

Predicting trophic guild and diet overlap from functional traits: statistics, opportunities and limitations for marine ecology

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Supplement. Data sources for diet, the averaged functional traits values, the classification of species into guilds for 35 Mediterranean fish and the conceptual framework of the present study

Table S1. Species and their associated data sources for diet

Order	Family	Species	Source
Anguilliformes	Congridae	<i>Conger conger</i>	Cau & Manconi 1984
Cupleiformes	Cupleidae	<i>Sardinella aurita</i>	Moreno & Castro 1995
Gadiformes	Gadidae	<i>Phycis phycis</i>	Papaconstantinou & Caragitsou 1989
	Merlucciidae	<i>Merluccius merluccius</i>	Le Loc'h 2004
Perciformes	Atherinidae	<i>Atherina</i> sp.	Pinnegar & Polunin 2000
	Centracanthidae	<i>Spicara maena</i>	Khoury 1987
	Labridae	<i>Coris julis</i>	Bell & Harmelin-Vivien 1983
		<i>Labrus merula</i>	Bell & Harmelin-Vivien 1983
		<i>Labrus viridis</i>	Bell & Harmelin-Vivien 1983
		<i>Symphodus tinca</i>	Khoury 1987
	Mugilidae	<i>Liza aurata</i>	Blaber 1976
	Mullidae	<i>Mullus surmuletus</i>	Pinnegar & Polunin 2000
	Pomacentridae	<i>Chromis chromis</i>	Bell & Harmelin-Vivien 1983
	Scorpaenidae	<i>Scorpaena notata</i>	Bell & Harmelin-Vivien 1983
		<i>Scorpaena porcus</i>	Bell & Harmelin-Vivien 1983
		<i>Scorpaena scrofa</i>	Bell & Harmelin-Vivien 1983
	Serranidae	<i>Serranus cabrilla</i>	Bell & Harmelin-Vivien 1983
		<i>Serranus scriba</i>	Arculeo et al. 1993
		<i>Epinephelus marginatus</i>	Reñones et al. 2002
	Sparidae	<i>Boops boops</i>	Bell & Harmelin-Vivien 1983
		<i>Dentex dentex</i>	Morales-Nin & Moranta 1996
		<i>Diplodus annularis</i>	Rosecchi & Nouaze 1987
		<i>Diplodus puntazzo</i>	Sala & Ballasteros 1997
		<i>Diplodus sargus</i>	Rosecchi & Nouaze 1987
		<i>Diplodus vulgaris</i>	Sala & Ballasteros 1997
		<i>Oblada melanura</i>	Moreno & Castro 1995
		<i>Pagellus acarne</i>	Morato et al. 2001
		<i>Pagellus erythrinus</i>	Rosecchi 1983
		<i>Pagrus pagrus</i>	Papaconstantinou & Caragitsou 1989
		<i>Sarpa salpa</i>	Havelange et al. 1997
		<i>Spondyliosoma cantharus</i>	Bell & Harmelin-Vivien 1983
	Sphyraenidae	<i>Sphyraena</i> sp.	Barreiros et al. 2002
	Uranoscopidae	<i>Uranoscopus scaber</i>	Sanz 1985
Pleuronectiformes	Soleidae	<i>Solea solea</i>	Darnaude 2005
Zeiformes	Zeidae	<i>Zeus faber</i>	Bell & Harmelin-Vivien 1983

Table S2. Averaged values and standard deviation of traits on 35 Mediterranean fish

