

Changing isotopic food webs of two economically important fish in Mediterranean coastal lakes with different trophic status

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Supplementary material

Figure S1

Isotopic niche biplots of the community in each lake. LP: low eutrophication, IP: intermediate eutrophication, HP: high eutrophication. Empty symbols represent the basal resources of the respective study location. Black and grey symbols represent invertebrates and fish respectively. The isotopic niche space was divided into Isotopic Trophic Units (ITUs), i.e. squares having $1 \times 1\%$ $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ ranges. The ITUs were defined as groups of individuals occupying the same position in the $\delta^{13}\text{C}$ - $\delta^{15}\text{N}$ niche space. For details please refer to the methods section.

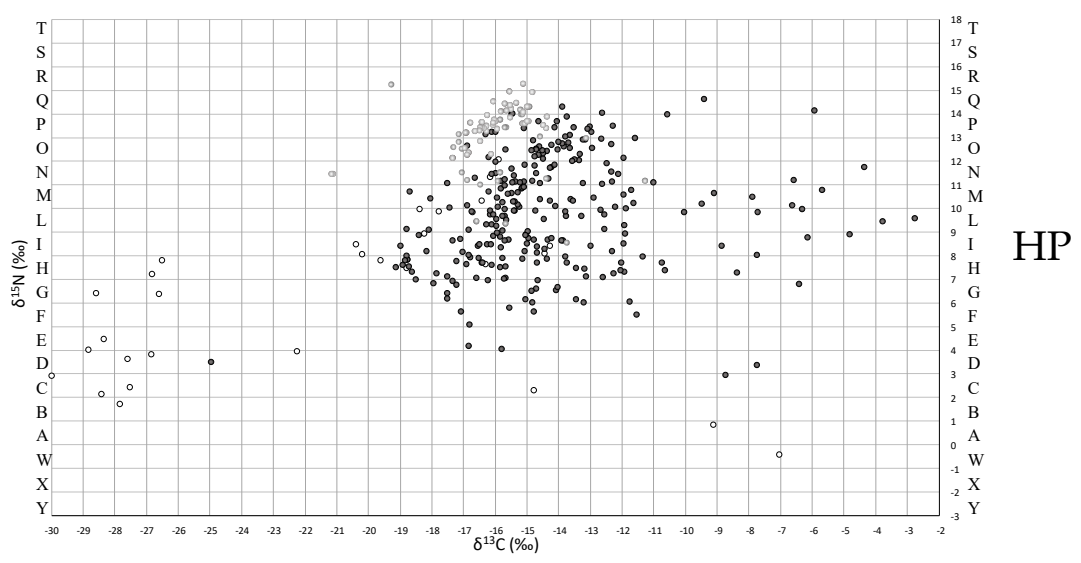
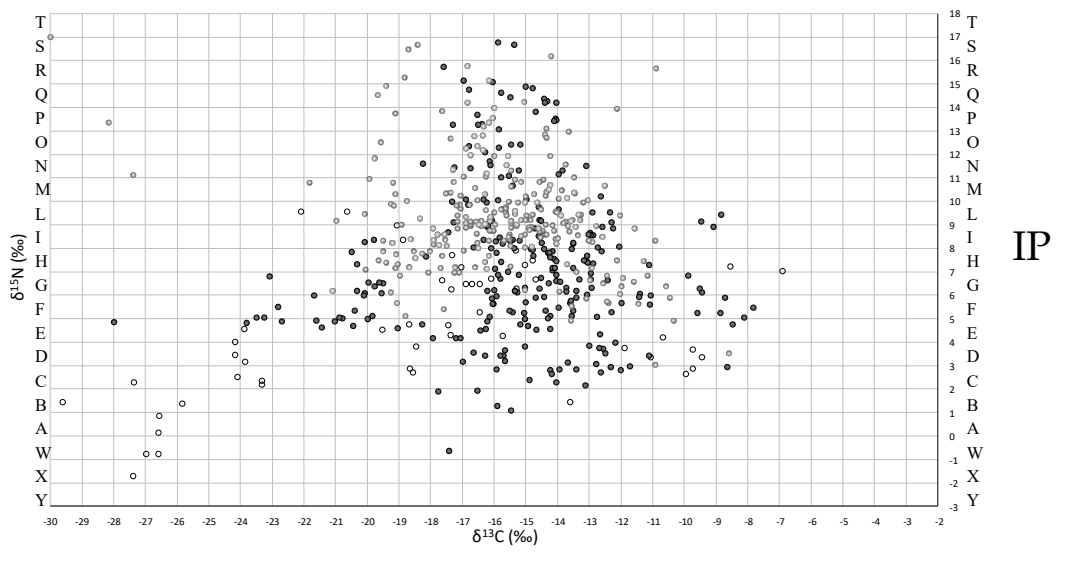
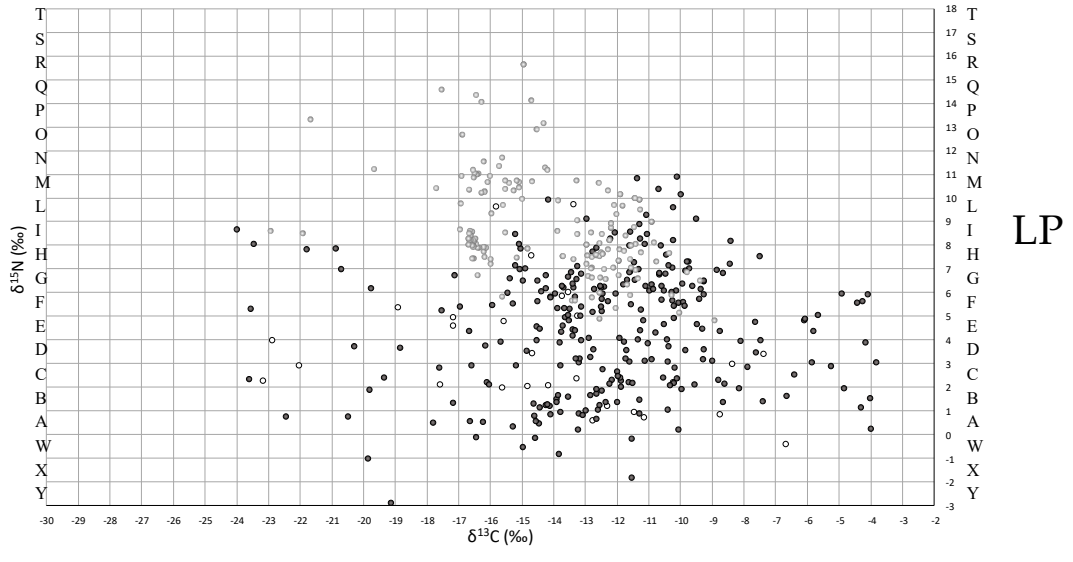


