

Table S1 List of fish species and their functional traits. RMS1: Ends before the eye; RMS2: Ends at the anterior edge of the eye; RMS3: Ends at the center of the eye; RMS4: Ends at the posterior edge of the eye; RMS5: Ends behind the eye; P: Planktivorous; B: Benthivorous; P-B: Planktivorous-Benthivorous; N: Nektivorous; P-B-N: Planktivorous-Benthivorous-Nektivorous; Shape1: Depressiform; Shape2: Depressed anterior part and compressed posterior part; Shape3: Asymmetry; Shape4: Compressiform; Shape5: Slightness; Shape6: Hippocampal formation; Shape7: Band shape; Shape8: Fusiform; Shape9: Anguilliform; Shape10: Depressed anterior part; Shape11: Arrow shape; Shape12: Sub-cylinder.

Code	Scientific name	Food type	Relative mouth size	Mouth position	Trophic level	Habitat water layer	Body shape	Length at 50% maturity (cm)
sp1	<i>Raja porosa</i>	B	RMS1	Ventral	4.0	Demersal	Shape1	57
sp2	<i>Scyliorhinus torazame</i>	N	RMS5	Terminal	3.9	Demersal	Shape2	50
sp3	<i>Lophius litulon</i>	N	RMS5	Superior	4.5	Demersal	Shape1	150
sp4	<i>Eopsetta grigorjewi</i>	B	RMS1	Superior	3.5	Demersal	Shape3	60
sp5	<i>Cleisthenes herzensteini</i>	P-B-N	RMS3	Terminal	4.2	Demersal	Shape3	47
sp6	<i>Liopsetta obscurus</i>	/	RMS1	Terminal	3.5	Demersal	Shape3	56
sp7	<i>Pleuronichthys cornutus</i>	B	RMS2	Terminal	3.4	Demersal	Shape3	27.5
sp8	<i>Pseudopleuronectes yokohamae</i>	B	RMS1	Terminal	3.6	Demersal	Shape3	45
sp9	<i>Kareius bicoloratus</i>	B	RMS1	Terminal	4.1	Demersal	Shape3	30
sp10	<i>Microstomus achne</i>	B	RMS1	Terminal	3.4	Demersal	Shape3	60
sp11	<i>Tanakius kitaharae</i>	B	RMS1	Terminal	3.5	Demersal	Shape3	50
sp12	<i>Raja pulchra</i>	B	RMS1	Ventral	4.3	Demersal	Shape1	23.6
sp13	<i>Pseudorhombus cinnamomeus</i>	B	RMS1	Terminal	3.5	Demersal	Shape3	35
sp14	<i>Tarphops oligolepis</i>	B	RMS1	Terminal	3.3	Demersal	Shape3	9
sp15	<i>Paralichthys olivaceus</i>	N	RMS3	Terminal	4.9	Demersal	Shape3	103
sp16	<i>Arnoglossus polyspilus</i>	B	RMS1	Terminal	3.5	Demersal	Shape3	24
sp17	<i>Cynoglossus semilaevis</i>	B	RMS1	Inferior	3.7	Demersal	Shape3	61.1
sp18	<i>Cynoglossus joyneri</i>	B	RMS1	Inferior	4.3	Demersal	Shape3	24
sp19	<i>Cynoglossus abbreviatus</i>	B	RMS1	Inferior	3.5	Demersal	Shape3	31.4
sp20	<i>Zebrias zebra</i>	B	RMS1	Terminal	3.5	Demersal	Shape3	19
sp21	<i>Konosirus punctatus</i>	P	RMS2	Terminal	3.0	Pelagic	Shape4	32
sp22	<i>Sardinella zunasi</i>	P	RMS2	Terminal	3.4	Pelagic	Shape4	18
sp23	<i>Setipinna taty</i>	P	RMS5	Inferior	3.2	Pelagic	Shape4	22
sp24	<i>Coilia mystus</i>	P	RMS5	Inferior	3.3	Pelagic	Shape4	21
sp25	<i>Thryssa chefuensis</i>	P	RMS5	Inferior	3.2	Pelagic	Shape4	15
sp26	<i>Thryssa mystax</i>	P	RMS5	Inferior	3.6	Pelagic	Shape4	19