	Biomass	Biomass SD	Ops	Ops SD	Osh	Osh SD	Osf	Osf SD	Edst	Edst SD	Eps	Eps SD	Grlst	Grlst SD	Glst	Glst SD	Pro	Pro SD	Pfps	Pfps SD	Cpt	Cpt sd	Bsh	Bsh SD	Bsf	Bsf SD
<i>Atherina sp</i>	3.63	0.58	0.59	0.06	2.21	0.26	0.35	0.06	0.61	0.02	0.61	0.02	0.28	0.02	0.56	0.06	2.97	0.41	0.46	0.02	4.88	0.43	1.52	0.07	2.89	0.17
<i>boops boops</i>	116.39	39.80	0.54	0.09	1.59	0.25	0.12	0.02	0.56	0.05	0.60	0.05	0.04	0.02	1.92	0.73	3.92	0.51	0.73	0.08	4.56	0.49	1.55	0.14	1.44	0.06
<i>Chromis chromis</i>	21.50	9.63	0.49	0.14	1.43	0.19	0.11	0.00	0.42	0.08	0.65	0.06	0.03	0.01	0.85	0.07	2.86	1.05	0.70	0.18	2.65	0.18	2.29	0.06	1.96	0.13
<i>Conger conger</i>	1350.00	130.00	0.59	0.14	0.67	0.04	0.31	0.09	0.60	0.02	0.91	0.03	0.00	0.00	0.51	0.01	0.00	0.00	0.71	0.05	0.00	0.00	0.87	0.10	1.10	0.04
<i>Coris julis</i>	21.00	-	0.66	-	1.42	-	0.16	-	0.36	-	0.75	-	0.00	-	0.23	-	1.00	-	0.77	-	0.00	-	1.93	-	1.78	-
<i>Dentex dentex</i>	1060.00	1145.51	0.40	0.11	1.02	0.06	0.26	0.04	0.28	0.04	0.84	0.02	0.03	0.02	0.76	0.03	9.25	3.80	0.78	0.05	4.34	0.72	2.34	0.07	1.26	0.12
<i>Diplodus annularis</i>	60.18	18.27	0.39	0.08	1.41	0.28	0.02	0.02	0.39	0.04	0.72	0.06	0.03	0.01	1.49	0.43	3.36	0.65	0.76	0.03	3.65	1.39	3.25	0.28	1.60	0.09
<i>Diplodus puntazzo</i>	200.00	-	0.48	-	1.53	-	0.07	-	0.33	-	0.65	-	0.03	-	1.55	-	2.00	-	0.76	-	5.64	-	2.88	-	1.38	-
<i>Diplodus sargus</i>	460.29	334.97	0.42	0.07	0.95	0.24	0.11	0.04	0.28	0.06	0.72	0.03	0.02	0.01	1.46	0.42	4.74	0.96	0.76	0.04	4.16	0.44	2.89	0.27	1.40	0.22
<i>Diplodus vulgaris</i>	99.08	72.01	0.36	0.08	1.28	0.52	0.11	0.04	0.39	0.04	0.70	0.05	0.03	0.02	1.03	0.46	5.39	2.06	0.76	0.03	4.19	1.94	3.17	0.21	1.55	0.08
<i>Labrus merula</i>	230.88	165.60	0.50	0.08	1.24	0.14	0.14	0.02	0.36	0.07	0.82	0.06	0.05	0.01	0.95	0.38	7.19	2.67	0.77	0.04	2.15	1.13	1.96	0.30	1.37	0.08
<i>Labrus viridis</i>	185.29	70.84	0.49	0.10	1.18	0.20	0.17	0.07	0.35	0.04	0.84	0.07	0.03	0.02	0.72	0.32	7.39	1.57	0.76	0.04	2.09	0.83	2.07	0.16	1.36	0.07
<i>Merlicius merlicius</i>	151.60	87.23	0.72	0.07	1.28	0.10	1.41	0.41	0.60	0.08	0.74	0.11	0.03	0.01	0.67	0.13	0.00	0.00	0.80	0.14	4.14	0.49	1.19	0.13	1.36	0.07
<i>Liza aurata</i>	48.67	6.89	0.35	0.04	1.15	0.07	0.16	0.01	0.50	0.04	0.51	0.03	0.25	0.03	3.25	0.61	4.68	0.37	0.48	0.03	3.01	0.29	1.32	0.09	1.62	0.03
<i>Mullus surmuletus</i>	107.63	77.13	0.24	0.10	1.11	0.15	0.31	0.04	0.38	0.03	0.81	0.06	0.03	0.01	0.69	0.12	4.31	1.29	0.78	0.03	3.07	0.44	1.76	0.08	1.47	0.07
<i>Oblada melanura</i>	150.00	-	0.34	-	1.27	-	0.15	-	0.38	-	0.74	-	0.04	-	1.59	-	6.41	-	0.69	-	4.85	-	2.16	-	1.44	-
<i>Pagellus acarne</i>	104.80	34.48	0.48	0.04	1.13	0.21	0.20	0.02	0.58	0.15	0.80	0.15	0.04	0.01	0.67	0.32	6.93	1.34	0.71	0.04	3.18	0.39	1.81	0.10	1.49	0.05
