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SNAPSHOT OF THE UPPER SLOPE MACRO- AND MEGAFAUNA OF THE SOUTHEASTERN MEDITERRANEAN SEA: ECOLOGICAL DIVERSITY AND PROTECTION

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LEVANT SEA
SOFT BOTTOM
CONTINENTAL SLOPE
MACRO/MEGAFAUNA

ABSTRACT. – The slope faunal assemblages at the southeastern Mediterranean have never been studied though mounting evidence points to the vulnerability of the continental slope biota to anthropogenic disturbance. An introductory investigation of the abundance and bathymetric distribution of the soft-bottom macro- and megafauna on the Levant Sea's upper slope collected 112,440 individuals comprising 119 species at depths ranging from 200 to 570 m. Our results, though preliminary, suggest that the fauna of the upper slope in the southern Levant Sea comprise distinct and unique assemblages, differing in the composition and relative abundance of their taxa from slope habitats elsewhere in the Mediterranean Sea. Were climate change to bring about a reduction in the supply of nutrients to the Mediterranean deep-sea floor, assemblage composition and abundance throughout the sea may become more similar to the current Levantine deep-water biota. In view of the vulnerability and low resilience of the soft bottom slope assemblages and the rapid development of extensive offshore gas and oil fields, multi-stressor management at regional level is required to achieve protection for the deep Levantine biota.

INTRODUCTION

The Levant Sea, at the easternmost Mediterranean Sea, is a warm, oligotrophic environment (Krom *et al.* 2003), expressed in its exceptionally low values for chlorophyll, primary production and cell abundance (Berman *et al.* 1984, Azov 1986). As primary production and energy transfer to the sea floor decrease with increasing depth, benthic/demersal biomass on the Levantine slope are notably lower than elsewhere in the Mediterranean. That scarcity has fundamentally altered sea floor biota – reducing their abundance, shifting species distribution, and altering composition of sea floor assemblages (Galil 2004). The continental margin off the Mediterranean coast of Israel has been experiencing in recent decades rapid increase in anthropogenic pressures, *i.e.* coastal sprawl, land-based pollution and eutrophication, physical erosion, overexploitation of living resources, offshore gas production, changes in Nilotic flow regime, and increased temperature and salinity (UNEP/MAP 2012, Mazor *et al.* 2014). Furthermore, the invasion of thermophilic species through the Suez Canal has markedly altered the shelf biota, resulting in changes to the structure and function of marine ecosystems (Galil 2007, Goren *et al.* 2016). Yet, our ability to comprehend and evaluate possible interactions between the shelf and upper slope biota is severely hampered by the lack of data, as only scarce information is available on the biota of the transitional zone (100-1000 m depth) between the shelf break and the deep sea in the southeastern Mediterranean Sea.

The development of a local trawl fleet in the 1940s extended fishery grounds to the upper slope and stimulated interest in exploiting deep-sea fishery resources (Ben-Tuvia 1953). Subsequent studies listed species obtained from trawlers working at greater depths, up to 550 m (Lewinsohn & Holthuis 1964, Ben-Tuvia 1971). Yet, due to consumers' preference for shelf dwelling Erythraean shrimps (e.g. *Penaeus pulchricaudatus*) over slope-dwelling aristeid shrimps, declining hake stocks and rising deep-water fishing costs, bottom trawling has been largely limited to the shelf.

Fredj & Laubier (1985) stated in their review on the deep Mediterranean benthos that "... the southern part of the Levant Sea has practically never been studied". Few studies have been conducted since. The biota adjacent to the gas production site off the southern Mediterranean coast of Israel at depths of 175-340 m was sampled briefly using a commercial bottom trawler (Galil & Herut 2003). Later, using the same commercial bottom trawler, shelf break sites (100, 120 m), as well as the upper margin of the slope (250 m) were sampled (Stern *et al.* 2014, Innocenti *et al.* 2017). Aware of the ruination of the native shelf biota, the lack of documentation of upper slope soft bottom habitats, and the forecast for major increase in usage of the upper slope in the preliminary policy document released by the Planning Administration of the Ministry of Finance (Policy document for the maritime space of Israel/Mediterranean Sea 2018), trawl research-surveys were conducted in winter 2017-2018 at depths between 200 and 570 m off the southern Israeli coast.