sp27	<i>Engraulis japonicus</i>	P	RMS5	Inferior	3.6	Pelagic	Shape4	18
sp28	<i>Protosalanx chinensis</i>	B	RMS3	Inferior	3.0	Demersal	Shape5	17
sp29	<i>Zenopsis nebulosa</i>	/	RMS1	Terminal	4.3	Demersal	Shape3	41
sp30	<i>Syngnathus acus</i>	P	RMS1	Terminal	3.3	Demersal	Shape5	50
sp31	<i>Hippocampus trimaculatus</i>	P	RMS1	Terminal	3.8	Demersal	Shape6	22
sp32	<i>Hippocampus kelloggi</i>	P	RMS1	Terminal	3.8	Demersal	Shape6	8
sp33	<i>Leiognathus rivulatus</i>	P	RMS1	Terminal	3.2	Pelagic	Shape4	12
sp34	<i>Pampus argenteus</i>	P	RMS2	Inferior	3.2	Demersal	Shape4	60
sp35	<i>Trichiurus lepturus</i>	N	RMS4	Terminal	3.9	Demersal	Shape7	234
sp36	<i>Liza haematocheila</i>	B	RMS1	Inferior	2.5	Pelagic	Shape8	80
sp37	<i>Eupleurogrammus muticus</i>	N	RMS4	Terminal	4.4	Demersal	Shape7	87
sp38	<i>Sparus macrocephalus</i>	P-B-N	RMS3	Terminal	3.2	Demersal	Shape4	50
sp39	<i>Chrysophrys major</i>	P-B-N	RMS2	Terminal	3.9	Demersal	Shape4	100
sp40	<i>Champsodon snyderi</i>	B	RMS5	Superior	4.0	Demersal	Shape4	9.9
sp41	<i>Pholis fangi</i>	B	RMS3	Terminal	3.6	Demersal	Shape7	30
sp42	<i>Pholis nebulosa</i>	B	RMS3	Terminal	3.2	Demersal	Shape7	30
sp43	<i>Odontamblyopus rubicundus</i>	B	RMS4	Terminal	3.9	Demersal	Shape9	25
sp44	<i>Ctenotrypauchen microcephalus</i>	B	RMS1	Terminal	3.7	Demersal	Shape4	18
sp45	<i>Ctenotrypauchen chinensis</i>	P	RMS1	Terminal	3.6	Demersal	Shape4	11.8
sp46	<i>Zoarces gillii</i>	B	RMS3	Inferior	3.5	Demersal	Shape7	30
sp47	<i>Lateolabrax japonicus</i>	N	RMS3	Superior	4.7	Demersal	Shape4	102
sp48	<i>Scomberomorus niphonius</i>	N	RMS4	Terminal	4.8	Pelagic	Shape8	113
sp49	<i>Scomber japonicus</i>	N	RMS4	Terminal	4.2	Pelagic	Shape8	64
sp50	<i>Decapterus maruadsi</i>	P-B-N	RMS1	Terminal	3.4	Pelagic	Shape8	25
sp51	<i>Trachurus japonicus</i>	P-B-N	RMS2	Terminal	3.4	Pelagic	Shape8	50
sp52	<i>Oplegnathus fasciatus</i>	B	RMS1	Terminal	3.6	Demersal	Shape4	80
sp53	<i>Haplogenyx nigripinnis</i>	P-B-N	RMS2	Terminal	4.0	Demersal	Shape4	40
sp54	<i>Argyrosomus argentatus</i>	B	RMS3	Inferior	3.9	Demersal	Shape4	43.5
sp55	<i>Nibea albiflora</i>	P-B-N	RMS2	Terminal	4.0	Demersal	Shape4	40
sp56	<i>Pseudosciaena polyactis</i>	P-B-N	RMS3	Terminal	3.7	Demersal	Shape4	40
sp57	<i>Johnius belangerii</i>	B	RMS2	Inferior	3.7	Demersal	Shape4	30
sp58	<i>Collichthys niveatus</i>	P-B-N	RMS3	Terminal	3.7	Demersal	Shape4	15
sp59	<i>Collichthys lucidus</i>	P-B-N	RMS2	Terminal	3.5	Demersal	Shape4	17

sp60	<i>Miichthys miituy</i>	N	RMS4	Terminal	4.4	Demersal	Shape4	70
sp61	<i>Xenoccephalus elongatus</i>	B	RMS3	Superior	4.3	Demersal	Shape10	30
sp62	<i>Apogon lineatus</i>	P-B-N	RMS4	Terminal	3.7	Demersal	Shape4	9
sp63	<i>Chirolophis japonicus</i>	P	RMS3	Terminal	2.0	Demersal	Shape4	8.3
sp64	<i>Sillago sihama</i>	B	RMS1	Terminal	3.4	Demersal	Shape4	31
sp65	<i>Synechogobius ommaturus</i>	B	RMS4	Terminal	4.0	Demersal	Shape2	43
sp66	<i>Hyporhamphus sajori</i>	P-B-N	RMS3	Superior	3.4	Pelagic	Shape11	40
sp67	<i>Chaeturichthys hexanema</i>	N	RMS1	Terminal	3.3	Demersal	Shape4	17.4
sp68	<i>Chaeturichthys stigmatias</i>	B	RMS1	Terminal	4.0	Demersal	Shape2	28.2
sp69	<i>Parachaeturichthys polynema</i>	B	RMS2	Terminal	3.1	Demersal	Shape4	15
sp70	<i>Cryptocentrus filifer</i>	B	RMS2	Terminal	3.4	Demersal	Shape4	13.2
sp71	<i>Ctenogobius pflaumi</i>	B	RMS2	Terminal	3.1	Demersal	Shape2	12
sp72	<i>Tridentiger barbatus</i>	B	RMS1	Terminal	3.4	Demersal	Shape4	10.4
sp73	<i>Callionymus sagitta</i>	B	RMS1	Terminal	2.9	Demersal	Shape1	18
sp74	<i>Callionymus beniteguri</i>	B	RMS1	Terminal	3.3	Demersal	Shape1	16
sp75	<i>Callionymus valenciennesi</i>	B	RMS1	Terminal	3.2	Demersal	Shape1	10
sp76	<i>Sphyraena pinguis</i>	N	RMS1	Terminal	4.1	Pelagic	Shape12	50
sp77	<i>Ammodytes personatus</i>	P	RMS5	Terminal	3.3	Demersal	Shape5	15
sp78	<i>Psenopsis anomala</i>	P-B	RMS2	Inferior	4.0	Demersal	Shape4	30
sp79	<i>Muraenesox cinereus</i>	N	RMS5	Inferior	4.4	Demersal	Shape9	220
sp80	<i>Conger myriaster</i>	N	RMS4	Inferior	4.8	Demersal	Shape9	100
sp81	<i>Navodon septentrionalis</i>	B	RMS1	Terminal	3.4	Demersal	Shape4	36
sp82	<i>Stephanolepis cirrhifer</i>	B	RMS1	Terminal	2.8	Demersal	Shape4	30
sp83	<i>Takifugu rubripes</i>	B	RMS1	Terminal	3.6	Demersal	Shape12	80
sp84	<i>Takifugu pseudommus</i>	B	RMS1	Terminal	3.4	Demersal	Shape12	35
sp85	<i>Takifugu niphobles</i>	B	RMS1	Terminal	4.0	Demersal	Shape12	15
sp86	<i>Saurida elongata</i>	N	RMS5	Terminal	4.8	Demersal	Shape12	50
sp87	<i>Gadus macrocephalus</i>	P-B-N	RMS2	Terminal	4.5	Demersal	Shape8	119
sp88	<i>Coelorinchus multispinulosus</i>	B	RMS1	Inferior	3.6	Demersal	Shape4	38
sp89	<i>Minous monodactylus</i>	B	RMS1	Superior	4.1	Demersal	Shape4	12
sp90	<i>Hemirhamphus villosus</i>	N	RMS5	Terminal	4.3	Demersal	Shape4	35
sp91	<i>Trachidermus fasciatus</i>	N	RMS5	Terminal	3.0	Demersal	Shape2	14
sp92	<i>Pseudoblennius cottoides</i>	B	RMS3	Terminal	4.3	Demersal	Shape1	13