Table S1

Carbon ($\delta^{13}\text{C}$) and Nitrogen ($\delta^{15}\text{N}$) Isotopic signature and abundances ($n^\circ \text{Ind./m}^2$) of invertebrate in each lake. LP: low eutrophication, IP: intermediate eutrophication, HP: high eutrophication. The dash (-) indicates that the taxon was not found. Isotopic signatures were expressed as mean \pm s.e. Different superscript letters indicate differences between lakes (Bootstrap comparison; $p < 0.05$).

	TAXON	LP			IP			HP		
		$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	$n^\circ \text{Ind./m}^2$	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	$n^\circ \text{Ind./m}^2$	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	$n^\circ \text{Ind./m}^2$
CNIDARIANS										
	Anthozoa	-13.99 \pm 0.32	2.81 \pm 0.38	183.00 \pm 68.92	-16.37 \pm 1.05	5.00 \pm 0.56	27.5 \pm 8.82	-13.87 \pm 0.83	10.12 \pm 0.49	19.00 \pm 8.13
	Hydrozoa	-15.67 \pm 0.05	7.15 \pm 0.05	3.00 \pm 3.00	0.25 \pm 0.25		0.25 \pm 0.25	-18.78 \pm 0.05	10.73 \pm 0.05	0.25 \pm 0.25
ASCIDIANS										
	Ascidiacea		-			-		-18.17 \pm 0.05	9.10 \pm 0.05	0.50 \pm 0.50
MOLLUSKS										
	Bivalvia	-16.69 \pm 0.91	2.34 \pm 0.63	102.75 \pm 88.55	-19.58 \pm 0.54	5.39 \pm 0.25	39.75 \pm 5.44	-17.14 \pm 0.39	7.33 \pm 0.20	92.25 \pm 31.29
	Gastropoda	-11.20 \pm 0.54	5.01 \pm 0.35	74.25 \pm 8.34	-15.53 \pm 0.73	8.29 \pm 0.94	35.50 \pm 25.56	-13.09 \pm 0.45	10.02 \pm 0.38	63.5 \pm 21.22
ANNELIDA										
	Clitellata (oligochaeta)		-			-	0.50 \pm 0.50	-17.16 \pm 0.10	8.86 \pm 0.68	2.50 \pm 2.50
	Polychaeta	-13.70 \pm 0.71	3.56 \pm 0.32	52.25 \pm 10.83	-15.55 \pm 0.28	4.52 \pm 0.35	49.75 \pm 26.01	-15.48 \pm 0.27	9.9 \pm 0.25	45.00 \pm 18.28
ECHINODERMS										
	Eleutherozoa (Asteroidea)	-9.34 \pm 3.41	4.89 \pm 0.58	0.75 \pm 0.48		-		-5.23 \pm 0.79	12.96 \pm 1.19	1.00 \pm 1.00
	Euechinoidea (Echinoidea)	-13.90 \pm 0.52	5.96 \pm 0.18	1.75 \pm 1.75		-			-	
	Holoturoidea	-8.27 \pm 1.97	3.26 \pm 0.8	1.75 \pm 1.03		-			-	
	Ophiuroidea	-6.65 \pm 2.03	3.24 \pm 1.91	9.75 \pm 7.60	-12.88 \pm 1.33	7.82 \pm 0.48	1.25 \pm 0.75	-6.49 \pm 0.93	9.44 \pm 0.53	79.25 \pm 78.92
ARTHROPODA										
	Insecta		-		-15.76 \pm 0.29	4.20 \pm 1.35	22.75 \pm 17.82	-16.44 \pm 0.40	7.51 \pm 0.49	5.50 \pm 3.4
CRUSTACEANS										
