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## Supplementary Material

### Molluscs collected with otter trawl in the northern Alboran Sea: main assemblages, spatial distribution and environmental linkage

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**Annex 1 Supplementary Material:** Mollusc species caught with otter trawl in the MEDITS surveys between 2012 and 2015 on circalittoral and bathyal soft bottoms of the northern Alboran Sea. Depth range for collected specimens (meters); %F: frequency of occurrence expressed as %;  $N_t$ : total abundance (individuals); % $D_N$ : dominance index of abundance expressed as percentage;  $B_t$ : total Biomass (g) and % $D_B$ : dominance index of biomass expressed as percentage. Systematic and taxonomical classification according to WoRMS, Gofas *et al.*, (2011) and Guerra (1992).

	Depth range	%F	$N_t$	% $D_N$	$B_t$	% $D_B$
<b>GASTROPODA</b>						
Family Trochidae						
<i>Callumbonella suturalis</i> (Philippi, 1836)	573	0.52	5	<0.01	7	<0.01
Family Calliostomatidae						
<i>Calliostoma granulatum</i> (Born, 1778)	44-664	8.42	256	0.311	1267	0.04
Family Turritellidae						
<i>Turritella</i> spp.	56	0.52	274	0.33	274	0.01
<i>Turritella communis</i> Riso, 1826	53-64	1.05	9279	11.26	10204	0.40
Family Aporrhaidae						
<i>Aporrhais pespelecani</i> (Linnaeus, 1758)	64	0.52	39	0.04	155	<0.01
<i>Aporrhais serresianus</i> (Michaud, 1828)	128-775	10.0	161	0.19	733.6	0.02
Family Xenophoridae						
<i>Xenophora crista</i> (Koenig, 1825)	44-638	10.5	1627	1.97	49013	1.92
Family Capulidae						
<i>Capulus ungaricus</i> (Linnaeus, 1758)	119	0.52	2	<0.01	8	<0.01
Family Ovulidae						
<i>Pseudosimnia adriatica</i> (Sowerby G.B.I, 1828)	529-541	0.52	2	<0.01	2	<0.01
Family Naticidae						
<i>Euspira fusca</i> (de Blainville, 1825)	92-762	10.0	68	0.08	719	0.02
<i>Euspira grossularia</i> (Marche-Marchad, 1957)	236-441	4.21	28	0.03	297	0.01
Family Cassidae						
<i>Galeodea rugosa</i> (Linnaeus, 1771)	329-852	16.8	322	0.39	20974.4	0.82
<i>Semicassis granulata undulata</i> (Born, 1778)	86	0.52	2	<0.01	56	<0.01
<i>Semicassis saburon</i> (Bruguière, 1792)	529	0.52	1	<0.01	23	<0.01
Family Ranellidae						
<i>Charonia lampas</i> (Linnaeus, 1758)	114-116	0.52	4	<0.01	2742	0.10
<i>Ranella olearium</i> (Linnaeus, 1758)	117-839	10.0	36	0.04	5817.8	0.22
Family Muricidae						
<i>Bolinus brandaris</i> (Linnaeus, 1758)	43-52	1.57	55	0.06	671	0.02
<i>Ocenebra erinaceus</i> (Linnaeus, 1758)	62-66	0.52	6	<0.01	18	<0.01
<i>Orania fusulus</i> (Brocchi, 1814)	139	0.52	2	<0.01	2	<0.01
Family Fasciolaridae						

(continued)

