

Shifts in Eastern Mediterranean fish communities: Abundance changes, trait overlap and possible competition between native and non-native species

Erik Arndt, Or Givan, Dor Edelist, Oren Sonin, Jonathan Belmaker

Supplementary Materials

Table S1. Data used in calculation of GLM to relate the changes in species abundance (population trend) with traits.

Population trend*	Minimum depth*	Maximum depth*	Length at first maturity*	Trophic level	Schooling	Growth rate K	Non-indigenous
3.6302	0.30103	1.78533	1.17609	3.6	4	0.45	1
3.3685	0.77815	1.90849	1.11394	3.7	3	0.83	1
2.9839	1.61278	2.44091	1.23300	3.68	4	0.8	1
2.968	1.70757	2.30320	0.84510	3.5	3	0.8	1
2.8007	1.20412	1.49136	0.81954	3.6	3	0.8	1
2.406	0.00100	1.70757	1.11394	3.5	4	0.41	1
2.4034	1.32222	2.00432	1.12057	3.8	4	0.39	1
1.561	0.30103	1.61278	1.11394	3.5	1	0.7	1
1.3681	1.36173	1.79934	1.20412	3.7	1	0.4	1
0.8622	0.00100	1.70757	1.11394	3.4	4	0.55	1
0.748	0.00100	2.47857	1.47129	3.9	3	0.5	0
0.5835	1.49136	2.11727	1.05308	4.5	3	0.25	0
0.5511	0.00100	2.69984	1.39620	3.7	4	0.226	0
0.5454	1.61278	1.70757	1.20952	3.5	3	0.4	1
0.5046	1.70757	3.00043	1.23045	3.7	1	0.24	0
0.3371	1.32222	1.85126	0.99123	3.5	4	0.29	1
0.2367	1.70757	2.54531	1.02531	3.5	4	0.24	0
0.2269	0.00100	2.60314	1.02938	3.1	4	0.7	0
0.1631	1.32222	1.70757	1.32222	2.8	3	0.4	1
0.1083	0.00100	2.17898	1.29667	3.4	3	0.24	0
0.0613	1.61278	2.00432	1.23045	3.8	3	0.3	0
-0.0292	0.00100	2.54531	1.18752	3.4	4	0.53	0
-0.0353	1.20412	2.60314	1.23045	3.4	1	0.43	0
-0.0508	0.00100	2.47857	1.32222	4	1	0.28	0
-0.1246	1.32222	1.49136	1.17609	3.6	4	0.65	1
-0.1651	1.49136	2.69984	1.17609	3.5	3	0.2	0
-0.1661	0.30103	2.54531	1.31806	4.5	1	0.27	1
-0.1748	0.47712	2.00432	1.18752	3.3	1	0.8	1
-0.1958	1.32222	2.00432	1.19590	3.5	2	0.24	0
-0.2298	0.77815	2.00432	0.94448	3.5	1	0.3	0
-0.2762	0.00100	2.00432	1.14613	2.8	3	0.25	0
-0.3173	1.04139	2.00432	1.19866	3.1	4	0.45	0
-0.4033	1.20412	2.47857	1.00432	3	4	0.47	0
-0.4238	0.77815	2.39967	1.32222	3.8	4	0.22	0
-0.5351	1.90849	2.28103	0.95424	3.3	1	0.42	0
-0.6349	0.77815	1.49136	1.29885	3.3	4	0.6	1
-0.6542	0.00100	1.70757	1.32222	4.4	4	0.53	1
-0.6596	0.77815	1.70757	1.69020	4	3	0.12	0
-0.8221	1.85126	2.60314	1.64147	4.4	1	0.16	0
-0.8878	1.49136	2.47857	1.08279	3.1	3	0.4	0
-1.1608	1.70757	2.60314	1.49136	3.7	1	0.16	0
-1.2345	0.60206	1.90849	1.23300	3.5	3	0.32	0
-1.2475	0.77815	2.60314	1.17609	4.4	1	0.2	0
-2.1136	0.30103	2.17898	1.32222	4.2	1	0.4	0
-2.369	0.00100	2.56937	1.41497	3.3	4	0.1	0

* Data log10 transformed

Population trend and trait values are described in 'Methods: Statistical analyses'

Table S2. Data used in calculation of Bray-Curtis index (overlap of habitat-related traits).