<i>Pagellus erythrinus</i>	170.46	191.28	0.33	0.07	1.42	0.21	0.19	0.04	0.43	0.05	0.69	0.02	0.03	0.01	0.84	0.30	7.17	1.58	0.79	0.03	4.59	0.55	2.29	0.38	1.48	0.13
<i>Pagrus pagrus</i>	1549.60	2027.08	0.27	0.05	1.03	0.20	0.16	0.03	0.31	0.11	0.71	0.05	0.02	0.01	0.99	0.25	8.01	2.95	0.74	0.04	3.96	0.70	2.29	0.14	1.30	0.14
<i>Phycis phycis</i>	540.00	409.88	0.54	0.16	1.03	0.10	0.49	0.08	0.49	0.07	0.76	0.06	0.03	0.02	0.89	0.19	0.00	0.00	0.62	0.16	2.55	0.14	1.52	0.27	1.29	0.07
<i>Sardina pilchardus</i>	33.50	5.73	0.70	0.06	2.22	0.31	0.33	0.06	0.53	0.03	0.73	0.07	0.26	0.03	0.95	0.15	0.00	0.00	0.97	0.02	4.48	0.79	1.89	0.19	1.62	0.05
<i>Sarpa salpa</i>	486.10	72.64	0.39	0.07	0.84	0.09	0.06	0.01	0.32	0.02	0.62	0.06	0.07	0.00	2.58	0.58	0.00	0.00	0.65	0.03	4.29	1.19	2.00	0.12	1.29	0.02
<i>Scorpaena notata</i>	23.00	5.66	0.50	0.07	1.18	0.23	0.71	0.01	0.53	0.17	0.93	0.09	0.07	0.03	0.80	0.34	4.84	0.97	0.86	0.05	3.83	0.20	1.78	0.12	1.92	0.09
<i>Scorpaena porcus</i>	109.52	70.81	0.64	0.11	0.86	0.07	0.65	0.08	0.45	0.05	1.00	0.00	0.07	0.01	0.69	0.14	6.97	1.32	0.87	0.05	2.30	0.75	1.60	0.13	1.58	0.13
<i>Scorpaena scrofa</i>	409.08	498.37	0.74	0.13	0.97	0.15	0.77	0.21	0.30	0.04	1.00	0.00	0.06	0.01	0.75	0.26	8.78	3.09	0.90	0.14	3.31	0.32	1.47	0.13	1.47	0.19
<i>Serranus cabrilla</i>	83.60	23.45	0.67	0.22	1.10	0.12	0.79	0.14	0.44	0.07	0.84	0.08	0.10	0.04	0.84	0.28	4.66	0.59	0.73	0.12	4.20	0.65	1.92	0.13	1.50	0.05
<i>Serranus scriba</i>	90.63	35.82	0.64	0.21	1.09	0.16	0.63	0.11	0.40	0.10	0.87	0.20	0.09	0.03	0.76	0.32	4.99	1.18	0.74	0.04	2.41	0.68	2.01	0.19	1.51	0.08
<i>Solea solea</i>	88.70	18.30	0.00	0.00	1.18	0.17	0.11	0.02	0.58	0.09	0.88	0.06	0.00	0.00	1.93	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.01	1.46	0.03
<i>Spicara maena</i>	90.28	26.82	0.54	0.15	1.03	0.50	0.14	0.03	0.42	0.05	0.66	0.07	0.03	0.01	1.00	0.29	8.64	1.44	0.78	0.03	3.59	1.22	2.18	0.21	1.49	0.05
<i>Spondyliosoma cantharus</i>	169.67	78.68	0.40	0.06	1.37	0.31	0.10	0.03	0.39	0.03	0.63	0.05	0.04	0.01	1.18	0.08	6.17	0.76	0.78	0.03	3.49	1.05	2.38	0.36	1.46	0.07
<i>Symphodus tinca</i>	88.20	47.89	0.53	0.16	1.03	0.31	0.16	0.07	0.28	0.03	0.79	0.04	0.02	0.01	0.79	0.42	4.01	2.10	0.72	0.07	2.16	0.69	2.44	0.30	1.53	0.09
<i>Uranoscopus scaber</i>	306.00	137.90	0.94	0.04	0.99	0.43	0.37	0.13	0.15	0.02	1.00	0.00	0.00	0.00	0.87	0.13	8.44	1.10	0.96	0.01	3.39	0.78	0.70	0.05	1.35	0.04
<i>Zeus faber</i>	560.00	643.38	0.51	0.04	0.93	0.09	1.01	0.19	0.23	0.03	0.88	0.03	0.01	0.00	0.65	0.10	27.02	10.46	0.68	0.04	3.93	1.01	5.13	0.75	1.31	0.11
<i>Epinephelus marginatus</i>	1160.00	84.85	0.72	0.02	0.86	0.25	0.34	0.12	0.29	0.03	0.78	0.01	0.06	0.02	0.66	0.07	10.50	2.12	0.75	0.00	2.47	0.27	1.79	0.14	1.24	0.01
<i>Sphyraena sphyraena</i>	710.00	70.71	0.56	0.10	1.21	0.11	0.96	0.16	0.54	0.01	0.58	0.06	0.00	0.00	0.54	0.17	0.00	0.00	0.78	0.03	4.25	0.03	1.13	0.16	1.15	0.02