The aim of this study is to expand the knowledge of megafaunal bathymetric distribution in order to define bathymetric assemblages and to determine how they relate to soft-bottom upper slope assemblages elsewhere in the Mediterranean Sea. This paper is the first to investigate the abundance and bathymetric distribution of the megafaunal biota on the upper continental slope in the southeastern Mediterranean.

MATERIAL AND METHODS

Study area and sampling: The study was carried on the upper slope off the southern Mediterranean coast of Israel (Fig. 1) using the 240 hp F/V bottom trawler 'Shaldag'. The trawl net was 20 m long (from opening to cod-end), with a vertical opening of about 2 m, horizontal opening of about 12 m and a diamond mesh size was 42 mm at the cod-end. Tow duration was 3 h, measured from the point of optimal net opening to the moment when speed was reduced prior to raising the net. The average trawl speed was 2.2 knots and each haul covered an estimated area of 0.14 km^2 for a total of 4.49 km^2. The seabed at all trawling sites consisted of silt/clay. Each depth was sampled both during day and night-time. A total of 32 trawl tows, collected over 8 days were conducted between October and December 2017 at depths ranging from 200 to 570 m (beginning of the tow). Due to complex topography, the final depth differs, in some tows, from the initial depth (Supplement S1). The entire haul was sorted, identified to specific level (with few exceptions). Individuals of each species in each sample were counted and weighed together.

Data analysis: The faunal distribution data were analyzed using statistical software package PRIMER 7.0 software package (Clarke *et al*. 2014). A Bray-Curtis resemblance matrix was created from the square root transformed data. Hierarchical cluster analysis was performed on the resemblance matrix with a similarity percentage (SIMPER) test to determine sample group structure in the faunal data, i.e. identify 'assemblages'. Multidimensional scaling (MDS) plots were produced to visualize patterns in the grouping of samples. An ordered one-way analysis of similarities (ANOSIM) was used to investigate differences within and between the various samples and depths. Prior to treating the data, the table of the raw data was standardized (by transforming the abundance values to percentage). Diversity indices (Pielou's evenness, Shannon diversity (log10)) were calculated.

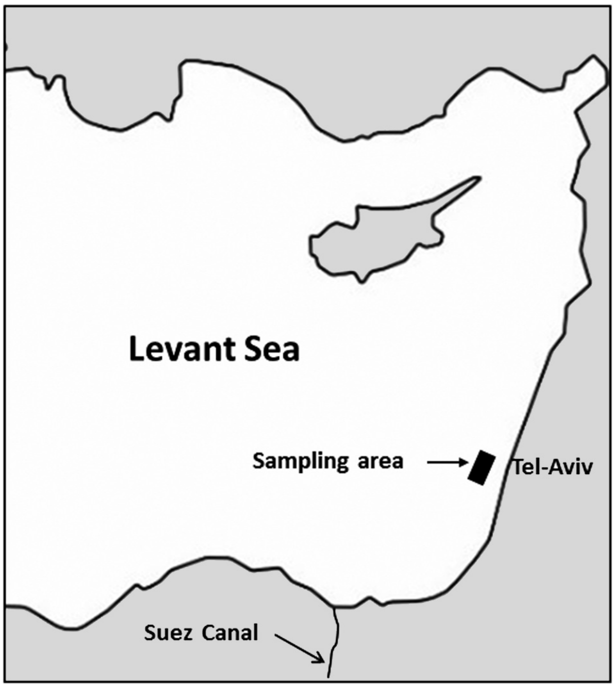

Fig. 1. – Map of research site.

Catch per unit effort (CPU) was calculated for a unit of 3 hours' tow (= 1 tow), which covered an area of 0.14 km^2.

RESULTS

A total of 112,440 individuals comprising 119 species (65 Osteichthyes, 9 Chondrichthyes, 19 Crustacea, 16 Mollusca, 10 other) were collected (Scientific name, author, year, in Supplement S2). Crustaceans comprised ca. 51 % of the total number of individuals (abundance: 12,825/km^2), fish (Osteichthyes and Chondrichthyes) ca. 43 % (abundance: 10,851/km^2), and molluscs ca. 3 % (abundance: 688/km^2), all other groups (combined) comprised less than 3 % (abundance: 620/km^2). The numbers of individuals/ km^2 for each depth are presented in Table I.

