Towards the authentication of European sea bass origin through a combination of biometric measurements and multiple analytical techniques

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Supplementary Material Table S1 Description of European sea bass sources (n=160).

Source	FAO fishing areas, subarea, division	Number of specimens		Country	Locality	Type	Equipment features	Stocking density
		FW	SS					
1	27.8b	5	5	-	North East Atlantic	W	-	-
2	37.2.1	5	5	Croatia	Pakostane	F	floating cages	intensive
3	37.2.1	5	5	Italy	Porto Tolle	F	valliculture	extensive
4	37.2.1	5	5	Italy	Monfalcone	F	floating cages	intensive
5	37.2.1	5	5	Italy	Porto Tolle	F	earthen tanks	semi-intensive
6	37.1.3	5	5	Italy	Lavagna	F	submersible cages	intensive
7	37.3.1	5	5	Turkey	Bodrum	F	floating cages	intensive
8	37.2.1	5	5	-	North West Adriatic	W	-	-
9	37.3.1	5	-	Greece	Athens	F	floating cages	intensive
10	37.1.3	5	5	Italy	Follonica	F	earthen tanks	semi-intensive
11	37.3.1	5	-	Turkey	Izmir	F	floating cages	intensive
12	37.3.1	5	5	Greece	Koropiu	F	floating cages	intensive
13	37.2.1	5	5	-	North East Adriatic	W	-	-
14	37.1.2	5	5	-	Gulf of Lion	W	-	-
15	37.1.3	5	5	Italy	Golfo Aranci	F	floating cages	intensive
16	37.2.2	5	5	Italy	Capo Passero	F	floating cages	intensive
17	37.1.3	5	5	-	Tyrrenian Sea	W	-	-
18	37.1.3	5	-	Italy	Castellammare	F	floating cages	intensive

W = wild; F = farmed; FF = fall/winter; SS = spring/summer

Supplementary Material Table S2: Means, standard deviations (SD) an ANOVA P-values of data grouped according to stocking density factor (n=160, P val[1]) and Country of origin of intensively reared samples (n= 85, P val.[2]). A post hoc Bonferroni correction was applied due to the high number of parameters analysed (n = 175).

Parameter	**Wild** (n=45)		**ER** (n=10)		**SIR** (n=20)		**IR** (n=85)			**IR**							
										Croatia (n=10)		**Greece** (n=15)		**Italy** (n=45)		**Turkey** (n=15)	
	mean	***SD***	**mean**	***SD***	**mean**	***SD***	**mean**	***SD***	**P val.[1]**	**mean**	***SD***	**mean**	***SD***	**mean**	***SD***	**mean**	***SD***	**P val.[2]**
Biometric parameters																		
BW (g)	819.02	*359.81*	701.95	*117.85*	601.12	*123.98*	395.95	*60.97*	< 0.001	419.20	*2.58*	371.08	*0.93*	609.79	*4.86*	395.35	*1.88*	0.006
TL (cm)	41.01	*5.82*	38.40	*2.27*	37.05	*2.39*	33.10	*1.71*	< 0.001	33.01	*140.73*	32.71	*26.97*	36.95	*294.56*	32.49	*45.50*	< 0.001
% CF	1.13	*0.14*	1.23	*0.07*	1.17	*0.14*	1.09	*0.09*	0.028	1.13	*0.13*	1.06	*0.08*	1.14	*0.12*	1.16	*0.13*	0.247
CY (g)	89.60	*3.49*	88.19	*2.26*	89.96	*2.87*	89.55	*2.24*	1.000	88.13	*4.65*	90.42	*1.57*	89.58	*2.55*	87.81	*1.95*	0.251
PVF (g)	16.63	*2.00*	16.39	*1.00*	23.18	*1.45*	14.40	*2.26*	1.000	13.59	*1.42*	12.87	*1.18*	17.47	*1.86*	26.21	*1.95*	0.012
% VSI	9.90	*3.66*	11.02	*1.94*	9.79	*2.65*	9.94	*2.16*	1.000	11.37	*4.52*	9.06	*1.57*	9.95	*2.49*	11.75	*1.99*	0.111
% HSI	1.52	*0.57*	2.27	*0.41*	1.89	*0.81*	2.14	*0.72*	0.002	1.99	*0.79*	1.88	*0.67*	2.02	*0.74*	2.31	*0.53*	0.062
% GSI	1.71	*1.69*	2.92	*1.30*	1.71	*2.49*	1.72	*1.78*	1.000	0.88	*1.12*	1.63	*1.28*	2.07	*2.08*	0.84	*0.82*	1.000
EW (g)	736.12	*335.46*	618.53	*102.97*	538.61	*100.04*	354.16	*52.44*	< 0.001	365.10	*104.85*	335.33	*22.47*	546.28	*269.55*	346.89	*38.54*	0.004
Viscera (g)	79.20	*39.66*	78.02	*20.41*	60.84	*26.51*	39.80	*12.38*	< 0.001	51.99	*39.21*	33.79	*7.08*	60.71	*31.99*	46.73	*11.26*	1.000
Liver (g)	12.55	*7.52*	16.09	*4.24*	11.77	*6.61*	8.62	*3.62*	0.002	7.82	*2.37*	7.04	*2.66*	12.06	*6.51*	9.17	*2.49*	0.289
Gonads (g)	13.22	*15.13*	21.14	*9.96*	11.18	*17.23*	7.11	*8.00*	0.161	3.06	*3.62*	6.17	*4.96*	12.65	*14.50*	3.23	*3.01*	0.510
LFW (g)	200.62	*89.14*	167.53	*27.53*	141.71	*28.98*	99.89	*14.82*	< 0.001	104.13	*30.27*	94.68	*6.34*	149.06	*71.95*	96.63	*8.74*	0.007
RFW (g)	199.62	*88.23*	168.76	*27.80*	141.26	*29.79*	100.64	*14.74*	< 0.001	103.57	*29.40*	94.78	*5.91*	149.16	*71.07*	98.23	*8.97*	0.006
SLFW (g)	180.44	*79.29*	148.39	*25.11*	123.25	*25.24*	89.24	*13.64*	< 0.001	93.39	*29.04*	84.33	*5.76*	133.05	*64.52*	85.76	*7.91*	0.005
SRFW (g)	178.61	*78.58*	151.45	*24.93*	123.83	*24.98*	90.19	*13.75*	< 0.001	93.64	*27.04*	84.46	*5.96*	133.43	*63.08*	86.89	*8.10*	0.005
Skin (g)	36.75	*19.24*	32.05	*8.62*	30.78	*9.31*	19.38	*3.10*	< 0.001	19.34	*4.10*	18.58	*2.04*	29.41	*15.16*	20.15	*2.29*	0.184
Frame (g)	330.28	*156.07*	278.17	*52.08*	249.88	*47.01*	150.67	*25.98*	< 0.001	154.42	*45.65*	143.35	*14.54*	243.18	*125.70*	148.47	*24.43*	0.003
% Fat	2.02	*2.00*	2.33	*1.00*	3.74	*1.45*	3.64	*2.26*	0.025	3.21	*1.42*	3.48	*1.18*	2.91	*1.86*	6.55	*1.95*	< 0.001
FY (g)	49.01	*2.66*	48.08	*3.23*	47.11	*3.16*	50.76	*2.56*	< 0.001	50.20	*3.64*	51.12	*1.83*	49.28	*3.13*	49.45	*2.24*	1.000
SFY (g)	44.04	*2.57*	42.86	*3.05*	41.19	*3.26*	45.32	*2.62*	< 0.001	45.05	*3.17*	45.53	*1.73*	43.86	*3.26*	43.82	*2.14*	1.000
% Frame	39.96	*2.66*	39.58	*2.66*	41.86	*3.20*	38.04	*2.57*	< 0.001	37.22	*2.84*	38.61	*2.39*	39.52	*3.02*	37.46	*2.94*	0.202
% Skin	4.39	*0.68*	4.52	*0.61*	5.07	*0.66*	4.91	*0.61*	0.003	4.81	*0.90*	5.03	*0.59*	4.78	*0.63*	5.11	*0.31*	0.019
GuY (g)	0.50	*0.69*	0.79	*0.73*	0.25	*0.63*	0.51	*0.61*	1.000	0.50	*0.63*	0.53	*0.60*	0.47	*0.61*	0.44	*0.37*	1.000
SY (g)	0.70	*0.88*	0.59	*0.72*	1.10	*0.60*	0.83	*0.41*	1.000	0.79	*0.54*	0.76	*0.42*	0.87	*0.57*	1.03	*0.23*	1.000
SBY (g)	10.15	*1.57*	10.88	*1.44*	12.62	*1.73*	10.78	*1.30*	< 0.001	10.23	*1.62*	10.93	*1.13*	11.06	*1.62*	11.41	*0.74*	0.718
Moisture*	76.08	*2.24*	75.48	*1.21*	71.16	*2.16*	72.01	*1.88*	< 0.001	72.48	*2.04*	71.85	*1.78*	73.23	*2.36*	70.17	*1.85*	< 0.001