sp93	<i>Chelidonichthys spinosus</i>	B	RMS3	Inferior	3.8	Demersal	Shape10	60
sp94	<i>Hexagrammos otakii</i>	B	RMS1	Terminal	3.8	Demersal	Shape4	57
sp95	<i>Platycephalus indicus</i>	P-B-N	RMS3	Terminal	4.0	Demersal	Shape1	100
sp96	<i>Erisphex potti</i>	B	RMS1	Terminal	3.8	Demersal	Shape4	15
sp97	<i>Sebastes marmoratus</i>	N	RMS3	Terminal	4.7	Demersal	Shape4	36.2
sp98	<i>Lepidotrigla microptera</i>	B	RMS3	Inferior	3.6	Demersal	Shape12	30
sp99	<i>Sebastes hubbsi</i>	B	RMS2	Terminal	3.5	Demersal	Shape4	15.6
sp100	<i>Sebastes thompsoni</i>	B	RMS2	Terminal	3.7	Demersal	Shape4	30
sp101	<i>Takifugu xanthopterus</i>	B	RMS1	Terminal	3.4	Demersal	Shape12	50
sp102	<i>Sebastes schlegelii</i>	N	RMS2	Terminal	4.7	Demersal	Shape4	65
sp103	<i>Liparis tanakai</i>	P-B-N	RMS2	Terminal	3.9	Demersal	Shape2	47
sp104	<i>Mugil cephalus</i>	B	RMS1	Inferior	2.5	Pelagic	Shape8	100
sp105	<i>Zoarces elongatus</i>	B	RMS2	Inferior	3.4	Demersal	Shape7	30
sp106	<i>Cynoglossus macrolepidotus</i>	B	RMS1	Inferior	3.5	Demersal	Shape3	37
sp107	<i>Callionymus richardsoni</i>	B	RMS1	Terminal	3.2	Demersal	Shape1	11.1
sp108	<i>Lagocephalus spadiceus</i>	B	RMS1	Terminal	3.7	Demersal	Shape12	37.4
sp109	<i>Tridentiger trigonocephalus</i>	B	RMS4	Terminal	3.3	Demersal	Shape2	11
sp110	<i>Champsodon capensis</i>	B	RMS5	Superior	4.0	Demersal	Shape4	9.9
sp111	<i>Takifugu vermicularis</i>	B	RMS2	Terminal	3.3	Demersal	Shape12	30
sp112	<i>Periophthalmus cantonensis</i>	P	RMS4	Terminal	3.2	Demersal	Shape4	10
sp113	<i>Coilia nasus</i>	P	RMS5	Inferior	3.7	Pelagic	Shape4	41
sp114	<i>Seriola lalandi</i>	N	RMS1	Superior	4.2	Demersal	Shape8	250
sp115	<i>Upeneus japonicus</i>	B	RMS1	Terminal	3.6	Demersal	Shape4	16.2

Table S2 Comparison of CWM trait differences between seasons using Tukey's HSD Tests. Significant difference ($p < 0.05$) is in bold.

CWM trait	Pairwise Season	<i>p</i>	CWM trait	Pairwise Season	<i>p</i>
Benthivorous	Spring vs Summer	0.418	Compressiform	Spring vs Summer	0.978
	Spring vs Autumn	0.559		Spring vs Autumn	0.947
	Spring vs Winter	0.961		Spring vs Winter	0.974
	Summer vs Autumn	0.991		Summer vs Autumn	0.999
	Summer vs Winter	0.243		Summer vs Winter	0.850
	Autumn vs Winter	0.339		Autumn vs Winter	0.782
Nektivorous	Spring vs Summer	0.243	Depressed anterior part and compressed posterior part	Spring vs Summer	0.999
	Spring vs Autumn	0.237		Spring vs Autumn	1.000
	Spring vs Winter	0.185		Spring vs Winter	0.880
	Summer vs Autumn	1.000		Summer vs Autumn	0.997
	Summer vs Winter	0.995		Summer vs Winter	0.833
	Autumn vs Winter	0.996		Autumn vs Winter	0.912
Planktivorous	Spring vs Summer	0.868	Fusiform	Spring vs Summer	0.254
	Spring vs Autumn	1.000		Spring vs Autumn	0.998
	Spring vs Winter	0.900		Spring vs Winter	1.000
	Summer vs Autumn	0.896		Summer vs Autumn	0.207
	Summer vs Winter	0.519		Summer vs Winter	0.261
	Autumn vs Winter	0.872		Autumn vs Winter	0.997
Planktivorous-Benthivorous-Nektivorous	Spring vs Summer	0.874	Ends at the anterior edge of the eye	Spring vs Summer	0.738
	Spring vs Autumn	0.995		Spring vs Autumn	0.983
	Spring vs Winter	0.290		Spring vs Winter	0.597
	Summer vs Autumn	0.763		Summer vs Autumn	0.549
	Summer vs Winter	0.630		Summer vs Winter	0.193
	Autumn vs Winter	0.220		Autumn vs Winter	0.785
Demersal	Spring vs Summer	0.232	Ends at the center of the eye	Spring vs Summer	0.659
	Spring vs Autumn	0.990		Spring vs Autumn	0.661
	Spring vs Winter	0.803		Spring vs Winter	0.896
	Summer vs Autumn	0.329		Summer vs Autumn	1.000
Pelagic	Summer vs Winter	0.078	Ends at the posterior edge of the eye	Summer vs Winter	0.959
	Autumn vs Winter	0.645		Autumn vs Winter	0.960
	Spring vs Summer	0.250		Spring vs Summer	0.779
	Spring vs Autumn	0.992		Spring vs Autumn	0.926