Table S3. Classification of species into trophic guilds according to their diets and the *k*-means partitioning method

k-means partition into 3 guilds

Piscivorous	Planktivorous	Others	
<i>Conger conger</i>	<i>Atherina sp.</i>	<i>Labrus viridis</i>	<i>Oblada melanura</i>
<i>Dentex dentex</i>	<i>Boops boops</i>	<i>Coris julis</i>	<i>Pagellus acarne</i>
<i>Merlicius merlicius</i>	<i>Chromis chromis</i>	<i>Diplodus puntazzo</i>	<i>Pagellus erythrinus</i>
<i>Phycis phycis</i>	<i>Liza aurata</i>	<i>Diplodus sargus</i>	<i>Pagrus pagrus</i>
<i>Scorpaena porcus</i>	<i>Sardina pilchardus</i>	<i>Diplodus vulgaris</i>	<i>Sarpa salpa</i>
<i>Scorpaena scrofa</i>	<i>Spicara maena</i>	<i>Diplodus annularis</i>	<i>Scorpaena notata</i>

Uranoscopus scaber
Zeus faber
Sphyraena sphyraena

Labrus merula
Mullus surmuletus
Symphodus tinca
Epinephelus marginatus

Serranus cabrilla
Serranus scriba
Solea solea
Spondyliosoma cantharus

k-means partition into 6 guilds

Piscivorous	Planktivorous	Benthic invertebrate feeders	Macro carnivorous	Others
<i>Conger conger</i>	<i>Atherina</i> sp.	<i>Coris julis</i>	<i>Spondyliosoma cantharus</i>	<i>Epinephelus marginatus</i>
<i>Dentex dentex</i>	<i>Boops boops</i>	<i>Diplodus puntazzo</i>	<i>Serranus cabrilla</i>	<i>Serranus scriba</i>
<i>Merlicius merlicius</i>	<i>Chromis chromis</i>	<i>Diplodus sargus</i>		<i>Scorpaena notata</i>
<i>Phycis phycis</i>	<i>Liza aurata</i>	<i>Diplodus vulgaris</i>		<i>Pagrus pagrus</i>
<i>Scorpaena porcus</i>	<i>Sardina pilchardus</i>			<i>Oblada melanura</i>
<i>Scorpaena scrofa</i>	<i>Spicara maena</i>	Benthic invertebrate feeders II		<i>Pagellus acarne</i>
<i>Uranoscopus scaber</i>		<i>Symphodus tinca</i>		<i>Pagellus erythrinus</i>
<i>Zeus faber</i>		<i>Solea solea</i>		<i>Labrus merula</i>
<i>Sphyraena sphyraena</i>		<i>Sarpa salpa</i>		<i>Labrus</i>
				<i>viridis</i>
		<i>Mullus surmuletus</i>		
		<i>Diplodus annularis</i>		