Total lipids*	3.72	*2.10*	4.40	*1.53*	9.00	*2.34*	7.66	*2.15*	< 0.001	6.71	*1.61*	8.21	*2.06*	6.49	*2.59*	9.87	*2.18*	< 0.001
Overall fatty acid profile																		
SFA	26.31	*1.91*	24.85	*1.15*	21.05	*1.01*	20.71	*1.22*	< 0.001	23.47	*3.16*	20.68	*1.28*	22.69	*2.66*	19.04	*0.53*	< 0.001
MUFA	30.34	*5.51*	28.32	*1.95*	30.22	*1.64*	31.82	*3.48*	1.000	28.01	*2.07*	32.75	*1.80*	30.57	*2.84*	37.50	*2.53*	< 0.001
PUFA	35.07	*6.87*	38.11	*3.56*	42.37	*2.42*	41.14	*3.16*	< 0.001	42.57	*2.95*	39.69	*2.16*	39.54	*5.54*	37.45	*2.42*	1.000
PUFA n-3	28.86	*7.47*	29.66	*2.87*	22.36	*3.32*	24.28	*2.98*	< 0.001	28.84	*5.31*	26.42	*2.59*	24.19	*3.93*	22.11	*1.55*	< 0.001
PUFA n-6	6.21	*2.63*	8.26	*1.98*	20.01	*3.98*	16.77	*3.88*	< 0.001	13.73	*7.69*	13.27	*3.65*	15.25	*5.99*	15.34	*2.87*	< 0.001
n-3/n-6	5.95	*3.82*	3.78	*0.94*	1.20	*0.47*	1.56	*0.53*	< 0.001	4.62	*4.86*	2.16	*0.67*	1.97	*1.07*	1.50	*0.34*	< 0.001
14:0	1.51	*0.45*	1.93	*0.21*	2.69	*0.61*	2.69	*0.42*	< 0.001	2.45	*0.24*	2.91	*0.52*	2.37	*0.70*	2.34	*0.16*	< 0.001
15:0	0.37	*0.07*	0.67	*0.16*	0.22	*0.04*	0.23	*0.03*	< 0.001	0.28	*0.08*	0.25	*0.04*	0.31	*0.16*	0.22	*0.02*	1.000
16:0	19.01	*1.83*	17.72	*1.17*	14.46	*0.49*	14.20	*0.77*	< 0.001	16.38	*2.42*	14.14	*0.85*	15.91	*2.44*	13.29	*0.43*	< 0.001
17:00	0.60	*0.15*	0.47	*0.22*	0.36	*0.05*	0.36	*0.10*	< 0.001	0.42	*0.08*	0.35	*0.12*	0.45	*0.16*	0.26	*0.05*	< 0.001
18:00	4.86	*0.74*	4.05	*0.36*	3.32	*0.45*	3.22	*0.38*	< 0.001	3.94	*0.82*	3.03	*0.50*	3.65	*0.64*	2.94	*0.24*	< 0.001
16:1 n-7	5.27	*1.04*	7.03	*0.83*	4.50	*0.66*	4.39	*0.57*	< 0.001	4.81	*0.67*	4.74	*0.76*	5.04	*1.05*	3.67	*0.28*	0.006
18:1 n-7	3.55	*0.50*	4.27	*0.38*	3.04	*0.37*	3.18	*0.52*	< 0.001	2.91	*0.27*	3.32	*0.61*	3.34	*0.58*	3.46	*0.48*	1.000
18:1 n-9	19.33	*4.95*	15.50	*2.43*	20.26	*2.39*	20.93	*2.97*	0.013	18.25	*1.92*	20.67	*1.82*	19.87	*3.11*	25.71	*1.73*	< 0.001
18:2 n-6	1.32	*1.00*	3.54	*1.54*	18.34	*3.99*	15.09	*3.89*	< 0.001	11.72	*8.01*	11.55	*3.76*	12.34	*7.53*	13.79	*2.93*	< 0.001
18:3 n-3	0.78	*0.34*	1.03	*0.16*	2.23	*0.37*	2.25	*0.43*	< 0.001	1.64	*0.64*	2.11	*0.22*	1.77	*0.67*	2.91	*0.18*	< 0.001
18:4 n-3	0.58	*0.40*	0.80	*0.13*	0.86	*0.29*	0.95	*0.20*	< 0.001	0.98	*0.10*	1.04	*0.24*	0.83	*0.28*	0.75	*0.09*	0.010
20:1 n-9	1.22	*1.07*	0.83	*0.20*	1.60	*0.35*	2.12	*0.78*	< 0.001	1.47	*0.31*	2.52	*0.62*	1.45	*0.63*	3.03	*0.64*	< 0.001
20:1 n-7	0.49	*0.36*	0.58	*0.13*	0.22	*0.03*	0.26	*0.17*	< 0.001	0.18	*0.03*	0.27	*0.09*	0.33	*0.22*	0.28	*0.07*	0.001
20:2 n-6	0.43	*0.16*	0.50	*0.10*	0.75	*0.11*	0.72	*0.14*	< 0.001	0.61	*0.24*	0.61	*0.05*	0.68	*0.17*	0.71	*0.19*	< 0.001
20:4 n-3	0.39	*0.13*	0.60	*0.10*	0.52	*0.12*	0.57	*0.13*	< 0.001	0.51	*0.04*	0.68	*0.12*	0.48	*0.12*	0.73	*0.09*	< 0.001
20:4 n-6	3.09	*1.53*	2.85	*0.98*	0.66	*0.09*	0.68	*0.11*	< 0.001	0.94	*0.43*	0.78	*0.15*	1.56	*1.44*	0.57	*0.04*	< 0.001
20:5 n-3	8.41	*1.93*	6.59	*1.77*	8.51	*1.79*	8.74	*1.61*	0.715	9.23	*1.29*	8.95	*0.56*	8.59	*1.81*	6.08	*0.64*	< 0.001
22:1 n-11	0.42	*1.38*	0.11	*0.08*	0.60	*0.34*	0.94	*0.55*	0.195	0.40	*0.36*	1.23	*0.44*	0.52	*0.50*	1.35	*0.45*	0.055
22:4 n-6	0.69	*0.36*	0.61	*0.11*	0.07	*0.02*	0.07	*0.04*	< 0.001	0.10	*0.06*	0.10	*0.08*	0.29	*0.36*	0.07	*0.01*	< 0.001
22:5 n-6	0.69	*0.25*	0.75	*0.07*	0.19	*0.03*	0.21	*0.04*	< 0.001	0.36	*0.20*	0.23	*0.07*	0.39	*0.30*	0.19	*0.02*	0.012
20:5 n-3	8.41	*1.93*	6.59	*1.77*	8.51	*1.79*	8.74	*1.61*	0.014	9.23	*1.29*	8.95	*0.56*	8.59	*1.81*	6.08	*0.64*	1.000
22:6 n-3	15.71	*7.96*	16.13	*1.70*	8.36	*1.43*	10.00	*1.72*	< 0.001	13.10	*7.34*	11.42	*2.16*	10.37	*3.11*	9.58	*1.04*	< 0.001
Polar lipids*																		
P 14:0	0.52	*0.16*	0.50	*0.12*	0.85	*0.24*	0.70	*0.21*	< 0.001	0.74	*0.14*	0.68	*0.09*	0.65	*0.25*	0.75	*0.21*	1.000
P 15:0	0.18	*0.05*	0.24	*0.10*	0.13	*0.03*	0.11	*0.02*	< 0.001	0.15	*0.04*	0.11	*0.02*	0.14	*0.06*	0.12	*0.02*	0.318
P 16:0	17.21	*2.57*	13.65	*1.67*	16.79	*3.37*	14.78	*3.26*	0.006	19.24	*1.69*	14.66	*3.84*	15.03	*3.12*	14.83	*2.35*	< 0.001
P 17:0	0.60	*0.15*	0.63	*0.17*	0.36	*0.07*	0.35	*0.05*	< 0.001	0.37	*0.07*	0.33	*0.05*	0.47	*0.18*	0.32	*0.08*	0.039