	Spring vs Winter	0.768		Spring vs Winter	0.674
	Summer vs Autumn	0.342		Summer vs Autumn	0.984
	Summer vs Winter	0.078		Summer vs Winter	0.997
	Autumn vs Winter	0.623		Autumn vs Winter	0.944
	Spring vs Summer	0.839		Spring vs Summer	0.956
	Spring vs Autumn	0.909		Spring vs Autumn	0.991
Inferior	Spring vs Winter	0.469	Ends before the eye	Spring vs Winter	0.641
	Summer vs Autumn	0.499		Summer vs Autumn	0.859
	Summer vs Winter	0.182		Summer vs Winter	0.393
	Autumn vs Winter	0.811		Autumn vs Winter	0.791
	Spring vs Summer	0.934		Spring vs Summer	0.956
	Spring vs Autumn	0.984		Spring vs Autumn	0.980
Terminal	Spring vs Winter	0.584	Ends behind the eye	Spring vs Winter	0.164
	Summer vs Autumn	0.790		Summer vs Autumn	0.999
	Summer vs Winter	0.318		Summer vs Winter	0.297
	Autumn vs Winter	0.770		Autumn vs Winter	0.258

Table S3 Relative abundance (%) of fish species in different surveys. (Only the top 30 species by relative abundance are shown)

	Species	Spring			Summer			Autumn			Winter		
		A	B	C	A	B	C	A	B	C	A	B	C
1	<i>Sebastes schlegelii</i>	0.001	0.012	0.042	0.005	0.016	0.020	0.028	0.259	0.576	0.012	0.109	0.060
2	<i>Liparis tanakai</i>	0.002	1.486	11.096	0.000	0.024	0.451	0.000	0.005	3.126	0.010	0.068	0.445
3	<i>Cynoglossus joyneri</i>	0.931	0.026	0.028	0.021	0.011	0.000	0.379	0.102	0.018	0.910	0.199	0.076
4	<i>Konosirus punctatus</i>	0.005	0.115	0.002	0.022	0.029	0.000	0.061	0.498	0.116	0.000	0.151	1.307
5	<i>Setipinna taty</i>	0.137	1.427	1.102	0.029	0.052	0.001	0.292	0.407	0.017	0.039	0.705	6.312
6	<i>Thryssa chefuensis</i>	1.648	0.970	0.008	0.030	0.341	0.009	0.574	2.175	1.982	0.000	0.235	0.555
7	<i>Engraulis japonicus</i>	0.000	1.777	2.346	0.013	4.913	82.879	0.022	0.608	8.403	0.000	0.099	4.711
8	<i>Lophius litulon</i>	0.003	0.238	0.289	0.000	0.018	0.150	0.000	0.027	2.422	0.007	0.590	2.781
9	<i>Syngnathus acus</i>	0.009	0.873	0.004	0.000	0.313	0.016	0.000	2.493	0.764	0.000	4.978	10.330
10	<i>Pampus argenteus</i>	0.001	0.016	0.011	0.026	0.005	0.000	0.001	0.030	0.754	0.003	0.138	0.654
11	<i>Pholis fangi</i>	0.201	6.574	9.852	0.000	0.098	2.405	0.001	0.263	2.464	0.014	4.055	7.027
12	<i>Zoarces gillii</i>	0.002	0.199	2.411	0.000	0.025	0.097	0.000	0.003	1.553	0.000	0.293	0.933
13	<i>Scomber japonicus</i>	0.000	0.000	0.000	0.006	1.621	1.077	0.000	0.008	0.080	0.000	0.000	0.000
14	<i>Cleisthenes herzensteini</i>	0.001	0.005	0.594	0.000	0.000	0.059	0.000	0.001	0.886	0.000	0.005	1.117
15	<i>Argyrosomus argentatus</i>	0.001	0.014	0.013	0.006	0.141	0.798	0.006	0.221	0.148	0.000	0.000	0.047
16	<i>Pseudosciaena polyactis</i>	0.002	0.102	1.289	0.000	0.082	0.303	0.001	0.322	1.349	0.000	0.177	0.778
17	<i>Johnius belangerii</i>	0.024	0.081	0.042	0.002	0.063	0.010	0.039	0.135	0.119	0.003	0.028	0.678
18	<i>Apogon lineatus</i>	0.000	0.047	2.257	0.001	0.544	0.034	0.067	13.009	22.962	0.000	0.008	17.805
19	<i>Synechogobius ommaturus</i>	0.006	0.000	0.000	0.002	0.000	0.000	0.014	0.117	0.635	3.046	0.041	0.068
20	<i>Chaeturichthys hexanema</i>	0.340	1.102	0.250	0.008	0.249	0.174	0.361	0.939	0.425	0.303	7.324	2.443
21	<i>Chaeturichthys stigmatias</i>	13.316	0.023	0.000	0.049	0.099	0.058	0.468	10.031	0.148	0.000	1.632	0.664
22	<i>Pleuronichthys cornutus</i>	0.000	0.022	0.722	0.000	0.008	0.074	0.000	0.019	0.049	0.000	0.012	0.037
23	<i>Callionymus beniteguri</i>	0.094	0.037	0.000	0.000	0.022	0.004	0.054	0.644	0.127	0.226	0.312	0.417
24	<i>Callionymus valenciennesi</i>	0.013	0.873	0.303	0.001	0.045	0.100	0.000	0.016	0.167	0.000	0.369	0.964
25	<i>Ammodytes personatus</i>	0.000	1.628	0.430	0.000	0.002	0.007	0.000	0.001	0.109	0.003	0.018	0.088
26	<i>Conger myriaster</i>	0.000	0.067	0.816	0.000	0.040	0.044	0.000	0.163	0.186	0.000	0.399	0.363
27	<i>Saurida elongata</i>	0.000	0.042	0.010	0.000	0.050	0.001	0.042	0.808	0.758	0.000	0.000	0.106
28	<i>Gadus macrocephalus</i>	0.000	0.280	25.102	0.000	0.000	1.192	0.010	0.006	1.512	0.000	0.000	0.399
29	<i>Chelidonichthys spinosus</i>	0.000	0.005	0.000	0.000	0.215	0.160	0.000	0.893	5.070	0.000	0.057	1.443
30	<i>Hexagrammos otakii</i>	0.014	2.334	1.884	0.000	0.058	0.276	0.000	0.082	0.779	0.000	0.089	0.495
31	Others	83.250	79.626	39.097	99.777	90.917	9.600	97.577	65.716	42.295	95.423	77.912	36.895