k-means partition into 10 guilds

Piscivorous	Planktivorous	Benthic invertebrate feeders	Macro carnivorous	Herbivorous
<i>Conger conger</i>	<i>Atherina</i> sp.	<i>Coris julis</i>	<i>Serranus cabrilla</i>	<i>Sarpa salpa</i>
<i>Dentex dentex</i>	<i>Sardina pilchardus</i>	<i>Diplodus puntazzo</i>	<i>Spondyliosoma cantharus</i>	
<i>Merlicius merlicius</i>	<i>Spicara maena</i>	<i>Diplodus sargus</i>		
<i>Zeus faber</i>	<i>Chromis chromis</i>	<i>Diplodus vulgaris</i>		
<i>Sphyraena sphyraena</i>				
Piscivorous II	Planktivorous II	Benthic invertebrate feeders II		
<i>Phycis phycis</i>	<i>Boops boops</i>	<i>Diplodus annularis</i>		
<i>Scorpaena porcus</i>	<i>Liza aurata</i>	<i>Mullus surmuletus</i>		
<i>Scorpaena scrofa</i>		<i>Solea solea</i>		
<i>Uranoscopus scaber</i>	Planktivorous III	<i>Symphodus tinca</i>		
<i>Labrus viridis</i>	<i>Oblada melanura</i>			
	<i>Pagellus acarne</i>	Benthic invertebrate feeders III		
	<i>Pagrus pagrus</i>	<i>Labrus merula</i>		
	<i>Serranus scriba</i>	<i>Pagellus erythrinus</i>		
	<i>Epinephelus</i>	<i>Scorpaena notata</i>		
	<i>marginatus</i>			

Fig. S1. Schema of the modeling methodology applied to diet and ecomorphological data using discriminant models (LDA and RF)

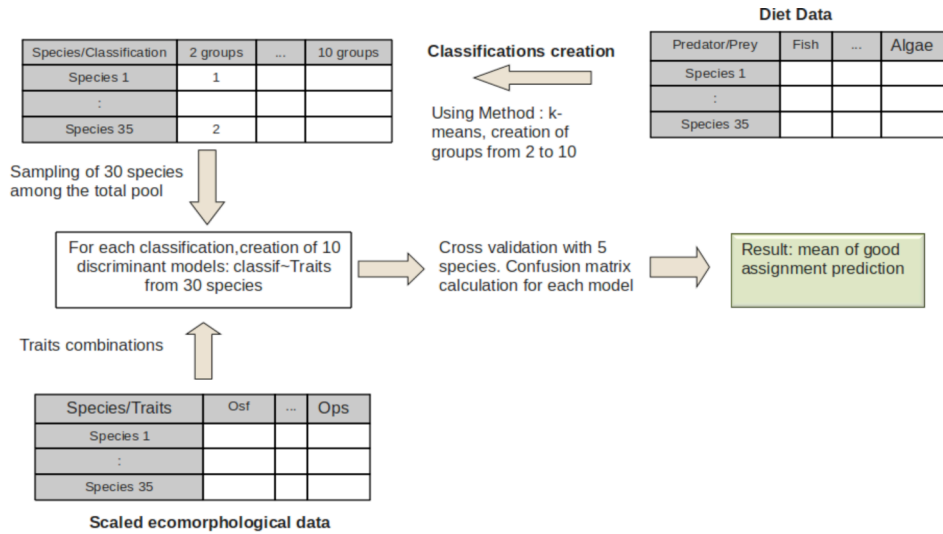
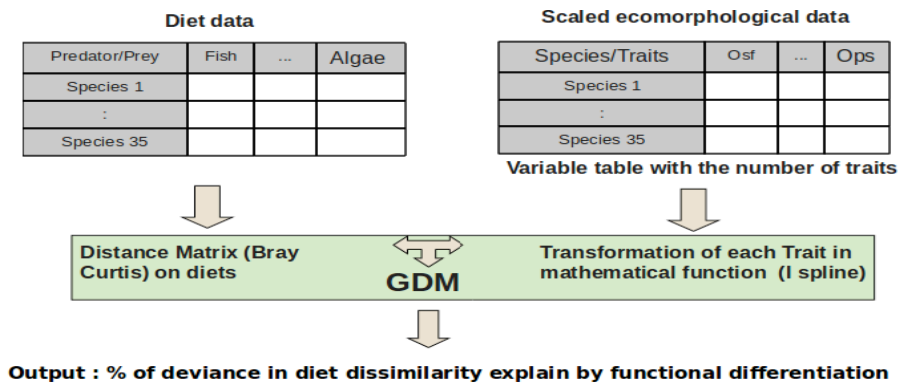


Fig. S2. Schema of the modeling methodology applied to diet and ecomorphological data using GDM models



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