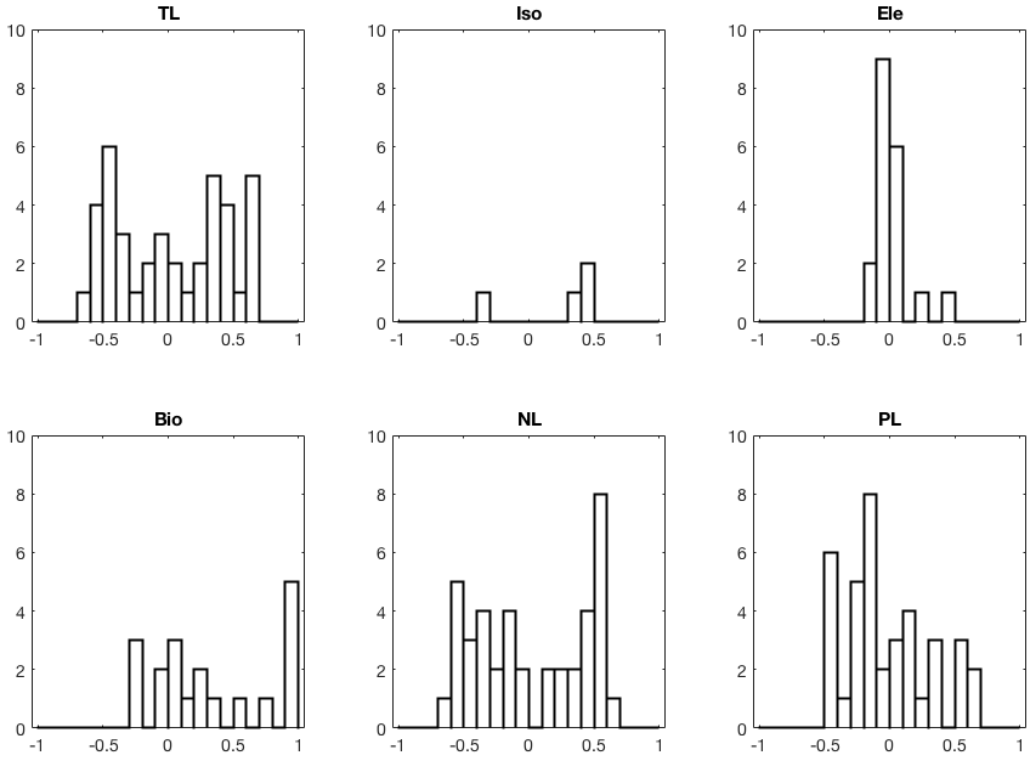
P 18:0	10.54	*4.23*	9.08	*1.26*	10.26	*3.12*	11.09	*2.91*	1.000	10.91	*2.60*	11.47	*3.51*	11.05	*3.66*	10.53	*2.17*	1.000
P 16:1 n-7	1.52	*0.40*	1.83	*0.38*	1.37	*0.45*	1.11	*0.34*	< 0.001	1.25	*0.30*	1.08	*0.10*	1.33	*0.46*	1.23	*0.49*	1.000
P 18:1 n-9	8.06	*1.67*	7.76	*1.10*	10.94	*1.43*	9.37	*2.67*	0.001	8.40	*1.02*	9.00	*0.52*	8.97	*2.18*	14.24	*1.11*	< 0.001
P 18:1 n-7	2.47	*0.47*	3.49	*0.29*	2.00	*0.34*	2.23	*1.08*	0.005	2.02	*0.23*	2.10	*0.36*	2.42	*1.06*	1.91	*0.21*	1.000
P 20:1	0.81	*0.39*	0.81	*0.18*	0.66	*0.19*	0.88	*0.28*	1.000	0.64	*0.11*	0.90	*0.08*	0.74	*0.22*	1.43	*0.28*	< 0.001
P 22:1	0.13	*0.16*	0.06	*0.01*	0.14	*0.08*	0.21	*0.12*	0.032	0.11	*0.06*	0.24	*0.07*	0.14	*0.08*	0.43	*0.10*	< 0.001
P 18:2 n-6	0.83	*0.50*	1.77	*0.52*	8.52	*2.32*	6.53	*1.48*	< 0.001	4.23	*2.84*	5.25	*1.91*	5.36	*3.27*	7.21	*1.06*	< 0.001
P 20:2 n-6	0.31	*0.16*	0.46	*0.15*	0.57	*0.13*	0.58	*0.12*	< 0.001	0.41	*0.20*	0.48	*0.09*	0.54	*0.17*	0.55	*0.07*	< 0.001
P 20:4 n-6	6.01	*2.38*	5.62	*0.70*	2.56	*0.55*	2.24	*0.48*	< 0.001	2.40	*0.84*	2.49	*0.23*	3.88	*2.42*	2.36	*0.37*	0.083
P 22:4 n-6	0.58	*0.32*	0.44	*0.07*	0.08	*0.03*	0.08	*0.02*	< 0.001	0.10	*0.06*	0.09	*0.01*	0.27	*0.31*	0.08	*0.00*	0.002
P 22:5 n-6	1.18	*0.41*	1.25	*0.07*	0.47	*0.04*	0.55	*0.09*	< 0.001	0.67	*0.18*	0.57	*0.05*	0.83	*0.47*	0.48	*0.08*	1.000
P 18:3 n-3	0.43	*0.16*	0.55	*0.07*	0.86	*0.22*	0.83	*0.25*	< 0.001	0.57	*0.16*	0.73	*0.12*	0.71	*0.22*	1.31	*0.17*	< 0.001
P 18:4 n-3	0.17	*0.09*	0.19	*0.06*	0.25	*0.10*	0.20	*0.04*	0.053	0.20	*0.02*	0.20	*0.03*	0.20	*0.07*	0.21	*0.06*	1.000
P 20:4 n-3	0.19	*0.08*	0.29	*0.06*	0.29	*0.06*	0.34	*0.09*	< 0.001	0.25	*0.07*	0.40	*0.06*	0.27	*0.08*	0.51	*0.06*	< 0.001
P 20:5 n-3	9.72	*2.98*	5.74	*1.46*	11.41	*2.44*	9.76	*1.85*	< 0.001	10.67	*1.72*	9.26	*0.83*	9.55	*2.79*	7.66	*1.60*	1.000
P 22:5 n-3	2.53	*1.26*	4.59	*0.95*	2.22	*0.49*	2.26	*0.47*	< 0.001	1.75	*0.76*	2.35	*0.12*	2.67	*1.07*	2.22	*0.26*	1.000
P 22:6 n-3	29.71	*7.04*	34.81	*1.20*	22.83	*2.50*	29.39	*3.77*	< 0.001	30.02	*5.05*	30.76	*2.08*	28.09	*5.23*	24.87	*3.83*	0.030
P SFA	29.06	*4.06*	24.11	*1.01*	28.40	*1.80*	27.03	*3.15*	0.010	31.41	*4.05*	27.24	*0.98*	27.34	*3.53*	26.55	*1.68*	0.046
P MUFA	12.98	*1.96*	13.96	*1.08*	15.11	*2.04*	13.81	*2.73*	1.000	12.42	*1.03*	13.32	*0.93*	13.61	*2.10*	19.23	*2.07*	< 0.001
P n-6	8.90	*3.20*	9.55	*0.93*	12.19	*2.60*	9.98	*1.59*	0.002	7.81	*2.28*	8.88	*2.04*	10.88	*1.91*	10.68	*1.37*	< 0.001
P n-3	42.75	*6.51*	46.17	*1.66*	37.86	*4.05*	42.78	*4.69*	0.028	43.47	*3.97*	43.71	*2.49*	41.48	*5.27*	36.78	*5.36*	< 0.001
P PUFA	51.65	*4.50*	55.71	*1.41*	50.05	*2.95*	52.76	*4.23*	0.389	51.28	*3.71*	52.59	*1.15*	52.36	*4.42*	47.46	*4.10*	0.041
Neutral lipids****																		
N 14:0	2.21	*0.57*	2.75	*0.31*	3.38	*0.72*	3.52	*0.46*	< 0.001	3.40	*0.54*	3.80	*0.44*	3.06	*0.80*	3.04	*0.14*	< 0.001
N 15:0	0.46	*0.10*	0.80	*0.18*	0.25	*0.05*	0.27	*0.04*	< 0.001	0.33	*0.08*	0.27	*0.03*	0.37	*0.20*	0.25	*0.01*	1.000
N 16:0	19.50	*1.99*	17.81	*1.10*	14.87	*0.63*	14.55	*0.84*	< 0.001	16.62	*2.50*	14.75	*0.48*	16.30	*2.53*	13.37	*0.70*	< 0.001
N 17:0	0.46	*0.17*	0.53	*0.06*	0.22	*0.03*	0.23	*0.05*	< 0.001	0.28	*0.08*	0.21	*0.02*	0.33	*0.16*	0.17	*0.01*	< 0.001
N 18:0	4.60	*0.77*	3.64	*0.29*	2.99	*0.35*	3.04	*0.36*	< 0.001	3.83	*0.64*	2.99	*0.29*	3.38	*0.67*	2.74	*0.30*	< 0.001
N 16:1 n-7	7.23	*0.93*	9.06	*1.27*	5.41	*0.89*	5.62	*0.69*	< 0.001	6.06	*1.21*	6.09	*0.64*	6.42	*1.43*	4.59	*0.55*	0.006
N 18:1 n-9	22.08	*4.38*	16.85	*2.12*	20.87	*2.70*	21.41	*3.01*	0.064	18.89	*1.80*	20.47	*1.38*	20.97	*3.21*	27.49	*0.78*	< 0.001
N 18:1 n-7	3.75	*0.59*	4.23	*0.33*	2.37	*0.26*	2.72	*0.23*	< 0.001	2.96	*0.59*	2.80	*0.19*	3.02	*0.69*	2.71	*0.25*	< 0.001
N 20:1 n-9	1.64	*1.40*	1.30	*0.45*	1.68	*0.27*	2.18	*0.79*	< 0.001	1.60	*0.29*	2.37	*0.74*	1.61	*0.57*	3.49	*0.31*	0.019
N 20:1 n-7	0.55	*0.33*	0.25	*0.27*	0.09	*0.09*	0.14	*0.09*	0.746	0.15	*0.11*	0.08	*0.08*	0.26	*0.26*	0.10	*0.11*	< 0.001
N 22:1 n-9	0.67	*1.33*	0.15	*0.05*	0.64	*0.32*	1.06	*0.71*	< 0.001	0.71	*0.31*	1.43	*0.66*	0.58	*0.57*	1.81	*0.47*	< 0.001
N 18:2 n-6	1.86	*1.21*	4.27	*1.89*	19.09	*3.97*	15.69	*3.55*	1.000	12.39	*8.24*	13.16	*4.77*	12.60	*7.50*	12.54	*1.18*	0.004