Table S4 Spearman Rank correlations between environmental variables and functional trait categories. The numbers in the table represent Spearman R values. Significance levels of the correlations are shown at $p < 0.05$ (*), $p < 0.01$ (**). RMS1: Ends before the eye; RMS2: Ends at the anterior edge of the eye; RMS3: Ends at the center of the eye; RMS4: Ends at the posterior edge of the eye; RMS5: Ends behind the eye; P: Planktivorous; B: Benthivorous; P-B: Planktivorous-Benthivorous; N: Nektivorous; P-B-N: Planktivorous-Benthivorous-Nektivorous; Shape1: Depressiform; Shape2: Depressed anterior part and compressed posterior part; Shape3: Asymmetry; Shape4: Compressiform; Shape5: Slightness; Shape6: Hippocampal formation; Shape7: Band shape; Shape8: Fusiform; Shape9: Anguilliform; Shape10: Depressed anterior part; Shape11: Arrow shape; Shape12: Sub-cylinder.

	Spring					Summer				
	Lon	Lat	Depth	SBT	SBS	Lon	Lat	Depth	SBT	SBS
Demersal	0.080	-0.592**	0.321**	-0.165*	0.158*	0.383**	-0.589**	0.536**	-0.539**	0.415**
Pelagic	-0.118	0.187*	-0.309	0.271**	-0.220**	0.057	-0.212**	-0.055	-0.048	0.000
Shape1	0.081	-0.400**	0.093	-0.046	-0.0014	0.205*	-0.44**	0.374**	-0.355**	0.293**
Shape2	0.219**	-0.542**	0.455**	-0.270**	0.294**	0.384**	-0.017	0.496**	-0.475**	0.339**
Shape3	-0.177*	-0.093	0.080	0.079	0.044	0.093	-0.322**	0.185*	-0.182*	0.184*
Shape4	0.008	-0.412**	0.066	0.012	0.089	0.078	-0.421**	0.106	-0.145	0.118
Shape5	-0.051	-0.170*	-0.081	-0.012	-0.122	0.055	-0.128	0.117	-0.105	0.121
Shape6	-0.186*	-0.348**	-0.066	0.082	-0.234**	-0.210**	-0.319**	-0.043	0.182*	-0.140*
Shape7	0.340**	-0.554**	0.476**	-0.433**	0.248**	0.563**	-0.479**	0.657**	-0.714**	0.512**
Shape8	0.378**	-0.398**	0.486**	-0.414**	0.362**	0.618**	-0.290**	0.369**	-0.473**	0.333**
Shape9	0.153	-0.497**	0.258**	-0.168*	0.181*	0.049	-0.550**	0.171*	-0.145	0.089
Shape10	-0.039	-0.054	0.001	0.009	-0.052	-0.026	-0.518**	0.106	-0.079	-0.22
Shape11	0.074	0.012	-0.004	-0.003	-0.041	0	0	0	0	0
Shape12	-0.079	-0.278**	-0.072	0.064	-0.175*	-0.057	-0.324**	-0.109	0.134	-0.073
Maximum Body Length	0.349**	-0.264**	0.435**	-0.411**	0.267**	0.258**	-0.151	0.222**	-0.213**	0.081
B	-0.123	-0.455**	0.134	0.013	0.003	0.283**	-0.378**	0.411**	-0.455**	0.399**
N	0.279**	-0.455**	0.288**	-0.236**	0.196*	0.366**	-0.488**	0.258**	-0.311**	0.216**
P-B-N	0.574**	-0.688**	0.700**	-0.624**	0.470**	0.571**	-0.575**	0.606**	-0.562**	0.440**
P	-0.182*	0.055	-0.313**	0.254**	-0.223**	-0.086	-0.152	-0.101	0.082	-0.093
RMS1	-0.489**	-0.242**	-0.263**	0.407**	-0.211**	-0.066	-0.285**	0.059	-0.067	0.042
RMS2	0.433**	-0.728**	0.557**	-0.457**	0.408**	0.257**	-0.327**	0.489**	-0.387**	0.358**
RMS3	0.387**	-0.603**	0.520**	-0.463**	0.295**	0.533**	-0.646**	0.607**	-0.627**	0.472**
RMS4	0.374**	-0.532**	0.439**	-0.349**	0.300**	0.215**	-0.441**	0.047	-0.129	0.046
RMS5	0.124	-0.053	-0.076	0.017	0.019	0.224**	-0.334**	0.211**	-0.226**	0.143
Terminal	0.132	-0.615**	0.347**	-0.205**	0.189*	0.467**	-0.544**	0.462**	-0.511**	0.379**
Inferior	-0.054	0.001	-0.129	0.178*	-0.106	0.004	-0.319**	0.025	-0.052	0.020
Superior	0.462**	-0.261**	0.259**	-0.363**	0.155	0.467**	-0.431**	0.565**	-0.555**	0.438**