Some species (*Raja clavata*, *Dipturus oxyrinchus*, *Plesionika edwardsii*, *Parapenaeus longirostris*, *Chlorophthalmus agassizi* and *Helicolenus dactylopterus*)

Table I. – The numbers of individuals/km^2 for each depth.

Depth (m)	Total abundance/km^2	Fish abundance/km^2	Crustaceans abundance/km^2	Molluscs abundance/km^2
200	22,047	4,863	15,212	1,961
320	34,777	13,865	20,350	561
440	32,212	21,404	9,601	183
570	12,654	3,824	7,109	38

Table II. – List of new records/ rarely recorded species in the Levant Sea.

	Species	Remarks
PORIFERA	*Rhizaxinella pyrifera* (Delle Chiaje, 1828)	First record, Levant Sea
CNIDARIA	*Lytocarpia myriophyllum* (Linnaeus, 1758)	Second record, S Levant Sea
	Funiculina quadrangularis (Pallas, 1766)	First published record, S Levant Sea
BRACHIOPODA	*Gryphus vitreus* (Born, 1778)	Exceedingly rare, Levant Sea
CRUSTACEA	*Pagurus alatus* Fabricius, 1775	First record, S Levant Sea
MOLLUSCA	*Ancistroteuthis lichtensteinii* (Férussac [*in* Férussac & d'Orbigny], 1835)	First record, Levant Sea
	Pyroteuthis margaritifera (Rüppell, 1844)	Previously recorded off Israel at 1330, 1470 m
PISCES	*Champsodon nudivittis* (Ogilby, 1895)	New depth record
	Coryphaenoides guentheri (Vaillant, 1888)	Rarely recorded, Levant Sea
	Epigonus constanciae (Giglioli, 1880)	Rarely recorded, Levant Sea
	Epigonus denticulatus (Dieuzeide, 1950)	Second record, Levant Sea
	Etrumeus golanii (DiBattista, Randall & Bowen, 2012)	New depth record
	Facciolella oxyrhyncha (Bellotti, 1883)	Rarely recorded, Levant Sea
	Lepidorhombus boscii (Risso, 1810)	Rarely recorded, Levant Sea
	Nemichthys scolopaceus (Richardson, 1848)	Second record, Levant Sea
	Notoscopelus bolini (Nafpaktitis, 1975)	First validated record, Levant Sea
	Tetronarce nobiliana (Bonaparte, 1835)	Rarely recorded, Levant Sea
	Trypauchen vagina (Bloch & Schneider, 1801)	New depth record

were collected from the whole depth range (200-570 m) although at disparate abundances, and thus may be considered eurytopic. Most other species were restricted to a narrower bathymetric range: some (e.g. *Arnoglosus kessleri*, *Citharus linguatula*, *Dentex macrophthalmus*, *Loligo vulgaris*, *Pagellus acarne*, *Trachurus trachurus*) were collected only on the uppermost slope, others (*Coryphaenoides guentheri*, *Epigonus constanciae*, *Funiculina quadrangularis*, *Gryphus vitreus*, *Polycheles typhlops*) only mid-slope.

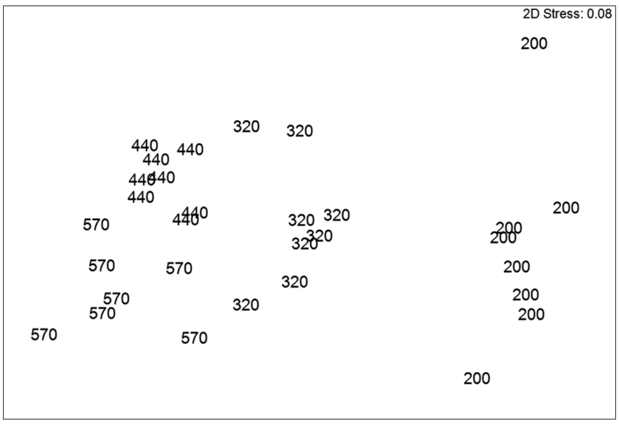

Fig. 2. – MDS graph of megafaunal assemblage structure along the depth gradient.