	Trawling depth* shallow	Trawling depth* medium	Trawling depth* deep	pelagic	hard bottom	soft bottom	vegetated bottom	diurnal active	nocturnal active
Apogon (Ostor.) fasciatus	2.361728	2.9154	0.778151	0	0	1	1	0	2
Apogon smithi	2.33646	3.014521	2.482874	0	0	2	0	0	2
Boops boops	2.778874	3.283301	3.098298	0	1	1	1	2	0
Bothus podas	2.418301	2.0086	0	0	0	2	0	2	0
Callionymus filamentosus	3.025715	2.30103	0	0	0	2	0	2	0
Chlorophthalmus agassizi	0	1.544068	2.424882	0	0	2	0	0	2
Citharus linguatula	1.30103	2.60206	2.78533	0	0	2	0	2	0
Decapterus russelli	2.92993	2.868056	1.380211	1	0	1	0	2	0
Dentex macrophthalmus	1.146128	0.778151	3.296665	0	1	1	0	0	2
Equulites klunzingeri	3.246006	3.927268	1.477121	0	0	2	0	0	2
Lagocephalus spadiceus	1.672098	2.474216	0.954243	0	0	1	1	2	0
Lagocephalus suezensis	3.087426	2.810904	1.255273	0	0	1	1	2	0
Lepidotrigla cavillone	2.515874	3.122216	2.650308	0	0	2	0	2	0
Lithognathus mormyrus	2.380211	1.477121	0	0	1	1	1	2	0
Macroramphosus scolopax	0	1.361728	3.078457	1	0	2	0	2	0
Merluccius merluccius	1.919078	2.536558	2.885926	1	0	1	0	0	2
Mullus barbatus	3.030195	3.596377	2.698101	0	0	2	0	2	0
Mullus surmuletus	3.017451	3.505557	2.320146	0	1	1	0	2	0
Nemipterus randalli	3.037426	3.350442	2.759668	0	0	2	0	2	0
Pagellus acarne	2.596597	3.482159	2.653213	0	1	1	1	2	0
Pagellus erythrinus	2.460898	3.499824	3.284882	0	1	1	0	0	2
Plotosus lineatus	3.587599	3.491922	2.20412	0	1	1	0	0	2
Saurida undosquamis	2.495544	3.08849	2.367356	0	0	2	0	1	1
Serranus hepatus	1.361728	2.641474	2.041393	0	1	1	1	2	0
Stephanolepis diaspros	2.421604	2.093422	0.954243	0	2	0	0	2	0
Trachinus draco	2.597695	1.079181	1.041393	0	0	2	0	0	2
Trigla lyra	0	2.243038	0	0	0	2	0	1	1
Upeneus moluccensis	2.613842	3.745933	3.192289	0	0	2	0	2	0
Upeneus pori	2.879669	2.460898	0.778151	0	0	2	0	2	0
Uranoscopus scaber	1.70757	2.033424	1.176091	0	0	2	0	0	2

Non-indigenous species are given in bold letters.

* Data are log10 transformed

Trait values are described in 'Methods: Statistical analyses'

Table S3. Data used in calculation of Morisita-Horn index (overlap of diet-related parameters).

