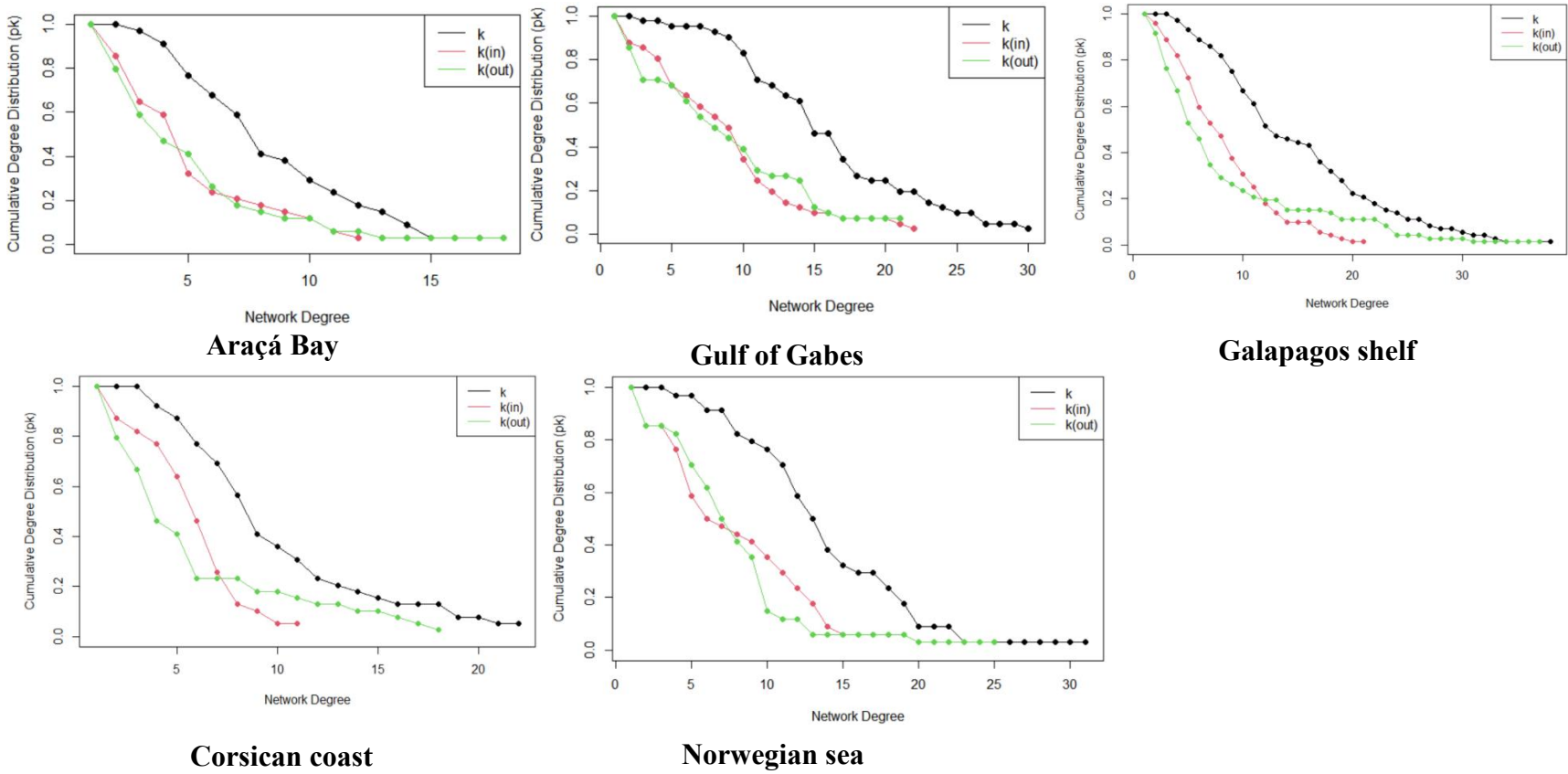
227 **Supplementary Figure 2. Sankey diagram of the food web; the blue circle represents the hub node. (a) Southern Ocean; (b) Northern**
228 **Benguela.**