N 20:2 n-6	0.47	*0.16*	0.50	*0.09*	0.70	*0.11*	0.69	*0.10*	< 0.001	0.60	*0.22*	0.58	*0.05*	0.65	*0.13*	0.71	*0.07*	< 0.001
N 20:4 n-6	2.19	*0.97*	2.56	*0.33*	0.53	*0.08*	0.58	*0.10*	< 0.001	0.71	*0.24*	0.68	*0.21*	1.29	*1.09*	0.50	*0.03*	< 0.001
N 22:4 n-6	0.67	*0.34*	0.57	*0.12*	0.09	*0.02*	0.09	*0.02*	< 0.001	0.12	*0.05*	0.11	*0.02*	0.32	*0.36*	0.11	*0.02*	0.068
N 22:5 n-6	0.53	*0.19*	0.65	*0.06*	0.17	*0.03*	0.18	*0.03*	< 0.001	0.30	*0.17*	0.21	*0.04*	0.33	*0.24*	0.17	*0.02*	0.004
N 18:3 n-3	1.08	*0.44*	1.27	*0.21*	2.46	*0.39*	2.52	*0.41*	< 0.001	1.89	*0.66*	2.25	*0.19*	2.05	*0.71*	3.18	*0.18*	1.000
N 18:4 n-3	0.82	*0.52*	1.07	*0.20*	1.02	*0.35*	1.18	*0.26*	< 0.001	1.24	*0.15*	1.31	*0.33*	1.02	*0.35*	0.95	*0.13*	< 0.001
N 20:4 n-3	0.48	*0.17*	0.70	*0.11*	0.57	*0.14*	0.62	*0.15*	0.007	0.60	*0.12*	0.75	*0.17*	0.55	*0.14*	0.84	*0.08*	1.000
N 20:5 n-3	8.53	*2.05*	7.24	*1.83*	8.62	*2.20*	9.06	*1.58*	< 0.001	9.11	*1.02*	9.47	*1.00*	8.87	*1.93*	6.06	*0.73*	< 0.001
N 22:5 n-3	2.24	*0.77*	4.32	*0.87*	1.87	*0.31*	1.78	*0.26*	1.000	1.50	*0.19*	2.15	*0.27*	2.18	*0.92*	2.02	*0.11*	0.012
N 22:6 n-3	11.33	*5.55*	12.91	*1.34*	7.21	*1.34*	7.84	*1.43*	< 0.001	11.36	*6.66*	8.95	*1.74*	8.19	*2.33*	8.65	*0.70*	1.000
N SFA	27.23	*2.17*	25.53	*1.04*	21.71	*1.04*	21.61	*1.30*	< 0.001	24.46	*2.84*	22.02	*0.67*	23.44	*2.81*	19.58	*0.62*	0.003
N MUFA	36.31	*4.25*	32.03	*1.56*	31.06	*1.45*	33.11	*3.34*	< 0.001	30.36	*1.21*	33.23	*1.16*	32.99	*3.25*	40.18	*0.94*	< 0.001
N n-6	5.72	*2.30*	8.55	*2.00*	20.58	*3.95*	17.23	*3.54*	< 0.001	14.12	*8.03*	14.74	*4.55*	15.19	*6.16*	14.03	*1.22*	< 0.001
N n-3	24.48	*5.92*	27.50	*2.26*	21.75	*3.76*	23.00	*2.48*	< 0.001	25.69	*5.80*	24.87	*3.29*	22.86	*3.60*	21.68	*1.53*	< 0.001
N PUFA	30.20	*5.25*	36.05	*2.13*	42.34	*1.48*	40.22	*2.55*	0.165	39.82	*2.79*	39.61	*1.69*	38.05	*6.14*	35.72	*1.02*	0.980
Isotopic abundances																		
δ^{13}C ‰ vs V-PDB	-17.38	*6.33*	-18.22	*3.16*	-20.87	*0.92*	-20.48	*2.44*	< 0.001	-17.01	*9.76*	11.67	*0.61*	47.60	*2.37*	10.87	*0.53*	< 0.001
% C	45.09	*0.87*	46.80	*1.12*	50.75	*1.03*	49.75	*2.58*	< 0.001	-19.83	*3.27*	11.61	*2.23*	48.44	*3.26*	11.89	*1.64*	< 0.001
δ^{15}N ‰ vs air	15.18	*0.52*	13.20	*1.03*	9.90	*0.48*	10.81	*1.23*	< 0.001	-21.65	*0.52*	10.07	*0.98*	51.60	*2.70*	10.73	*0.59*	< 0.001
% N	12.53	*0.75*	12.70	*0.31*	10.70	*0.92*	11.06	*3.11*	< 0.001	-20.73	*0.98*	10.87	*0.83*	50.13	*1.14*	10.33	*0.80*	< 0.001
Mineral composition (mg/Kg w.w.)																		
Ca	157.31	*49.82*	251.72	*189.26*	158.31	*157.98*	183.98	*122.53*	1.000	297.15	*229.21*	130.99	*27.83*	173.64	*110.05*	138.57	*43.24*	0.084
K	3274.94	*264.28*	3737.98	*187.35*	3272.16	*386.70*	3393.76	*372.46*	0.153	3675.85	*265.53*	3141.99	*257.58*	3412.42	*370.27*	3195.65	*236.92*	0.002
Mg	326.96	*38.69*	376.08	*57.20*	332.91	*45.11*	338.54	*51.63*	1.000	373.54	*67.66*	321.97	*18.65*	334.05	*49.77*	326.44	*19.69*	1.000
Na	600.41	*134.13*	436.83	*109.29*	464.52	*123.28*	559.96	*131.40*	0.012	545.33	*113.41*	538.18	*125.79*	544.27	*131.82*	559.24	*158.52*	1.000
P	2669.40	*200.85*	3075.79	*138.23*	2712.32	*250.13*	2811.33	*285.98*	0.007	3019.80	*229.14*	2616.39	*224.39*	2821.51	*260.28*	2623.55	*194.36*	< 0.001
S	7982.54	*2050.61*	9133.15	*1068.30*	6867.19	*2591.31*	7918.98	*2388.37*	1.000	7856.48	*3146.50*	6005.52	*2315.69*	8608.63	*1875.33*	6778.13	*2007.43*	0.001
As	0.62	*0.42*	0.72	*0.30*	0.64	*0.27*	0.56	*0.18*	1.000	0.60	*0.15*	0.50	*0.14*	0.56	*0.22*	0.64	*0.29*	1.000
Cd	0.01	*0.00*	0.01	*0.01*	0.01	*0.01*	0.01	*0.01*	1.000	0.01	*0.01*	0.01	*0.01*	0.01	*0.01*	0.01	*0.00*	0.329
Co	0.01	*0.01*	0.01	*0.01*	0.01	*0.00*	0.01	*0.01*	1.000	0.02	*0.01*	0.01	*0.00*	0.01	*0.01*	0.01	*0.00*	1.000
Cr	0.22	*0.03*	0.22	*0.06*	0.22	*0.02*	0.22	*0.04*	1.000	0.20	*0.05*	0.22	*0.03*	0.22	*0.03*	0.21	*0.01*	1.000
Cu	0.66	*0.19*	0.68	*0.18*	0.66	*0.07*	0.79	*0.18*	0.013	0.88	*0.16*	0.76	*0.13*	0.72	*0.18*	0.77	*0.18*	0.194
Fe	4.20	*0.95*	3.99	*0.68*	4.22	*0.72*	4.20	*1.01*	1.000	4.18	*0.76*	3.50	*0.62*	4.42	*0.91*	3.65	*0.99*	0.105