## Annex 1 Supplementary Material Continued

	Depth range	%F	N <sub>t</sub>	%D <sub>N</sub>	B <sub>t</sub>	%D <sub>B</sub>
<i>Fusinus</i> sp.	150	0.52	2	<0.01	4	<0.01
<i>Fusinus rostratus</i> (Olivi, 1792)	43-139	1.05	6	<0.01	16	<0.01
Family Buccinidae						
<i>Buccinum humphreysianum</i> Bennet, 1824	431-831	8.42	90	0.10	1028	0.04
<i>Colus gracilis</i> (da Costa, 1778)	529-794	3.68	30	0.03	190	<0.01
Family Nassariidae						
<i>Nassarius ovoideus</i> (Locard, 1886)	64-620	0.52	51	0.06	37	<0.01
Family Volutidae						
<i>Cymbium olla</i> (Linnaeus, 1758)	40-85	2.10	20	0.02	3655	0.14
Family Cancellariidae						
<i>Bivetiella similis</i> (Linnaeus, 1767)	40-238	3.68	45	0.05	227	<0.01
Family Clavatulidae						
<i>Fusiturris similis</i> (Bivona Ant.in Bivona And.,1838)	444-632	1.05	9	0.01	30	<0.01
Family Scaphandridae						
<i>Scaphander lignarius</i> (Linnaeus, 1758)	529	0.52	2	<0.01	41	<0.01
Family Philinidae						
<i>Philinidae</i> sp. Cray,1850 (1815)	564-774	0.52	3	<0.01	5	<0.01
Family Cymbuliidae						
<i>Cymbulia peronii</i> de Blainville, 1818	166-852	6.31	187	0.22	535	0.02
Family Pleurobranchaeidae						
<i>Pleurobranchaea meckeli</i> (de Blainville, 1825)	42-91	3.15	163	0.19	3110	0.12
Family Dorididae						
<i>Doris pseudoargus</i> Rapp, 1827	47-61	1.05	26	0.03	178	<0.01
Family Discodorididae						
<i>Baptodoris cinnabarina</i> Bergh, 1884	541	0.52	1	<0.01	2	<0.01
<i>Peltodoris atromaculata</i> Bergh, 1880	116	0.52	6	<0.01	2	<0.01
Family Dendrodorididae						
<i>Doriopsilla areolata</i> Bergh, 1880	119	0.52	2	<0.01	2	<0.01
Family Chromodorididae						
<i>Felimare picta</i> (Schultz in Philippi, 1836)	47	0.52	2	<0.01	26	<0.01
Family Tritoniidae						
<i>Marionia blainvillea</i> (Risso, 1818)	43-64	2.10	104	0.12	472	0.01
<i>Tritonia hombergii</i> Cuvier, 1803	42-53	1.05	18	0.02	94	<0.01
Family Tethydidae						
<i>Tethys fimbria</i> Linnaeus, 1767	44-68	0.52	42	0.05	2012	0.07
Family Arminidae						
<i>Armina tigrina</i> Rafinesque, 1814	53-64	1.05	11	0.01	139	<0.01
<b>BIVALVIA</b>						
Family Nuculidae						
<i>Nucula sulcata</i> Bronn, 1831	64-86	0.52	122	0.14	238	<0.01
Family Arcidae						
<i>Arca</i> sp.	54-114	1.05	200	0.24	336	0.01
<i>Arca tetragona</i> Poli, 1795	80-116	1.05	544	0.66	592	0.02
<i>Anadara corbuloides</i> (Monterosato, 1880)	61-86	0.52	6	<0.01	194	<0.01
<i>Anadara gibbosa</i> (Reeve, 1844)	52-119	1.05	32	0.03	776	0.03
Family Mytilidae						
<i>Amygdalum politum</i> (Verrill & S. Smith, 1880)	555	0.52	2	<0.01	9	<0.01

(continued)