Eighteen species (Eleven fish and seven invertebrates) are new records to the Levant Sea or rarely recorded in this region (Table II). Sampling data, Museum catalogue numbers and remarks are presented in Supplement S3.

Bathymetric patterns

ANOSIM used to investigate differences within and between the various samples and depths revealed that for a global test, R was 0.935 with a significance level of sample statistic: $P < 0.001$ (Number of random permutations: 999; Number of permuted statistics greater than or equal to R is 0).

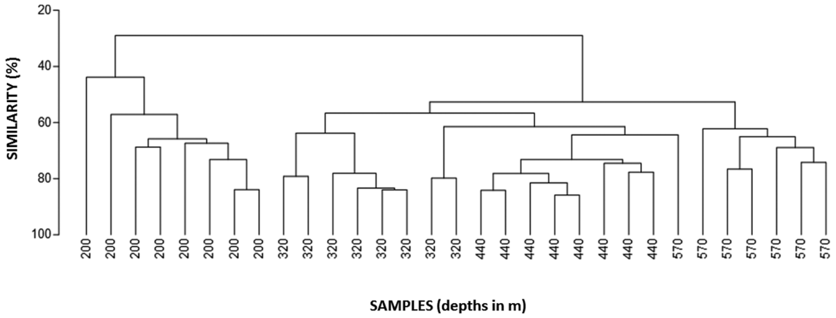

Fig. 3. – Cluster analysis graph of megafaunal assemblage structure along the depth gradient.

Table III. – P values for pair-wise ANOSIM, testing the significance of differences between depth. Number of permutations for each comparison: 999 (random samples).

Depths (m)	570	440	320
200	< 0.001	< 0.001	< 0.001
320	< 0.001	< 0.001	
440	< 0.001		

The MDS analysis (Fig. 2) and the Cluster analysis (Fig. 3) revealed the division of the assemblages along the bathymetric profile into four discrete assemblages, with the assemblage comprised of samples collected at 200 m clearly distinct. The cluster analysis shows that a sample taken at 570 m and two samples from 320 m are nested within the 440 m clade. Pairwise Tests were executed for each couple of depths (Table III). As evident from this table, each depth group differs significantly (P < 0.001) from all others (Number of random permutations: 999; Number of permuted statistics greater than or equal to R is 0 in all tests).

Table IV. – Dissimilarity between depth assemblages.

Depth	320 m	440 m	570 m
200 m	59.1 %	86.3 %	85.5 %
320 m		57.5 %	73.0 %
440 m			60.8 %

A SIMPER analysis of the depth assemblages revealed average similarities of 62 % and 66 %, within the depth assemblages of 320 m and 440 m, and 50 % and 54 %, within the assemblages of 200 and 570 m, respectively. The inter-depth comparison of the megafaunal assemblages revealed a high dissimilarity between depths (Table IV) that range between 57 % and 86 %. As revealed from the SIMPER analysis, at 200 m, the dominant species is the shrimp *Parapenaeus longirostris* (ca. 68 % of the total abundance) (Table V). The next six species contribute each from 2 to 8 % of the total. At 320 m, *P. longirostris* again is the most abundant species (ca. 64 % of the total abundance), the shortnose greeneye, *Chlorophthalmus agassizi*, comprises ca. 24 % of the total, and the other four species combined ca. 7 %. At 440 m, *C. agassizi* comprises ca. 61 % of the total, *Plesionika edwardsii* and *P. longirostris* ca. 14 and 12 %, respectively, while the next five species each contributes from 2 to 3 % of the total. The deepest samples (570 m) demonstrate a somewhat different pattern with the dominant species (*P. edwardsii)* comprising less than a third of the individuals and the next five species each contributes from 9 to 16 % of the total abundance.

Table V. – Similarity analysis of depth assemblages, cutoff SIMPER analysis at 95 %.