Hg	0.07	*0.07*	0.11	*0.09*	0.07	*0.04*	0.08	*0.08*	1.000	0.17	*0.16*	0.09	*0.08*	0.06	*0.05*	0.06	*0.02*	0.001
Mn	0.17	*0.04*	0.17	*0.02*	0.19	*0.12*	0.20	*0.04*	1.000	0.20	*0.04*	0.20	*0.05*	0.19	*0.06*	0.22	*0.05*	1.000
Ni	0.03	*0.02*	0.03	*0.01*	0.03	*0.01*	0.03	*0.01*	1.000	0.04	*0.02*	0.03	*0.01*	0.03	*0.01*	0.03	*0.01*	1.000
Pb	0.09	*0.07*	0.10	*0.13*	0.06	*0.02*	0.10	*0.13*	1.000	0.20	*0.25*	0.10	*0.12*	0.08	*0.06*	0.07	*0.03*	0.174
Se	0.28	*0.09*	0.27	*0.12*	0.26	*0.08*	0.22	*0.06*	0.012	0.19	*0.07*	0.22	*0.05*	0.25	*0.08*	0.21	*0.05*	0.016
Zn	5.96	*0.76*	6.38	*0.71*	6.46	*1.28*	6.32	*0.72*	1.000	6.39	*0.78*	6.52	*0.37*	6.29	*0.92*	6.07	*0.62*	1.000

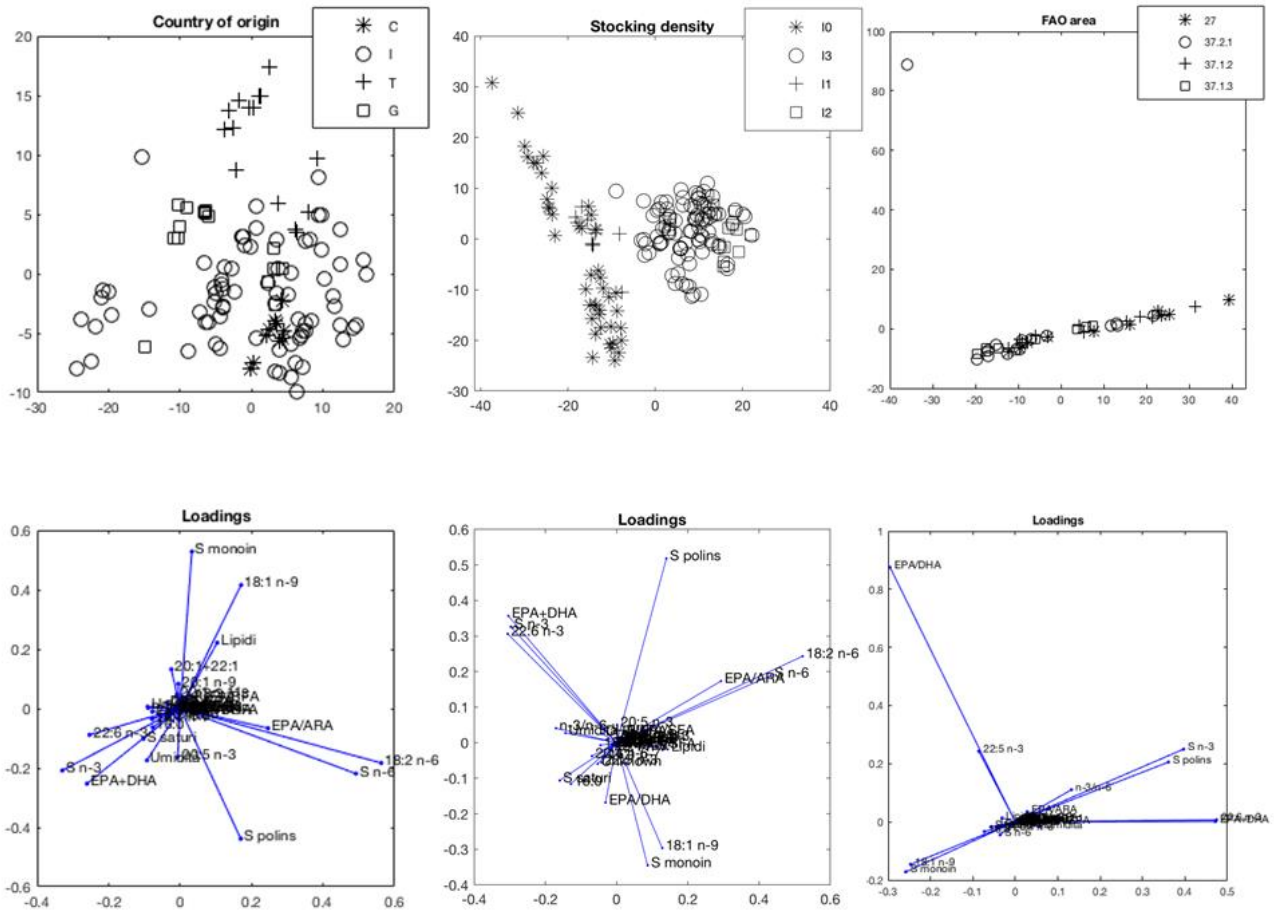
ER: extensively reared; SIR: semi-intensively reared; IR: intensively reared.
BW: body weight; TL: total length; CF: condition factor, calculated as the % ratio between body weight and fork length cubed; CY: carcass yield; PVF: perivisceral fat; VSI: viescerosomatic index; HIS: hepatosomatic index; GSI: gonadosomatic index; EW: eviscerated weight; LFW: left fillet weight; RFW: right fillet weight; SLFW: skinned left fillet weight; SRFW: skinned right fillet weight; FY: fillet yield; SFY: skinned fillet yield; GuY: gutting yield; SY: skinning yields; SBY: skinning + boning yields.
P: belonging to polar lipids, N: belonging to neutral lipids.
***** *Expressed in g/100g w.w.*
****** *Expressed in % FAME of total lipids*
******* *Expressed in % FAME of polar lipids*
******** *Expressed in % FAME of neutral lipids*

Supplementary Material Figure S1: Histogram plots of Pearson's correlation coefficients of the various parameter classes with biometric parameter “length”.



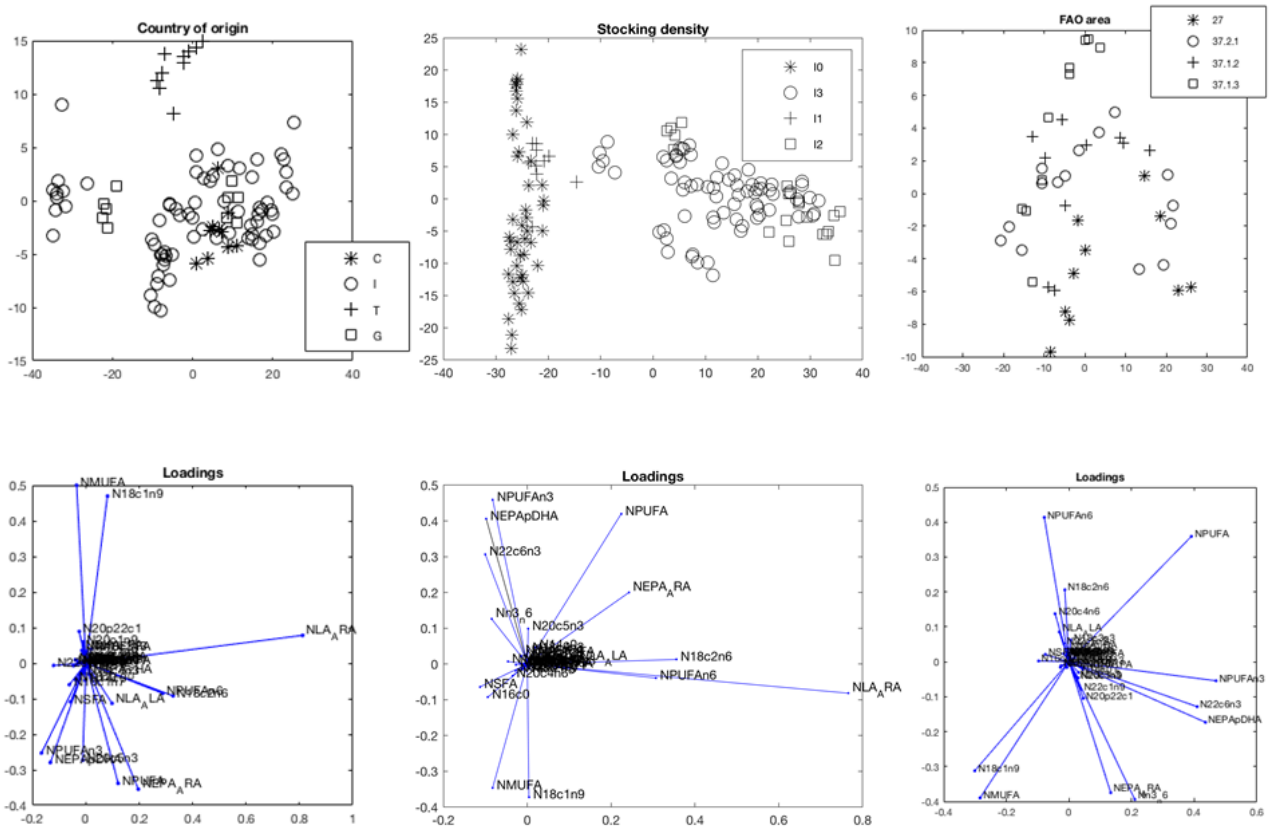
Supplementary Material Figure S2: Scatterplot of PCA and loadings performed on sea bass classified according to country of origin (n = 115), stocking density (n = 160) and FAO fishing subareas (n = 45), and obtained using "Total lipids and fatty acid composition of total lipids" as set of variables.