Annex 1 Supplementary Material Continued

	Depth range	%F	N <sub>t</sub>	%D <sub>N</sub>	B <sub>t</sub>	%D <sub>B</sub>
<i>Mytilus galloprovincialis</i> Lamarck, 1819	42-122	0.52	300	0.36	4004	0.15
Family Pinnidae						
<i>Atrina fragilis</i> (Pennant, 1777)	121-382	0.52	3	<0.01	114	<0.01
Family Pteriidae						
<i>Pteria hirundo</i> (Linnaeus, 1758)	42-534	5.78	68	0.08	737	0.02
Family Pectinidae						
<i>Pecten maximus</i> (Linnaeus, 1758)	43-62	0.52	4	<0.01	70	<0.01
<i>Mimachlamys varia</i> (Linnaeus, 1758)	52-74	1.05	8	0.01	20	<0.01
<i>Aequipecten opercularis</i> (Linnaeus, 1758)	43-74	1.57	19	0.02	87	<0.01
Family Spondylidae						
<i>Spondylus</i> sp,	82	0.52	2	<0.01	2	<0.01
Family Anomiidae						
<i>Anomia ehippium</i> Linnaeus, 1758	45-91	1.05	16	0.01	88	<0.01
<i>Monia patelliformis</i> (Linnaeus, 1761)	114	0.52	300	0.36	300	0.01
Family Gryphaeidae						
<i>Neopycnodonte cochlear</i> (Poli, 1795)	45-839	18.4	11249	13.6	87292	3.42
Family Carditidae						
<i>Centrocardita aculeata</i> (Poli, 1795)	52-119	1.05	12	0.01	42	<0.01
Family Astartidae						
<i>Astarte fusca</i> (Poli, 1791)	47-52	0.52	6	<0.01	14	<0.01
Family Chamidae						
<i>Chama circinata</i> Monterosato, 1878	114-116	0.52	70	0.08	62	<0.01
Family Cardiidae						
<i>Acanthocardia aculeata</i> (Linnaeus, 1758)	61	0.52	2	<0.01	98	<0.01
<i>Acanthocardia tuberculata</i> (Linnaeus, 1758)	61	0.52	2	<0.01	10	<0.01
<i>Laevicardium crassum</i> (Gmelin, 1791)	43	0.52	4	<0.01	10	<0.01
<i>Abra longicallus</i> (Scacchi, 1835)	444-555	0.52	6	<0.01	5	<0.01
Family Veneridae						
<i>Venus nux</i> Gmelin, 1791	40-241	8.94	7282	8.83	220825	8.66
<i>Chamelea striatula</i> (da Costa, 1778)	42-64	1.05	288	0.35	662	0.02
<i>Callista chione</i> (Linnaeus, 1758)	43	0.52	2	<0.01	230	<0.01
<i>Tapes rhomboides</i> (Pennant, 1777)	43-47	0.52	12	0.01	28	<0.01
<b>CEPHALOPODA</b>						
Family Sepiidae						
<i>Sepia elegans</i> de Blainville, 1827	42-381	14.2	826	1	6426	0.25
<i>Sepia officinalis</i> Linnaeus, 1758	43-82	5.26	134	0.16	43575	1.71
<i>Sepia orbignyana</i> de Férussac, 1826	56-419	14.7	6849	8.31	119972	4.71
Family Sepiolidae						
<i>Heteroteuthis dispar</i> (Rüppell, 1844 )	638	0.52	1	<0.01	4	<0.01
<i>Neorossia caroli</i> (Joubin, 1902)	45-774	7.89	96	0.11	1544	0.06
<i>Rondeletiola minor</i> (Naef, 1912)	55-573	11.0	569	0.69	1029	0.04
<i>Rossia macrosoma</i> (delle Chiaje, 1830)	114-570	8.41	199	0.24	6217	0.24
<i>Sepietta oweniana</i> (d'Orbigny, 1841)	40-554	12.6	1850	2.24	7041	0.27
<i>Sepiola</i> sp.	56	0.52	30	0.03	92	<0.01
<i>Sepiola intermedia</i> Naef, 1912	40-135	1.05	13	0.01	24	<0.01
<i>Sepiola ligulata</i> Naef, 1912	139	0.52	2	<0.01	2	<0.01
<i>Stoloteuthis leucoptera</i> (Verrill, 1878 )	331-648	1.57	5	<0.01	13	<0.01
<i>Alloteuthis</i> sp.	114	0.52	22	0.02	146	<0.01

(continued)