Depth	Species	Contribution (%)	Cumulative (%)
200 m	*Parapenaeus longirostris*	67.91	67.91
	Loligo vulgaris	7.61	75.52
	Dentex macrophthalmus	5.86	81.38
	Merluccius merluccius	5.24	86.62
	Macroramphosus scolopax	4.37	90.99
	Trachurus trachurus	2.03	93.02
	Argentina sphyraena	1.89	94.91
320 m	*Parapenaeus longirostris*	63.83	63.83
	Chlorophthalmus agassizi	23.97	87.80
	Coelorinchus caelorhincus	2.65	90.45
	Plesionika edwardsii	2.09	92.54
	Merluccius merluccius	1.58	94.12
	Ceratothoa steindachneri	0.84	95.08
440 m	*Chlorophthalmus agassizi*	58.01	58.01
	Plesionika edwardsii	14.14	72.15
	Parapenaeus longirostris	11.73	83.88
	Coelorinchus caelorhincus	2.88	86.76
	Ceratothoa steindachneri	2.77	89.52
	Aristeus antennatus	2.48	92.00
	Aristaeomorpha foliacea	1.76	93.77
	Funiculina quadrangularis	1.49	95.25
570 m	*Plesionika edwardsii*	28.63	28.63
	Parapenaeus longirostris	16.30	44.93
	Chlorophthalmus agassizi	13.57	58.51
	Funiculina quadrangularis	9.66	68.17
	Aristeus antennatus	9.27	77.43
	Aristaeomorpha foliacea	9.03	86.46
	Hymenocephalus italicus	3.40	89.87
	Helicolenus dactylopterus	2.36	92.22
	Coelorinchus caelorhincus	1.98	94.20
	Plesionika martia	1.00	95.16

A comparison of ecological parameters (Table VI) shows a similar average number of species (24-28) in all depths. The average number of individuals was highest at 320 m depth and lowest at 570 m.

Species diversity and evenness are similar at all depths except 570 m, which though having the lowest number of species, has the highest species diversity and evenness (Table VI).

DISCUSSION

The deep-water fauna of the Levant Sea has been considered the poorest in the Mediterranean, though the scarcity of data result-

Table VI. – A comparison of the number of species (S), Abundance, species diversity and evenness at the four depth assemblages.

Depth	No of samples	S (M ± S.D)	N (M ± S.D)	Species diversity (M ± S.D)	Evenness (M ± S.D)
200	8	27.62 ± 6.09	3092 ± 1602	0.636 ± 0.328	0.438 ± 0.202
320	8	25.62 ± 7.46	4811 ± 932	0.549 ± 0.088	0.394 ± 0.046
440	8	28.25 ± 4.03	4267 ± 1610	0.619 ± 0.116	0.429 ± 0.084
570	7	24.14 ± 5.30	1514 ± 608	0.887 ± 0.105	0.645 ± 0.040

ing from inadequate and sporadic research efforts may have contributed to the perception (Fredj 1974, Fredj & Laubier 1985). A series of cruises, conducted from 1988 to 1999, to monitor bathyal dumping sites off the Israeli coast, reported 56 species of fish, crustaceans and molluscs newly recorded for the Levant Sea (Galil 2004), and subsequent cruises resulted in additional records (Goren *et al.* 2006, Corbera *et al.* 2012, Bogi & Galil 2013). However, no similar research effort did take place on the slope. Our results provide evidence that in the southern Levant Sea the macro- and megafauna on the upper slope is woefully under-researched: three species are newly recorded for the Levant Sea, and five are newly recorded for the southern Levant Sea (Table II).

The comparison of the species collected in the present survey with those collected in 2003 using a similar commercial trawler reveals that the prevalent species then (*Macroramphosus scolopax, Merluccius merluccius, C. linguatula* and *P. longirostris,* occurred then in 10 of the 11 hauls, *C. agassizi* in 9 hauls, *and D. macrophthalmus, Helicolenus dactylopterus* and *Capros aper* in 8 hauls) endure and remain common in the recent samples. Yet, two erect sessile species, *Alcyonium palmatum* and *F. quadrangularis,* occurred then at 7 and 5 hauls respectively, but were conspicuously reduced in the present samples at that depth zone (Galil & Herut 2003).