	-0.028	-0.026	-0.017	0.009	-0.056	0.016	0.032	-0.008	0.004	0.003
Trophic level	0.029	-0.099	0.228**	-0.137	0.097	0.298**	-0.124	0.176*	-0.248**	0.141
	Autumn					Winter				
	Lon	Lat	Depth	SBT	SBS	Lon	Lat	Depth	SBT	SBS
Demersal	0.378**	-0.273**	0.442**	0.019	0.370**	0.240**	-0.543**	0.388**	0.587**	0.689**
Pelagic	0.051	0.070	-0.020	0.036	0.087	0.243**	-0.164*	0.345**	0.279**	0.067
Shape1	0.416**	-0.125	0.510**	-0.330**	0.351**	0.538**	-0.388**	0.568**	0.664**	0.359**
Shape2	0.437**	0.063	0.234**	-0.370**	0.138	-0.298**	0.373**	-0.364**	-0.464**	-0.237**
Shape3	0.064	0.039	0.176*	-0.174*	0.146	-0.019	0.067	0.0087	-0.104	0.234**
Shape4	0.050	0.002	0.029	0.107	0.051	0.598**	-0.535**	0.574**	0.730**	0.380**
Shape5	-0.125	-0.487**	0.124	0.478**	0.188*	-0.187*	-0.379**	0.107	0.225**	0.299**
Shape6	-0.202*	-0.406**	-0.051	0.400**	-0.017	-0.169*	-0.362**	0.009	0.265	0.027
Shape7	0.489**	-0.173*	0.567**	-0.195*	0.490**	0.453**	-0.655**	0.572**	0.714**	0.487**
Shape8	0.355**	-0.382**	0.547**	-0.143	0.513**	-0.186	0.028	-0.149	-0.277**	-0.107
Shape9	0.182*	-0.427**	0.260**	0.300**	0.345**	0.076	-0.512**	0.239**	0.457**	0.270**
Shape10	0.164*	-0.130**	0.280**	0.405**	0.259**	0.409**	-0.456**	0.522**	0.589**	0.406**
Shape11	0	0	0	0	0	0	0	0	0	0
Shape12	-0.172*	-0.428**	-0.168*	0.703**	-0.075	0.124	-0.302**	0.235**	0.351**	0.260**
Maximum Body Length	0.153	-0.227**	0.284**	-0.110	0.193*	-0.208**	-0.093	0.014	-0.031	0.017
B	0.163*	-0.172*	0.220**	0.148	0.170*	-0.122	-0.235**	0.074	0.167*	0.156*
N	0.215**	-0.246**	0.339**	0.113	0.286**	0.504**	-0.455**	0.409**	0.607**	0.270**
P-B-N	0.601**	-0.344**	0.630**	-0.100	0.563**	0.580**	-0.553**	0.742**	0.817**	0.579**
P	-0.089	0.005	-0.046	0.129	0.034	0.486**	-0.571**	0.690**	0.792**	0.510**
RMS1	-0.157	0.009	-0.089	0.331**	-0.104	0.007	-0.381**	0.045	0.329**	0.055
RMS2	0.504**	-0.511**	0.506**	0.683**	0.389**	0.504**	-0.511**	0.506**	0.683**	0.389**
RMS3	0.473**	-0.427**	0.604**	0.091	0.570**	0.341**	-0.607**	0.586**	0.671**	0.584**
RMS4	0.070**	-0.161*	0.035	0.352**	0.015	-0.305**	-0.109	-0.067	-0.110	0.088
RMS5	0.246**	-0.125	0.271**	-0.033	0.325**	0.750**	-0.393**	0.734**	0.723**	0.430**
Terminal	0.293**	-0.254**	0.331**	0.067	0.292**	0.281**	-0.543**	0.401**	0.622**	0.382**
Inferior	0.208**	-0.118	0.280**	0.035	0.271**	0.033	-0.245**	0.283**	0.213**	0.199*
Superior	0.637**	-0.148	0.688**	-0.475**	0.587**	0.688**	-0.443**	0.626**	0.652**	0.401**
Ventral	-0.043	0.154	-0.035	-0.089	-0.052	0.061	0.049	-0.049	0.072	-0.036
Trophic level	0.304**	-0.157*	0.298**	-0.249**	0.177*	-0.052	0.069	0.264*	-0.029	0.159*

Table S5 Wilcoxon rank sum test between seasons for functional diversity index of fish community in the coastal waters of Shandong Peninsula, China. FRic: Functional richness; FEve: Functional evenness; FDis: Functional dispersion. Significant results are presented in bold.

Category	Functional diversity index	Among season	<i>P</i>
Habitat use	FRic	Spring-summer	0.440
		Spring-Autumn	0.001
		Spring-Winter	0.002
		Summer-Autumn	0.001
		Summer-Winter	0.099
		Autumn-Winter	0.001
	FEve	Spring-Summer	0.147
		Spring-Autumn	0.175
		Spring-Winter	0.057
		Summer-Autumn	0.011
		Summer-Winter	0.560
		Autumn-Winter	0.003
	FDis	Spring-Summer	0.086
		Spring-Autumn	0.025
		Spring-Winter	0.482
		Summer-Autumn	0.973
		Summer-Winter	0.221
		Autumn-Winter	0.082
Trophic niche	FRic	Spring-Summer	0.544
		Spring-Autumn	0.006
		Spring-Winter	0.001
		Summer-Autumn	0.001
		Summer-Winter	0.068
		Autumn-Winter	0.001
	FEve	Spring-Summer	0.949
		Spring-Autumn	0.281
		Spring-Winter	0.263
		Summer-Autumn	0.220
		Summer-Winter	0.301
		Autumn-Winter	0.026
	FDis	Spring-Summer	0.526
		Spring-Autumn	0.002
		Spring-Winter	0.001
		Summer-Autumn	0.019
		Summer-Winter	0.001
		Autumn-Winter	0.001

Table S6 Pairwise comparisons between zones for functional diversity indices of fish community by Wilcoxon rank sum test in the coastal waters of Shandong Peninsula in different seasons. FRic: Functional richness; FEve; Functional evenness; FDis: Functional dispersion. Significant results are presented in bold.