	Malacostraca (Amphipoda)	-13.54 \pm 0.49	2.87 \pm 0.45	153.00 \pm 57.67	-13.41 \pm 0.52	4.61 \pm 0.43	210.75 \pm 67.02	-13.62 \pm 0.49	8.33 \pm 0.30	377.75 \pm 132.54
	Malacostraca (Decapoda)	-12.51 \pm 0.27	6.37 \pm 0.21	35.50 \pm 12.63	-15.30 \pm 0.16	9.70 \pm 0.27	7.75 \pm 5.57	-14.30 \pm 0.15	11.89 \pm 0.18	7.25 \pm 5.71
	Malacostraca (Isopoda)	-10.52 \pm 0.48	2.85 \pm 0.41	77.50 \pm 17.39	-12.19 \pm 0.43	5.02 \pm 0.32	214.00 \pm 64.91	-11.74 \pm 0.78	8.60 \pm 0.55	15.25 \pm 11.7
	Balanidae		-			-		-16.61 \pm 0.05	7.92 \pm 0.05	0.25 \pm 0.25
NEMERTEA										
	Nemertea	-12.81 \pm 0.05	1.36 \pm 0.05	0.50 \pm 0.50	-17.16 \pm 0.43	4.77 \pm 0.60	1.00 \pm 0.41	-15.70 \pm 0.24	10.24 \pm 0.51	0.25 \pm 0.25
NEMATODA										
	Nematoda	-15.51 \pm 0.05	6.99 \pm 0.05	0.75 \pm 0.75		-		-15.54 \pm 0.05	11.11 \pm 0.05	6.5 \pm 6.17
	Hs			2.58 ^a			2.03 ^b			2.25 ^c

Table S2

Contingency table for Invertebrates (Total Individuals) community composition in each lake. LP: low eutrophication, IP: intermediate eutrophication, HP: high eutrophication. Below the diagonal the observed Chi-square (χ^2) values and above the diagonal corresponding p-values.

Taxon	LP	IP	HP
Anthozoa	732	110	34
Hydrozoa	12	1	1
Ascidiacea	0	0	2
Bivalvia	411	106	369
Gastropoda	303	142	296
Clitellata (oligochaeta)	0	2	10
Polychaeta	210	202	180
Eleutherozoa (Asteroidea)	3	0	4
Euechinoidea (Echinoidea)	7	0	0
Holoturoidea	7	0	0
Ophiuroidea	39	8	317
Insecta	0	91	22
Malacostraca (Amphipoda)	582	833	1471
Malacostraca (Decapoda)	172	174	54
Malacostraca (Isopoda)	310	852	60
Balanidae	0	0	1
Nemertea	2	5	26
Nematoda	3	0	1
Chi-square (χ^2) \ p values			
LP	-	0.0001	0.0001
IP	1985.8	-	0.0001
HP	4610	1518.4	-

Table S3

Contingency table for fish (Total individuals) community composition in each lake. LP: low eutrophication, IP: intermediate eutrophication, HP: high eutrophication. Below the diagonal the observed Chi-square (χ^2) values and above the diagonal corresponding p-values.

Taxon	LP	IP	HP
Anguillidae	8	16	10
Atherininae	2	33	43
Belonidae	28	7	0
Blenniidae	9	8	5
Clupeidae	29	26	0
Cyprinodontidae	0	11	0
Gobiidae	11	29	3
Labridae	3	0	0
Moronidae	1	40	0
Mugilidae	40	61	8
Scorpaenidae	3	0	0
Soleidae	2	10	0
Sparidae	12	10	8
Syngnathidae	1	0	1
Chi-square (χ^2) \ p values			
LP	-	0.0001	0.0001
IP	2105.5	-	0.0001
HP	941.53	170.16	-