C = Croatia; I = Italy; T = Turkey; G = Greece; I0 = wild; I3 = intensively reared; I1 = extensively reared; I2 = semi-intensively reared; Legend of the top right figure reports the identification numbers of FAO fishing subareas.



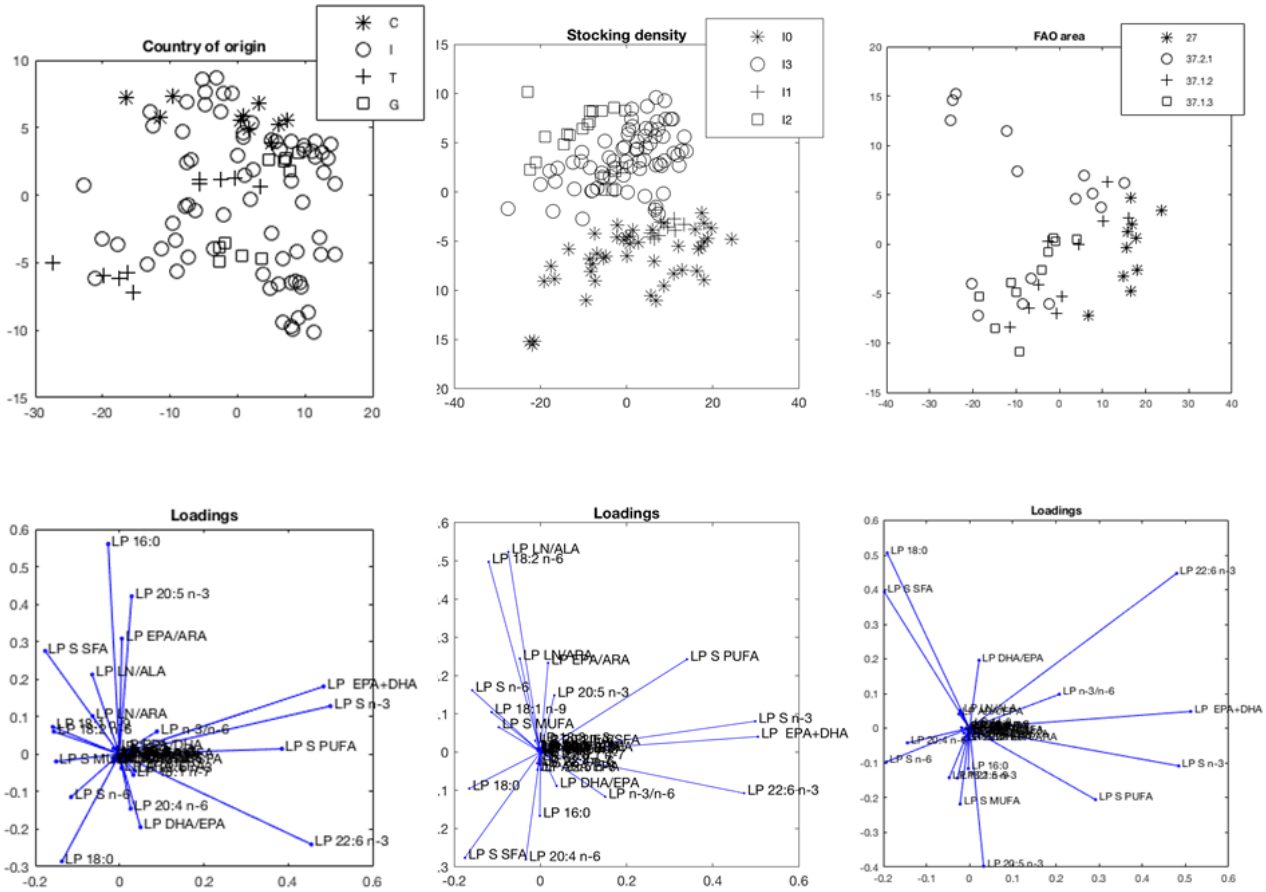
Supplementary Material Figure S3: Scatterplot of PCA and loadings performed on sea bass classified according to country of origin (n = 115), stocking density (n = 160) and FAO fishing subareas (n = 45), and obtained using "Fatty acid composition of neutral lipids" as set of variables.

C = Croatia; I = Italy; T = Turkey; G = Greece; I0 = wild; I3 = intensively reared; I1 = extensively reared; I2 = semi-intensively reared; Legend of the top right figure reports the identification numbers of FAO fishing subareas.



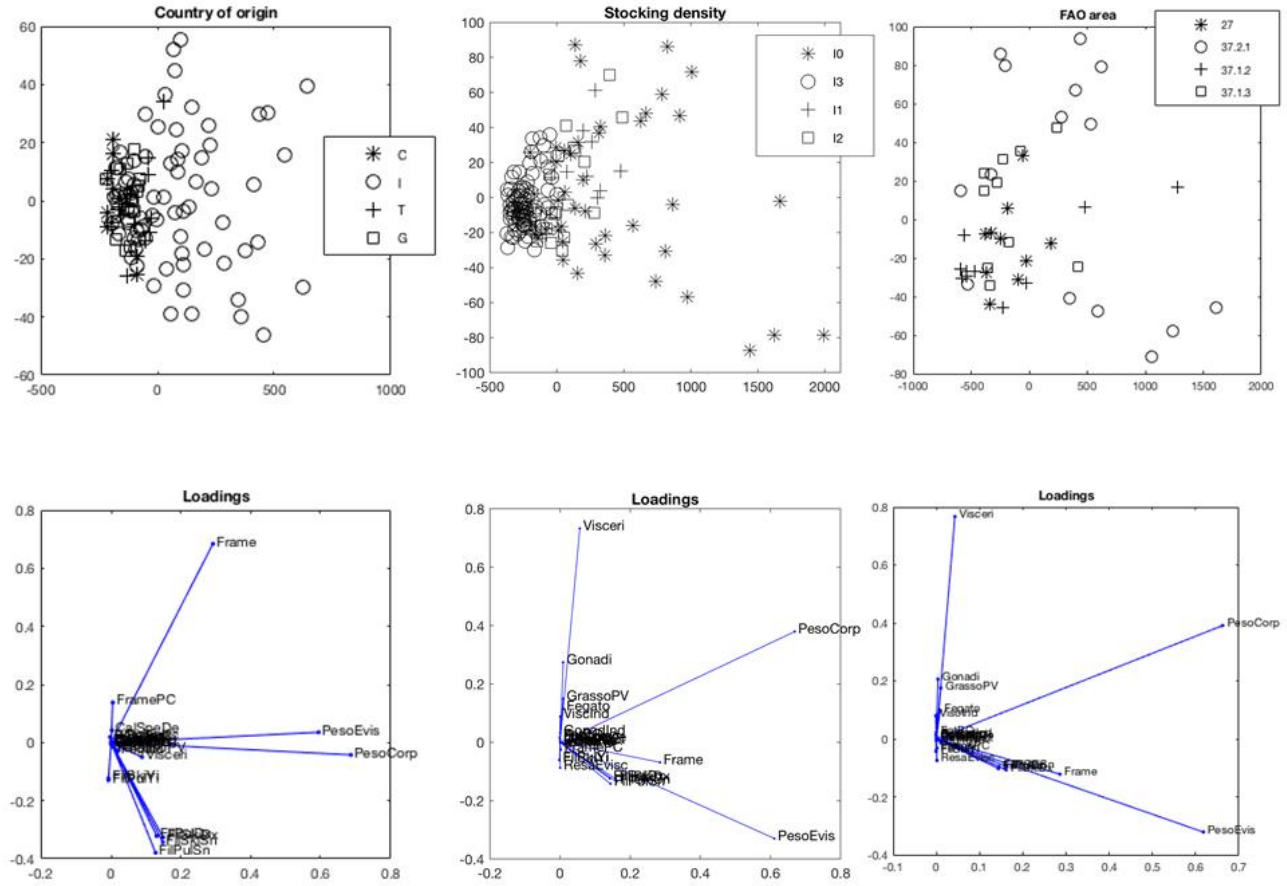
Supplementary Material Figure S4: Scatterplot of PCA and loadings performed on sea bass classified according to country of origin (n = 115), stocking density (n = 160) and FAO fishing subareas (n = 45), and obtained using "Fatty acid composition of polar lipids" as set of variables.