The results of the SIMPER (Table V), as well as the cluster and MDS analyses (Figs 2, 3), show major differences in the megafaunal assemblage structure along the depth gradient. The megafaunal depth distribution suggests the division of the bathymetric profile into four zones. The shelf-slope ecotone (200 m) with 29 unshared species is clearly distinct. The upper slope in turn is divided into three sub-zones. Among the multiple factors that affect the particular zonation of the local megafaunal assemblages it is likely that the characteristic high deep-water temperature and the long-term increase (0.03 ± 0.02 °C/y) of the Levantine intermediate (150-350 m) water mass off Israel (Ozer *et al.* 2017) is significant. The recent winter thermal mixing which has created fairly constant high temperature, 17.5 °C, as deep as 260 m in 2015, 150 m in 2016, and nearly 200 m in 2017 (Herut & Rahav 2017), may have contributed to the large number of shelf-inhabiting species at 200 m, including the thermophilic Erythraean aliens. The occurrence of three carnivorous Erythraean species, the crocodile toothfish *Champsodon nudivittis*, Golani's round herring *Etrumeus golanii*, and the burrowing goby, *Trypauchen vagina*, is of special interest. The present records follow a trend of Erythraean species collected beyond the shelf break and well into the upper slope (Galil *et al.* 2019). Given the role of predators in structuring biodiversity and ecosystem functioning, the occurrence of non-indigenous predators should be carefully monitored for their potential impact on the native Mediterranean deep-sea species.

The dominance of fish and decapod crustaceans differed between the Levantine samples and other Mediterranean regions. The commercially important rose shrimp, *P. longirostris,* is much more dominant in the Levant Sea than elsewhere in the Mediterranean Sea, comprising 75 % of the decapod crustacean specimens in our samples, and similarly abundant at 200 to 400 m in the Gulf of Antalya, Turkey (Table VII). The dominant fish in our samples is *C. agassizi,* with 72% of the bony fish specimens collected, with mean abundance (individuals/km^{-2}) (179, 10,156, 17,484, 2,027, respectively at 200, 320, 440 and 570 m). Yet, the species with the highest mean abundance (individuals/km^2) on the shelf break/upper slope across most of the geographical sub-areas (GSA) in the Mediterranean was the silvery pout *Gadiculus argentatus*, but for the Aegean Sea and Crete, where the argentine, *Argentina sphyraena*, prevailed (Farriols *et al.* 2019). The slope megafauna collected in the Mediterranean in the framework of MEDITS survey programme revealed distinct differences in the bathymetric boundaries and composition of demersal fish assemblages among sub-areas of the Mediterranean Sea (Farriols *et al.* 2019, Fernandez-Arcaya *et al.* 2019). As MEDITS stops short of the Levant Basin, our survey, together with an earlier one carried out at similar depths (300-600 m) off Mersin, on the Levantine coast of Turkey, though using a different net, offer a glimpse into the make-up of upper slope biota of the Levant. The northern Levantine upper slope assemblages exhibit some similarities to our southern Levantine data: the percentages of the total number of decapod crustacean individuals were 52.06, 72.8 for *P. longirostris*, 35.64, 5.9 for *A. foliacea*, and 9.5, 13 for *P. edwardsii*, off Turkey and Israel respectively. Whereas *Chlorophthalmus agassizi* featured prominently in both areas, some species – *Anguilla anguilla, Gadiculus argenteus, Lepidorhombus whiffiagonis, Lepidotrigla dieuzeidei, Oxynotus centrina* –were collected in the

Table VII. – Comparison of species abundance (%) among the present results and selected regional studies across the Mediterranean Sea. Letters in parenthesis: source of the data. Empty cells represent species that their proportion was less than 1% or the less than the lower percentage reported in the article. (a) present study; (b) D'Onghia *et al*. 1998 (data calculated for the combined data of autumns of 1994 and 1995); (c) Politou *et al*. 2008 (calculation combined the data of the depth ranges 300-500 m and 500-700 m); (d) Guijarro *et al*. 2011; (e) Labropoulou & Papaconstantinou 2000; (f) Mytilineou *et al*. 2005 (calculation combined the data of the depth ranges 300-500 m and 500-700 m; (g) Deval *et al*. 2017 (calculation combined the data of the depth ranges 200-600 m); (h) Gristina *et al*. 2006 (data calculated for the combined data of autumns of 1997 and 1998); (i) Farriols *et al*. 2019.