Category	Index	Zone	spring	summer	autumn	winter
Habitat	FRic	A-B	0.001	0.001	0.001	0.001
		A-C	0.590	0.001	0.001	0.001
		B-C	0.001	0.001	0.186	0.002
	FEve	A-B	0.851	0.001	0.836	0.335
		A-C	0.022	0.001	0.030	0.316
		B-C	0.017	0.183	0.042	0.955
	FDis	A-B	0.768	0.015	0.600	0.332
		A-C	0.137	0.001	0.105	0.947
		B-C	0.057	0.144	0.243	0.143
Trophic	FRic	A-B	0.001	0.001	0.000	0.001
		A-C	0.006	0.001	0.001	0.001
		B-C	0.002	0.001	0.496	0.001
	FEve	A-B	0.208	0.005	0.283	0.046
		A-C	0.563	0.049	0.213	0.024
		B-C	0.044	0.133	0.848	0.586
	FDis	A-B	0.042	0.734	0.449	0.141
		A-C	0.067	0.221	0.021	0.001
		B-C	0.579	0.064	0.097	0.014

Table S7 Pairwise comparisons between seasons of functional diversity indices of fish community by Wilcoxon rank sum test in the coastal waters of Shandong Peninsula, China in different zones. FRic: Functional richness; FEve: Functional evenness; FDis: Functional dispersion. Significant results are presented in bold.

Category	Index	Season	Zone A	Zone B	Zone C
Habitat	FRic	spring-summer	0.001	0.193	0.309
		spring-autumn	0.973	0.051	0.001
		spring-winter	0.001	0.001	0.001
		summer-autumn	0.001	0.336	0.012
		summer-winter	0.097	0.001	0.005
		autumn-winter	0.001	0.001	0.976
	FEve	spring-summer	0.002	0.575	0.448
		spring-autumn	0.738	0.304	0.348
		spring-winter	0.379	0.963	0.005
		summer-autumn	0.003	0.639	0.190
		summer-winter	0.162	0.524	0.040
		autumn-winter	0.168	0.383	0.002
	FDis	spring-summer	0.008	0.895	0.818
		spring-autumn	0.258	0.388	0.043
		spring-winter	0.990	0.214	0.031
		summer-autumn	0.058	0.523	0.186
		summer-winter	0.016	0.205	0.138
		autumn-winter	0.243	0.018	0.769
Trophic	FRic	spring-summer	0.001	0.281	0.313
		spring-autumn	0.942	0.130	0.002
		spring-winter	0.001	0.002	0.002
		summer-autumn	0.001	0.682	0.019
		summer-winter	0.222	0.001	0.020
		autumn-winter	0.001	0.001	0.911
	FEve	spring-summer	0.074	0.013	0.296
		spring-autumn	0.306	0.069	0.519
		spring-winter	0.020	0.616	0.225
		summer-autumn	0.006	0.353	0.656
		summer-winter	0.485	0.027	0.751
		autumn-winter	0.004	0.145	0.513
	FDis	spring-summer	0.096	0.825	0.437
		spring-autumn	0.034	0.535	0.003
		spring-winter	0.745	0.062	0.191
		summer-autumn	0.865	0.839	0.001
		summer-winter	0.016	0.048	0.036
		autumn-winter	0.002	0.020	0.081

Table S8 The number of fish species in different surveys

Area	Spring	Summer	Autumn	Winter
Total	79	75	94	84
A	42	30	45	18
B	65	62	79	56
C	52	55	74	72