C = Croatia; I = Italy; T = Turkey; G = Greece; I0 = wild; I3 = intensively reared; I1 = extensively reared; I2 = semi-intensively reared; Legend of the top right figure reports the identification numbers of FAO fishing subareas.



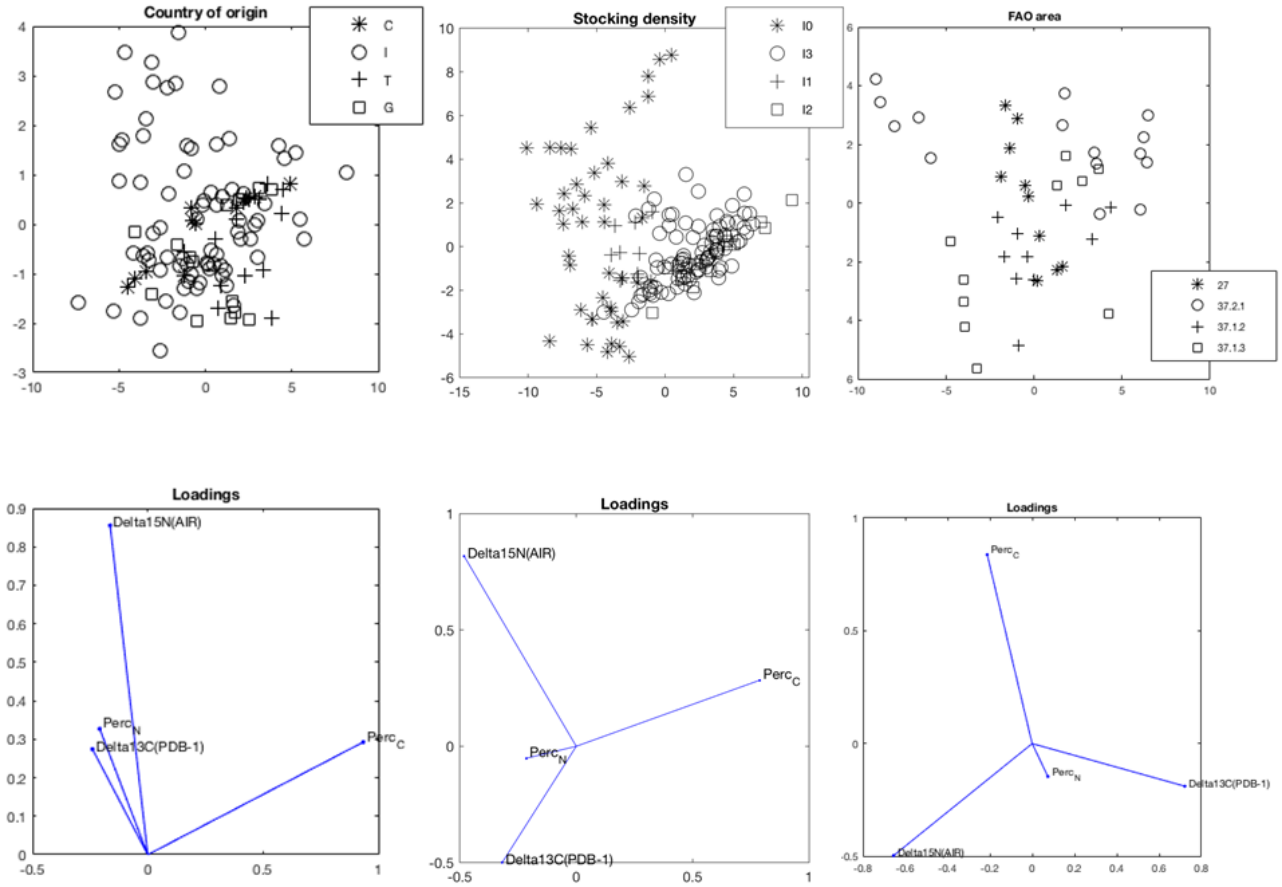
Supplementary Material Figure S5: Scatterplot of PCA and loadings performed on sea bass classified according to country of origin (n = 115), stocking density (n = 160) and FAO fishing subareas (n = 45), and obtained using "Biometric parameters" as set of variables.

C = Croatia; I = Italy; T = Turkey; G = Greece; I0 = wild; I3 = intensively reared; I1 = extensively reared; I2 = semi-intensively reared; Legend of the top right figure reports the identification numbers of FAO fishing subareas.



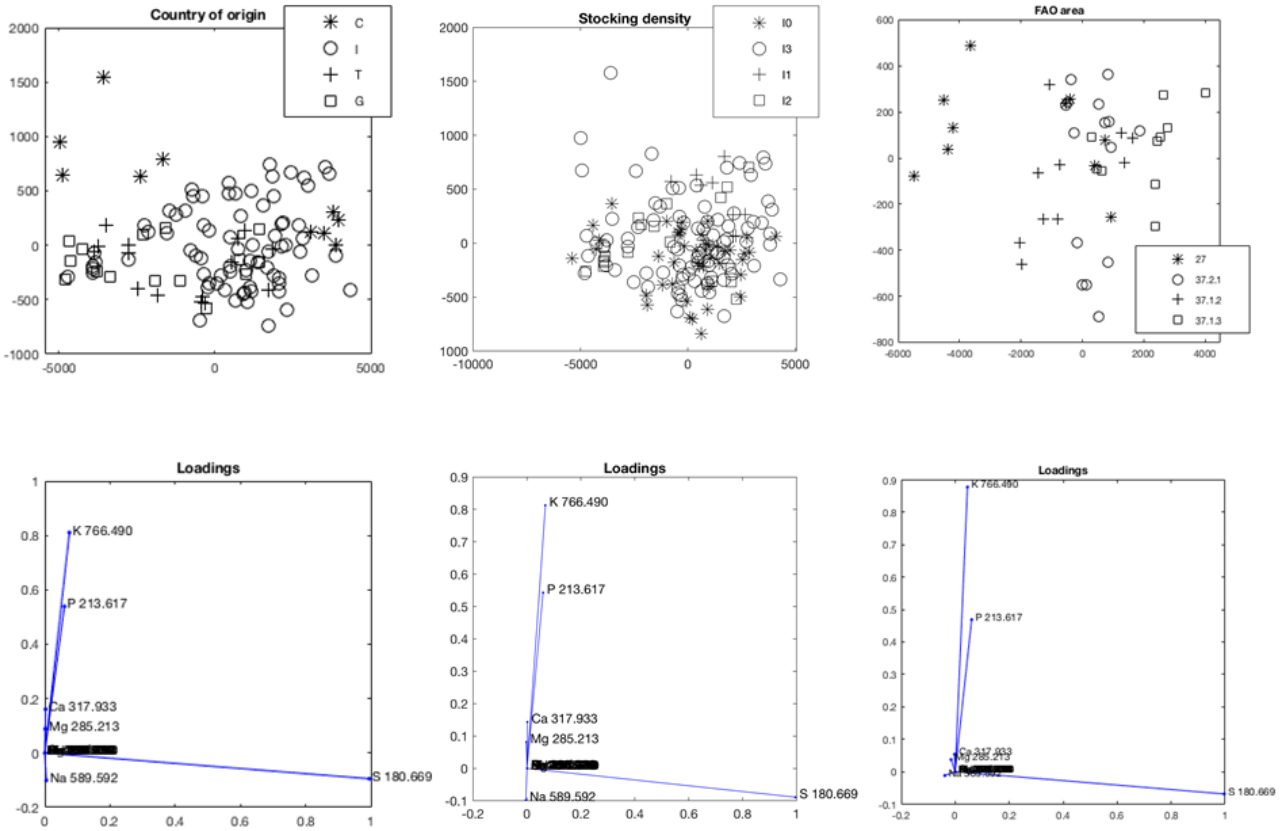
Supplementary Material Figure S6: Scatterplot of PCA and loadings performed on sea bass classified according to country of origin (n = 115), stocking density (n = 160) and FAO fishing subareas (n = 45), and obtained using "Isotopic abundances" as set of variables.

C = Croatia; I = Italy; T = Turkey; G = Greece; I0 = wild; I3 = intensively reared; I1 = extensively reared; I2 = semi-intensively reared; Legend of the top right figure reports the identification numbers of FAO fishing subareas.



Supplementary Material Figure S7: Scatterplot of PCA and loadings performed on sea bass classified according to country of origin (n = 115), stocking density (n = 160) and FAO fishing subareas (n = 45), and obtained using "Elemental composition" as set of variables.

C = Croatia; I = Italy; T = Turkey; G = Greece; I0 = wild; I3 = intensively reared; I1 = extensively reared; I2 = semi-intensively reared; Legend of the top right figure reports the identification numbers of FAO fishing subareas.



Materials and methods extended version.