	S Levant (a) (200-570 m)	NW Ionian (b) (200-750 m)	E. Ionian (c) (300-700 m)	Balearic Is. (d) (200-500 m)	S Levant (a) (200-570 m)	Antalya Bay (g) (200-600 m)	Aegean (i) (107-708 m)	N Aegean (e) (200-500 m)	Thracian (e) (200-500 m)	E Ionian (f) (300-700 m)	E Ionian (c) (300-700 m)	NW Ionian (b) (200-750 m)	Balearic Is. (d) (200-500 m)	Strait of Sicily area C (h) (250-350 m)	Strait of Sicily area L (h) (250-350 m)
Crustacea, Decapoda	**% of the total number of the individuals collected in the study**				**% of the number of the crustacean individuals collected in the study**										
Parapenaeus longirostris	37.4	13.3	1.5	1.6	72.8	46.2					6.8	21.3	12.6		
Plesionika edwardsii	6.7	5.0	2.1		13.0	6.9					9.2	12.6			
Aristaeomorpha foliacea	3.0	3.2	8.2		5.9	19.9					36.7	7.6			
Aristeus antennatus	1.8	5.6			3.5						2.7	9.0			
P. antigay			1.5	1.2							6.7		9.6		
P. heterocarpus		12.1	1.1	7.4	1.0	7.4					4.8	19.4	59.4		
P. giglioli		1.2		1.4							3.7	2.0			
P. marita		9.2	7.4		0.7	13.9					32.5	15.0	11.2		
Nephrops norvegicus		2.3										3.6	7.2		
Chlorotocus crassicornis		1.5										1.4			
Liocarcinus depurator		2.0										4.6			
Pasiphaea sivado		1.4													
Polycheles typhlops		1.4													
Solenocera membranacea		1.4										3.6			
Fish					**% of the number of the fish individuals collected in the study**										
Chlorophthalmus agassizi	30.7	5.2	65.5	3.9	70.5		**6**			57.8	86.0	11.4	4.5	30.9	22.2
Coelorinchus caelorhincus	3.4	2.1		3.2	7.8		4.0	17.5	2.9	2.7		4.7	3.6		
Dentex macrophthalmus	1.6				3.7										
Merluccius merluccius	1.2	2.0		2.8	2.9		10.0	3.5	5.2			4.2	3.2		1.2
Hymenocephalus italicus	1.2	3.4	2.3		2.8		3.0	20.6	22.4	5.5	3.0	7.9			
Macroramphosus scolopax	1.0				2.2										
Helicolenus dactylopterus		1.0		2.8	1.7		2.0			1.2	1.1	2.2	1.9		
Raja clavata					1.6										
Trachurus trachurus					1.0										
Argentina sphyraena			1.6				27.0			10.7	2.1			20.4	30.1
Hoplostethus mediterraneus		1.1	1.1								1.5				
Nezumia sclrorhyncha		2.2						7.5			1.2	1.8			
Peristedion cataphractum			1.2							2.0	1.7			8.7	
Lepidorhombus boscii							4.0	7.1	5.7						
Micromesistius poutassou		1.1		9.0			7.0	16.5	21.3			3.0	2.8		
Gadiculus argenteus		3.8		22.2			18.0		24.4	9.1		8.1	25.3	4.0	12.1
Lophius budegassa									1.3						
Phycis blennoides							5.0		1.6				1.0		
Scliorhinus canicula				5.8			5.0						6.6		
Capros aper		1.4		29.5						4.0		6.7	33.6		
Synchiropus phaeton													1.7		
Galeus melastomus		2.8		4.0						1.5		6.0	4.5		
Arnoglossus rueppelii		1.1										3.2			
Etmopterus spinax		1.1										2.0			
Synchiropus phaeton		1.0		1.8											
Lampanyctus crocodilus										1.1					
Lepidotrigla dieuzeidei										1.0				1.1	
Arnoglossus laterna												2.5			
Lepidopus caudatus							2.0								

northern, but not in the southern Levant Sea (Bayhan *et al*. 2018, Supplement S2).

With models of climate change predicting increased temperature and oligotrophy in the Mediterranean Sea (Taucher & Oschlies 2011), the current Levantine deep-water biota, at variance from elsewhere in the Mediterranean, may foreshow possible shifts in richness, assemblage composition and abundance driven by climate change.