	Diet of juveniles										Diet of adults												Dayfeeder	Nightfeeder
	Algae	Zooplankton	Fish	Echinodermata	Hydrozoa	Worms	Mollusks	Decapoda	Peracarida	Porifera	Seagrass, algae	Zooplankton	Hydrozoa	Fish	Worms	Cephalopods	Gastropoda	Bivalvia	Decapoda	Peracarida	Echinodermata	Porifera		
Apogon (Ostor.) fasciatus	0	3	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2
Apogon smithi	0	3	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2
Boops boops	0	0	0	0	0	0	0	2	2	0	3	0	0	0	0	0	0	0	0	1	0	1	2	0
Bothus podas	0	0	0	0	0	2	0	1	2	0	0	0	0	2	2	0	2	0	2	2	0	0	2	0
Callionymus filamentosus	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2	0	0	0	2	2	0	0	2	0
Chlorophthalmus agassizi	0	2	0	0	0	0	0	2	2	0	0	2	0	1	1	1	0	0	3	2	0	0	0	2
Citharus linguatula	0	0	0	0	0	1	0	2	3	0	0	0	0	2	1	1	0	0	2	3	0	0	2	0
Decapterus russelli	0	3	0	0	0	0	0	2	0	0	0	3	0	2	0	1	0	0	3	0	0	0	2	0
Dentex macropthalmus	0	0	2	0	0	2	0	2	2	0	0	0	0	3	1	0	0	0	2	2	0	0	0	2
Equulites klunzingeri	0	0	0	0	0	2	0	2	2	0	0	0	0	0	2	0	0	0	2	2	0	0	0	2
Lagocephalus spadiceus	0	0	2	0	0	0	2	2	2	0	0	0	0	2	0	2	0	0	3	0	0	0	2	0
Lagocephalus suezensis	0	0	2	0	0	0	2	2	2	0	0	0	0	2	0	2	0	0	3	2	0	0	2	0
Lepidotrigla cavillone	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	3	3	0	0	2	0
Lithognathus mormyrus	0	2	1	1	0	2	2	1	2	0	0	0	0	1	2	0	1	3	2	1	1	0	2	0
Macroramphosus scolopax	0	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	3	0	0	2	0
Merluccius merluccius	0	0	3	0	0	0	1	2	1	0	0	0	0	3	0	2	0	0	2	0	0	0	0	2
Mullus barbatus	0	0	0	0	0	2	2	2	2	0	0	0	0	0	2	0	2	2	2	2	0	0	2	0
Mullus surmuletus	0	0	0	0	0	2	1	1	2	0	0	0	0	1	2	0	2	2	2	2	1	0	2	0
Nemipterus randalli	0	0	0	0	0	1	0	3	0	0	0	0	0	2	1	1	0	0	3	0	0	0	2	0
Pagellus acarne	0	0	1	0	0	2	2	2	2	0	1	0	0	1	2	0	1	1	2	1	2	0	2	0
Pagellus erythrinus	0	0	2	0	0	2	2	2	3	0	0	0	0	2	2	1	0	1	3	0	2	1	0	2
Plotosus lineatus	0	0	0	1	0	2	1	1	2	0	0	0	0	1	0	0	1	2	2	2	1	0	0	2
Saurida undosquamis	0	0	2	0	0	0	2	2	2	0	0	0	0	3	0	2	1	1	2	2	0	0	1	1
Serranus hepatus	0	0	0	0	0	0	0	2	2	0	0	0	0	1	1	0	0	0	3	1	0	0	2	0
Stephanolepis diaspros	2	0	2	0	2	0	2	2	2	2	1	0	2	0	0	0	1	2	2	2	2	1	2	0
Trachinus draco	0	0	0	0	0	0	0	2	2	0	0	0	0	3	1	0	0	1	3	1	0	0	0	2
Trigla lyra	0	0	0	3	2	0	0	2	2	0	0	0	0	0	2	0	0	0	3	0	2	0	1	1
Upeneus moluccensis	0	0	0	0	0	2	0	2	2	0	0	0	0	1	2	0	2	2	2	2	0	0	2	0
Upeneus pori	0	0	0	0	0	2	0	2	2	0	0	0	0	1	2	0	2	2	2	2	0	0	2	0
Uranoscopus scaber	2	0	3	1	0	1	0	1	0	0	1	0	0	3	1	2	1	0	2	0	0	0	0	2

Non-indigenous species are given in bold letters.

Trait values are described in 'Methods: Statistical analyses'