Annex 1 Supplementary Material Continued

	Depth range	%F	N <sub>t</sub>	%D <sub>N</sub>	B <sub>t</sub>	%D <sub>B</sub>
<i>Alloteuthis media</i> Linnaeus, 1758	40-638	21.5	10344	12.5	42281	1.65
<i>Alloteuthis subulata</i> (Lamarck, 1798 )	53-251	4.73	343	0.41	1964	0.07
<i>Loligo forbesii</i> Steenstrup, 1856	45-348	3.15	537	0.65	47558	1.86
<i>Loligo vulgaris</i> Lamarck, 1798	40-114	3.68	1610	1.95	21109	0.82
Family Enoploteuthidae						
<i>Abralia veranyi</i> (Rüppell, 1844)	47-839	23.6	18330	22.2	12689.4	0.49
Family Onychoteuthidae						
<i>Ancistroteuthis lichtensteinii</i> (de Férussac & Orbigny, 1835 )	66-840	6.84	36	0.04	1161	0.04
Family Histioteuthidae						
<i>Histioteuthis bonnellii</i> (de Férussac, 1835)	460-586	2.63	11	0.01	5037	0.19
<i>Histioteuthis reversa</i> (Verrill, 1880)	331-765	3.15	12	0.01	368	0.01
Family Brachioteuthidae						
<i>Brachioteuthis riisei</i> (Steenstrup, 1882)	240-586	1.57	8	0.01	41	<0.01
Family Ommastrephidae						
<i>Illex coindetii</i> (Vérany, 1839)	40-747	26.3	3206	3.89	217822	8.55
<i>Todarodes sagittatus</i> (Lamarck, 1798)	47-852	26.8	653	0.79	171258	6.72
<i>Todaropsis eblanae</i> (Ball, 1841)	45-528	6.84	164	0.19	6579	0.25
Family Ancistrocheiridae						
<i>Ancistrocheirus lesueurii</i> (d'Orbigny, 1842 )	564	0.52	1	<0.01	354	0.01
Family Chiroteuthidae						
<i>Chiroteuthis veranii</i> (Férussac, 1835)	64	0.52	2	<0.01	18	<0.01
Family Octopodidae						
<i>Eledone cirrhosa</i> (Lamarck, 1798)	62-582	11.5	234	0.28	82011	3.21
<i>Eledone moschata</i> (Lamarck, 1798)	40-326	16.3	436	0.52	86106	3.38
<i>Octopus salutii</i> Vérany, 1836	122-419	3.15	32	0.03	12523	0.49
<i>Octopus vulgaris</i> Cuvier, 1797	40-341	22.1	1748	2.12	1210014.1	47.5
<i>Pteroctopus tetracirrhus</i> (delle Chiaje, 1830)	40-419	3.15	105	0.12	7045	0.27
Family Bathypolypodidae						
<i>Bathypolypus</i> sp.	236-326	0.52	2	<0.01	37	<0.01
<i>Bathypolypus sponsalis</i> (Fischer & Fischer, 1892)	238-840	18.4	284	0.34	12663	0.49

**Annex 2 Supplementary Material:** Results of pairwise comparisons of PERMANOVA and of SIMPER analyses for testing differences in demersal, benthic, bivalve, gastropod and cephalopod species as well as in all molluscan species between four sectors of the northern Alboran Sea: continental western (W), central (Cent) and eastern sectors (E) and Alboran Island sector (Ins) in the different main assemblages detected (shelf assemblage 30-200 m depth; upper slope assemblage 201-350 m depth; middle slope assemblage 351-800 m depth). Av. Diss.: average dissimilarity from SIMPER; *t*: value of *t-test* statistic for the pairwise comparison.

Pairwise comparisons	Group A Shelf assemblage (30-200 m depth)			Subgroup B1 Upper slope assemblage (201-350 m depth)			Subgroup B2 Middle slope assemblage (351-800 m depth)		
	t	p	Av.Diss.	t	p	Av.Diss.	t	p	Av.Diss.
Demersal Comparison									
E, W	1.9	0.002	44.22%	1.3	0.1	49.02%	1.1	0.250	40.88%
			48.76%						
E, Cent	1.6	0.026		1.2	0.141	46.72%	1.2	0.157	39.50%

(continued)