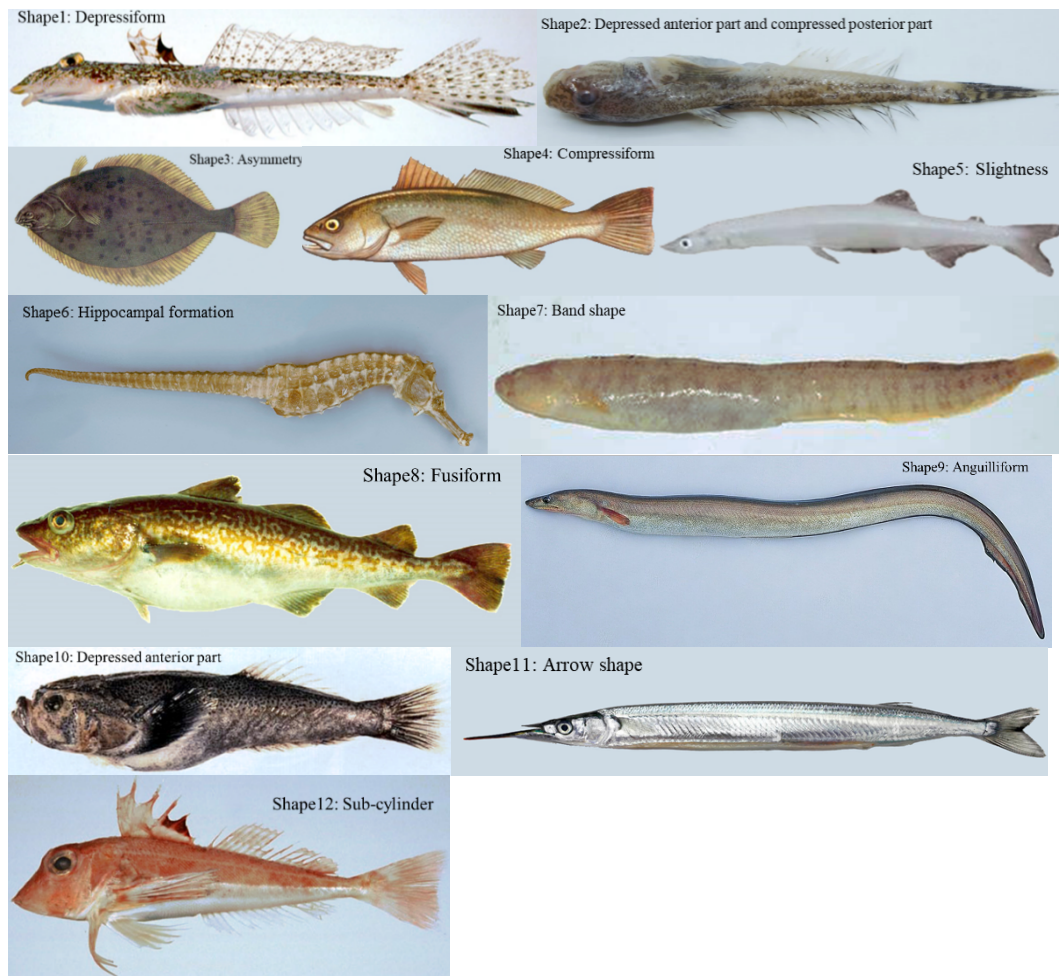


Fig. S1. Diagrams for body shape. Shape1: Depressiform; Shape2: Depressed anterior part and compressed posterior part; Shape3: Asymmetry; Shape4: Compressiform; Shape5: Slightness; Shape6: Hippocampal formation; Shape7: Band shape; Shape8: Fusiform; Shape9: Anguilliform; Shape10: Depressed anterior part; Shape11: Arrow shape; Shape12: Sub-cylinder.

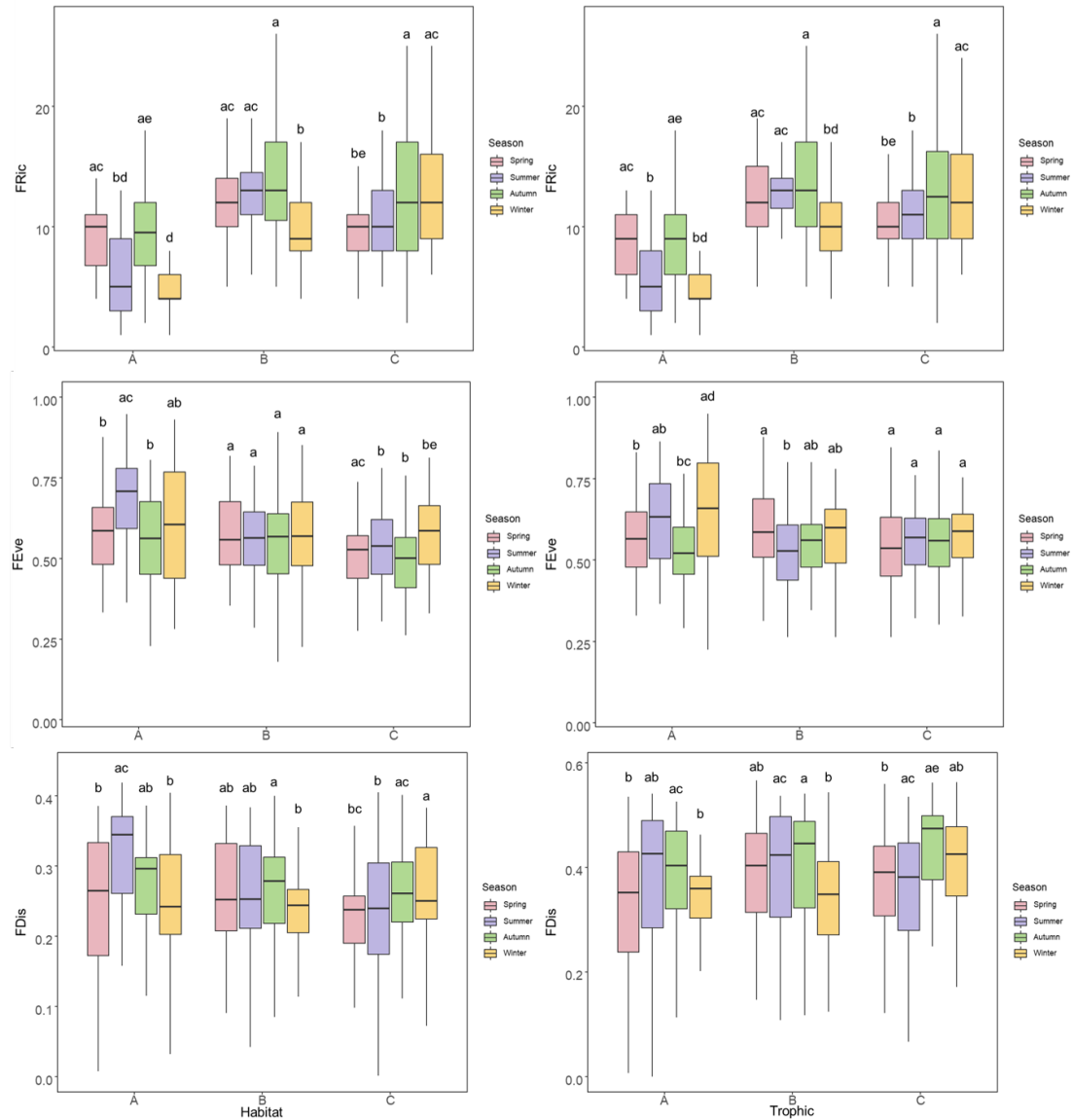


Fig. S2. Comparison between seasons of fish community functional diversity indices in different zones based on traits related to habitat use and trophic niche in coastal waters of Shandong. FRic: Functional richness; FEve: Functional evenness; FDis: Functional dispersion. Significant differences were marked using letter. Boxplots as in Fig. 5.