(a) In-degree food web above Level V

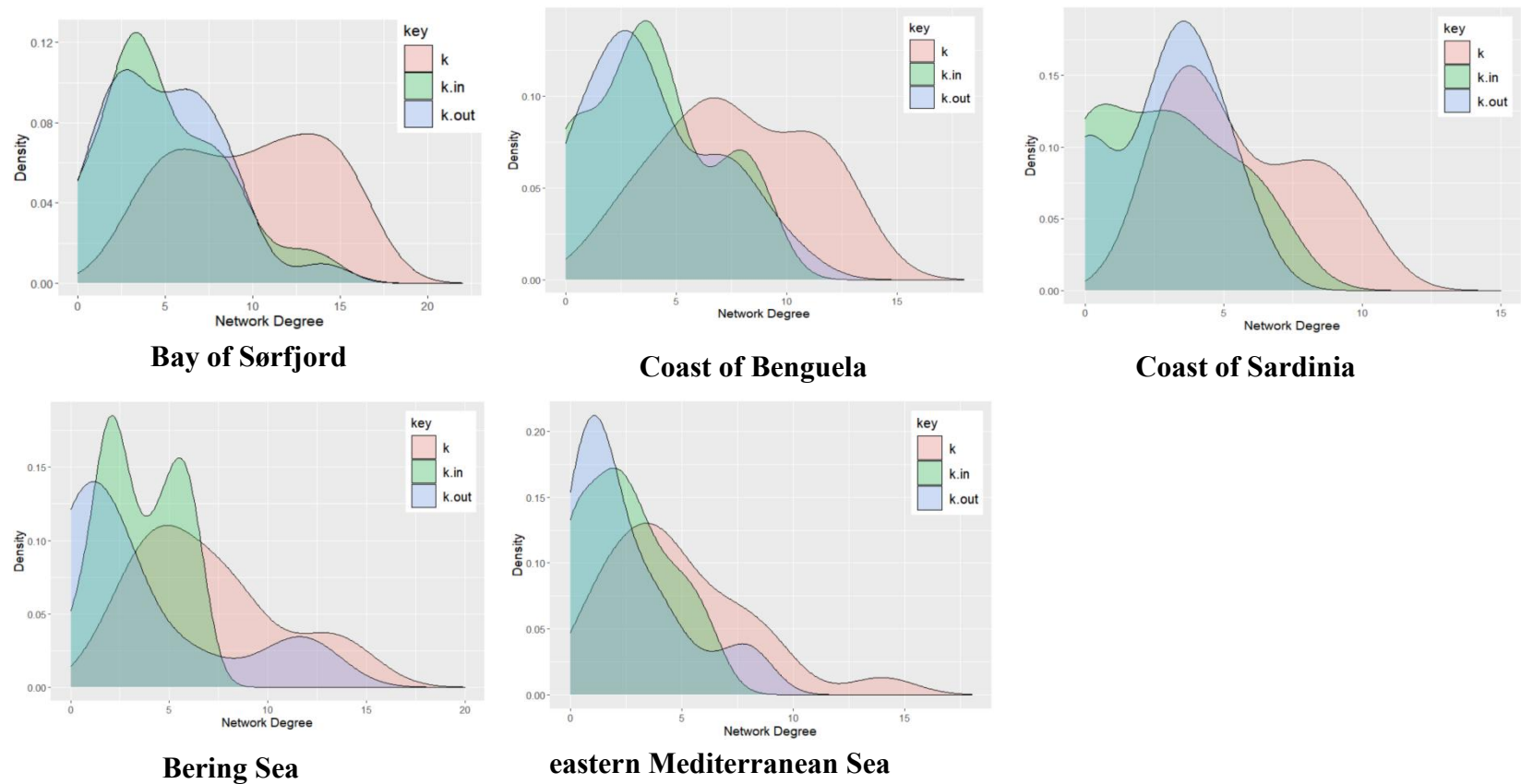


(b) Out-degree food web above Level V

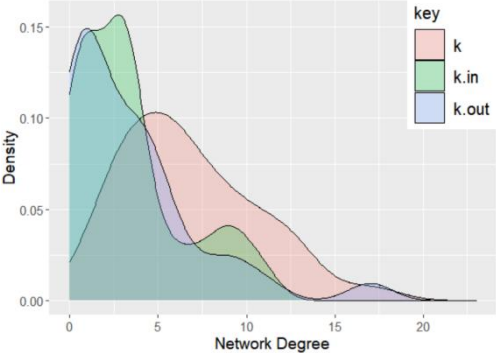


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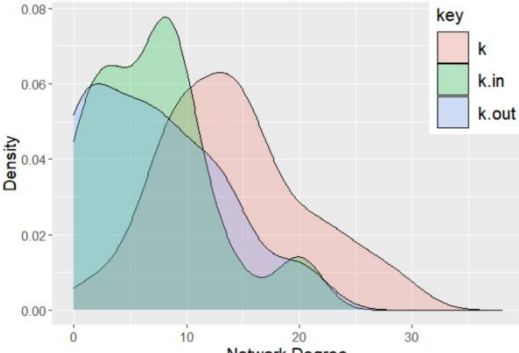
(a) In-degree food web above Level V



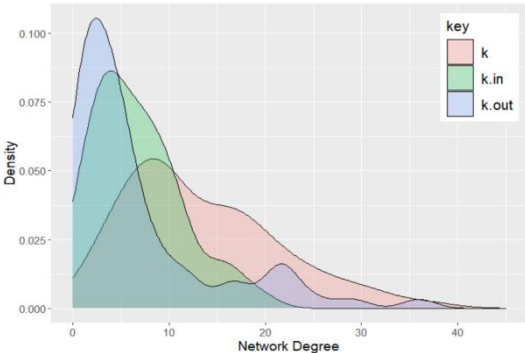
(b) Out-degree food web above Level V



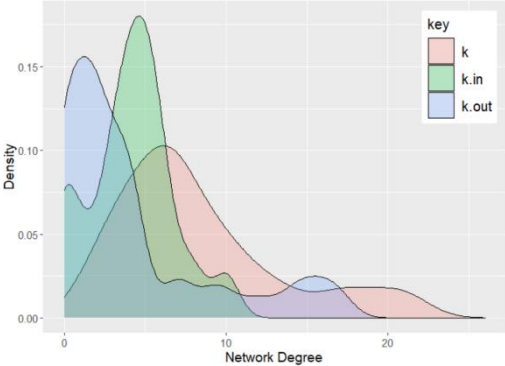
Araçá Bay



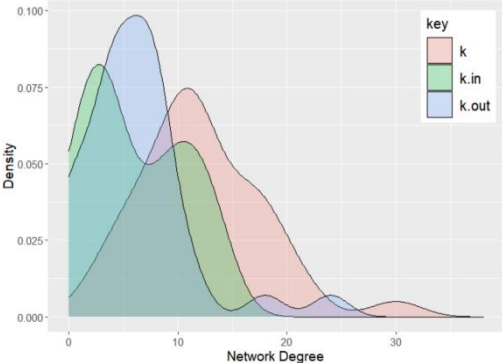
Gulf of Gabes



Galapagos shelf



Corsican coast



Norwegian sea

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245 **Supplementary Figure 5. Spatial distribution of 105 marine food webs throughout the world. Colours represent different ecosystem**
246 **types. The bottom-left inset indicates the total number of food webs under different ecosystem types. The bottom-right inset indicates**
247 **the total number of food webs in the two hemispheres (N, S), with approximate latitude.**