2.2 Moisture determination, lipid analysis and fatty acid profile

The moisture content of flesh was measured following AOAC procedure 950.46B [1], and analyses were realized in duplicate for each sample. According to the procedure, the flesh of both fillets from each subject was first homogenized, then 10 g of sample were put into a porcelain crucible and heated at 100–102 °C for 18 h to determine dry weight before calculating the moisture.

The extraction of total lipids (TL) was done in duplicate for each sample, following a procedure proposed by Bligh and Dyer (1959) [2], and adopting some adjustments, briefly described as follows: around 4 g of homogenized fillets were put into a tube immersed in an ice bath, and mixed twice with an Ultra-Turrax T25 (IKA-Werke GmbH & Co., Staufen, Germany) for 1 min, the first time after the addition of 18 mL of a solution of chloroform and methanol mixed in equal parts, and the second with 12 mL of a solution of chloroform and deionized water mixed in equal parts. After centrifugation (4000 rpm at 4 °C for 10 min), the upper aqueous phase and the intermediate solid phase were removed, while the lower phase, containing chloroform and dissolved TL, was passed through a layer of anhydrous sodium sulfate. One milliliter of the lipid extract was completely desolvated on a hot plate at 50 °C, and the lipid residue was weighed in order to calculate the TL percentage according to the following formula: $TL\% = 100 \times (g\ lipid \times mL^{-1}) \times (12 \times g\ sample^{-1})$, where the number 12 refers to the milliliters of chloroform used for extraction. Quantification of phospholipids (PL) in TL was carried out by colorimetric determination of phosphorus, following the procedure reported by Marinetti (1962) [3]. Briefly, three aliquots of 5 µg were taken from each TL extracted sample, and mineralized with perchloric acid at temperatures up to 250 °C. Afterwards, ammonium heptamolybdate and 1-amino-2-hydroxy-4-naphthalene sulfonic acid were added to the samples; they were kept at 100 °C for 7 min, till a colored complex was obtained. The absorbance of this complex was measured with a spectrophotometer at 830 nm. To calculate the amount of phosphorus in the samples, the results obtained were compared with the absorbance values of standard solutions. Finally, PL quantification was estimated by multiplying the calculated amount of phosphorus by 25.

Neutral lipids (NL) were separated from PL following a normal phase SPE (solid phase extraction) method, described by Bayır *et al.* (2010) [4], which uses 12 mL Strata SI-1 Silica (55 µm, 70 Å) columns, with 2 g of substrate (Phenomenex, Torrance, CA, USA). Briefly, after equilibration with 3 mL of chloroform, silica columns were loaded with TL sample, and diluted in 3 mL of chloroform. After that, the NL fraction was separated by charging the cartridge with 3 mL of chloroform eight times. The column was successively dried by vacuum, and PL were eluted with four aliquots of 3 mL of methanol and then four aliquots of 3 mL of a solution of chloroform/methanol 3:7 (v:v).

Fatty acid methyl esters (FAME) from TL, NL and PL were obtained by transmethylation involving sulfuric acid as catalyst, following the method proposed by Christie (1989) [5]. Briefly, samples were dried under a gentle nitrogen stream in a glass tube, and diluted with 100 µL of toluene and 1 mL of the methylating solution of 1% sulfuric acid in methanol (96% purity). Samples were kept at 50 °C in a heater for 12 h. Then, 1 mL of 5% NaCl buffer and 900 µL of hexane were added to the samples, which were successively vortex-mixed and centrifuged for 10

min at 2000 rpm. The supernatant containing FAME was then collected and injected into a Varian 3380 gas chromatograph (Agilent Technologies, Palo Alto, USA) fitted with a CP-8200 Varian autosampler, a split injector set at 230 °C, and a flame ionization detector system set at 300 °C. Chromatographic separation of FAME was attained by means of a 30 m × 0.32 mm (i.d.) × 0.25 µm (film thickness) fused silica-bonded phase column (DB-23, J&W Scientific); the oven temperature was programmed from 150 to 230 °C at a rate of 5 °C min^{-1}, with a final isotherm. High-purity nitrogen was used as carrier gas, with a 1.2 mL min^{-1} flow. Data obtained were acquired and processed by Varian Star Chromatography Workstation software; FAs were identified by comparing the retention times of unknown FAME with those of known FAME standard mixtures (Sigma-Aldrich Corp., St. Louis, MO, USA; PUFA n°1, of marine origin, and PUFA n°3, Menhaden Oil, Supelco, Inc, Bellefonte, PA, USA), their content being reported as a percentage of the sum of FAME (% FAME) of TL, NL and PL, respectively.

2.3 Determination of macro-, microelements and toxic elements

Mineralization was performed by adding 6 mL of nitric acid (Ultrapure Merck, Darmstadt, Germany, 67% purity) and 2 mL of hydrogen peroxide (Ultrapure Merck, 31% purity) to 1 g of sample, through a MULTIWAVE 3000 microwave system (Perkin Elmer). Analyses were realized in duplicate for each sample. Detection of the elements was obtained by means of an Optima 2100 inductively coupled plasma atomic emission spectrometer (ICP-OES; PerkinElmer, Waltham, MA, USA). For determination of the macroelements calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), sulfur (S), and phosphorus (P), a Meinhard cyclonic spray chamber was employed, with radial viewing configuration. Microelements and toxic elements, cobalt (Co), chromium (Cr), copper (Cu), iron (Fe), nickel (Ni), selenium (Se), manganese (Mn), zinc (Zn), arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb), were determined with a CETAC U5000 ultrasonic nebulizer (Thermo Fisher Scientific, Waltham, MA, USA) in axial view configuration.

2.4 Stable isotopes analysis

Determination of C and N isotopic composition in sea bass muscle was carried out through freeze-drying, for at least 5 days, about 2–5 g of frozen fillets from each subject. Thereafter, dried samples were manually ground to obtain a < 0.6 mm grain size; successively, 0.07 ± 0.01 and 0.7 ± 0.1 mg, respectively for $\delta^{13}C$ and $\delta^{15}N$ analysis, were weighed in (3.3 × 5 mm) tin capsules, using an analytical microbalance. Every sample was measured in duplicate. For determination of both parameters, an EA/NA-1100 elemental analyzer with CHN configuration (Thermo Finnigan), in helium continuous flow mode and coupled to a Finnigan Delta Plus XP mass spectrometer, was employed. Isotope values were expressed through δ notation: $\delta^{13}C$ or $\delta^{15}N = [(R_{sample} / R_{standard}) - 1]$ x 1000, where R_{sample} is the isotope ratio of samples, $R_{standard}$ is the isotope ratio of reference standards. Sample isotope ratios were then calculated according to international reference standard V-PDB for C, and atmospheric nitrogen for N.

2.5 Quality of analytical data

Analyses of samples were performed in duplicate, using reagents of analytical grade. Quality of data was constantly monitored by means of three standard reference materials (SRMs): “SRM 1946

– Lake Superior Fish Tissue" (NIST, National Institute of Standards & Technology, Gaithersburg, MD, USA) for proximate composition, main FAs (14:0, 16:0, 16:1n-7, 17:0, 18:0, 18:1n-9, 18:2n-6, 18:3n-3, 20:1n-9, 20:4n-6, 20:5n-3, 22:1n-9, 22:5n-3, 22:6n-3), and some macro- and microelements (Ar, Ca, Cd, Cu, Fe, Hg, K, Mg, Mn, Na, P, Pb, Se, Zn); "SRM 1546 – Meat Homogenate" (NIST, Gaithersburg, MD, USA) for some macro- and microelements (Ca, Cu, Fe, K, Mg, Mn); "DORM-2 – Dogfish Muscle Certified Reference Material for Trace Metals" (NRC, National Research Council of Canada, Ottawa, Ontario, Canada) for microelements and toxic elements (Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, Sn, Tl, Zn). During analysis, each SRM was processed in duplicate three times, following the same procedures. Results obtained from sea bass analysis always corresponded to those obtained from SRMs. The following reference standards were used for stable isotope analysis of N and C. KNO_3: $\delta^{15}N = 4.7 \pm 0.2$; IAEA N°1: $\delta^{15}N = 0.4 \pm 0.2$; IAEA N°2: $\delta^{15}N = 20.3 \pm 0.2$; USGS25: $\delta^{15}N = -30.4 \pm 0.4$; USGS24 (graphite): $\delta^{13}C = -16.0 \pm 0.1$; IAEA-CH-6 (carbohydrate): $\delta^{13}C = -10.4 \pm 0.2$; NBS22 (oil): $\delta^{13}C = -29.7 \pm 0.2$; polyethylene: $\delta^{13}C = -31.8 \pm 0.2$; cellulose: $\delta^{13}C = -25.5 \pm 0.2$. Urea ($CH_4N_2O$), with known %N and %C (respectively 46.65% and 20%), was used for elemental analysis. The precision of the measurements, calculated on the basis of repeated analysis of SRMs, was ± 0.2‰ for both elements.

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