Pairwise comparisons	Group A Shelf assemblage (30-200 m depth)			Subgroup B1 Upper slope assemblage (201-350 m depth)			Subgroup B2 Middle slope assemblage (351-800 m depth)		
	t	p	Av.Diss.	t	p	Av.Diss.	t	p	Av.Diss.
<b>Demersal</b>									
<b>Comparison</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>
E, Ins	2.5	0.001	24.22%	2.0	0.003	40.43%	0.6	0.819	42.36%
W, Cent	0.8	0.577	50.30%	1.6	0.057	47.41%	0.9	0.505	45.69%
W, Ins	2.6	0.001	24.15%	2.9	0.008	30.44%	1.0	0.346	45.63%
Cent, Ins	2.9	0.002	25.69%	2.4	0.001	37.08%	1.3	0.123	43.68%
<b>Benthic</b>									
<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	
E, W	1.9	0.358	33.44%	1.7	0.013	19.63%	1.0	0.329	31.13%
E, Cent	1.9	0.001	32.95%	1.8	0.002	12.29%	0.9	0.52	36.08%
E, Ins	1.7	0.004	36.68%	1.7	0.002	18.85%	1.3	0.088	30.47%
W, Cent	1.0	0.358	37.06%	2.0	0.003	17.01%	1.0	0.411	34.73%
W, Ins	1.8	0.003	37.01%	2.6	0.008	17.24%	1.5	0.026	28.11%
Cent, Ins	1.5	0.029	40.82%	2.4	0.001	8.74%	1.6	0.021	32.95%
<b>Bivalves</b>									
<b>t</b>	<b>p</b>	<b>Av. Diss</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	
E, W	2.4	0.002	30.99%	3.1	0.144	35.67%	1.0	0.511	15.21%
E, Cent	2.1	0.011	30.63%	1.0	0.333	42.27%	1.4	0.436	0%
E, Ins	1.2	0.129	40.65%	62	0.345	65.87%	12	0.197	0%
W, Cent	0.5	0.859	34.09%	1.8	0.066	15.40%	1.3	0.201	20.32%
W, Ins	1.9	0.013	26.18%	2.2	0.2	26.53%	2.2	0.07	30.63%
Cent, Ins	1.6	0.031	26.48%	0.6	1	26.45%	1.0	0.141	57.10%
<b>Gastropods</b>									
<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	
E, W	1.7	0.003	9.673%	1.2	0.214	14.08%	1.2	0.157	32.43%
E, Cent	1.7	0.007	9.773%	1.8	0.018	12.66%	0.9	0.548	38.19%
E, Ins	1.8	0.002	8.335%	0.7	0.79	23.46%	1.3	0.135	30.78%
W, Cent	1.4	0.046	17.35%	1.1	0.235	23.51%	1.2	0.19	34.10%
W, Ins	2.1	0.003	11.56%	1.0	0.301	11.01%	1.8	0.003	22.61%
Cent, Ins	1.5	0.049	27.89%	1.7	0.032	5.162%	1.5	0.135	30.78%
<b>Cephalopods</b>									
<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	
E, W	1.8	0.006	47.23%	1.5	0.051	44.26%	1.0	0.377	42.37%
E, Cent	1.6	0.018	46.33%	1.5	0.046	40.56%	1.1	0.289	40.30%
E, Ins	2.2	0.001	37.39%	2.1	0.001	35.32%	0.5	0.916	42.01%
W, Cent	0.8	0.676	50.31%	1.8	0.008	41.20%	0.8	0.676	45.87%
W, Ins	2.2	0.001	42.06%	2.9	0.006	28.94%	0.8	0.054	45.60%
Cent, Ins	1.9	0.004	42.14%	2.6	0.003	30.25%	1.0	0.385	43.12%
<b>All molluscs</b>									
<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	<b>t</b>	<b>p</b>	<b>Av.Diss.</b>	
E, W	2.1	0.001	64.30%	1.6	0.014	61.60%	1.1	0.245	63.50%
E, Cent	1.9	0.001	64.10%	1.7	0.009	65.80%	1.1	0.345	62.10%
E, Ins	2.0	0.001	68.80%	2.0	0.001	68.10%	1.2	0.148	65.10%
W, Cent	0.9	0.542	60.90%	1.8	0.006	65.20%	1.0	0.464	60.10%
W, Ins	2.1	0.001	69.80%	2.6	0.007	74.90%	1.4	0.06	64.10%
Cent, Ins	1.9	0.002	67.40%	2.5	0.001	76.30%	1.5	0.017	63.40%