The results of the present investigation are consequential beyond their faunistic interest. The Levantine Basin is the most promising hydrocarbon province in the Mediterranean Sea, with frenetic prospecting, bidding and extraction activity. The 'Strategic environmental survey for marine exploration and production of oil and gas' published by the Israeli Ministry of National Infrastructures, Energy and Water, defined the entire continental slope a single uniform habitat with low sensitivity to oil and gas exploration and production activities (GEOPROSPECT 2016). Crucially, the pronouncement of the entire slope as a 'low sensitivity' zone to such activities means, in effect, the removal of the area from environmental protection and conservation (Zvieli, 2016: 124, map of gas licenses). The preliminary policy document released by the planning administration of the ministry of finance, a fundamental component in the formulation of a maritime strategy for Israel and the framework for the management and planning of all uses and activities in the maritime area, adopted the findings of the strategic environmental survey (Policy Paper for Israel's Maritime Space/ Mediterranean Sea – Second Phase Report: Policy for Israel's Maritime Space 2018). Our results, though preliminary, contradict the purported uniformity of the soft bottom benthos and suggest that the megafauna of the shelf-break and upper slope in the southern Levant Sea comprise distinct and unique assemblages, differing in the composition and relative abundance of their taxa form slope habitats elsewhere in the Mediterranean Sea. Moreover, these assemblages comprise aggregations of regionally rare erect sponges, hydrozoans, anthozoans and brachiopod fields, which play a significant structural role in soft bottom ecosystems by furnishing the biota with spatially complex habitats. These ecosystem engineer/habitat former taxa are highly susceptible to human disturbance, thus their conservation is crucial for biodiversity preservation. In the Mediterranean Sea such habitats are associated with commercially important fishery grounds, and in consequence, have greatly declined over the past century. Yet, as the local bottom-trawling fishery has been mostly confined to the shelf and shelf edge, these vulnerable assemblages have survived.

Regulatory policies and instruments to manage the Levantine offshore environment have been reactive and slow to evolve, attempting to address only a subset of stressors, and still lacking legally binding, timely implemented and strictly monitored instruments. In view of the rapid development of extensive offshore gas and oil fields in the southern Levant Sea, and the vulnerability and low resilience of the soft bottom slope assemblages, a robust and vigorous commitment for a coordinated, integrative multi-stressor management approach, at national and regional levels, is required to achieve protection for the deep Levantine biota. The region still lacks comprehensive ecological characterization, including scientifically-sound habitat mapping, which is the principal requisite for informing policy makers. Adopting a data-rich approach that emphasizes environmental safety will go a long way to guarantee that anthropogenic activities conform to conservation objectives.

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Supplement S1. List of trawl hauls; date, depth (m), day- or night time haul (D/N), and coordinates (start and end of haul).

Date	Net	Depth	D/N	Start	End
23 Oct. 2017	1	500	D	31°58.119N; 34°23.450E	32°00.853N; 34°21.885E
23 Oct. 2017	2	550	D	32°05.765N; 34°24.300E	32°00.853N; 34°21.885E
23 Oct. 2017	3	600	N	32°01.779N; 34°22.365E	32°06.873N; 34°27.779E
23 Oct. 2017	4	550	N	32°06.235N; 34°26.331E	32°02.389N; 34°22.339E
24 Oct. 2017	5	440	D	32°00.923N; 34°24.289E	32°04.766N; 34°28.778E
24 Oct. 2017	6	440	D	32°05.190N; 34°27.614E	32°59.325N; 34°24.560E
24 Oct. 2017	7	440	N	32°00.826N; 34°24.400E	32°04.810N; 34°28.690E
24 Oct. 2017	8	430	N	32°04.912N; 34°27.420E	31°58.494N; 34°24.370E
5 Nov. 2017	1	330	D	31°50.379N; 34°19.924E	31°55.498N; 34°23.400E
5 Nov. 2017	2	330	D	31°55.598N; 34°23.100E	31°50.600N; 34°20.200E
5 Nov. 2017	3	330	N	31°50.807N; 34°20.295E	Missing
5 Nov. 2017	4	330	N	31°56.320N; 34°23.550E	31°50.600N; 34°20.200E
14 Nov. 2017	5	200	D	31°05.379N; 34°19.921E	31°55.948N; 34°23.400E
14 Nov. 2017	6	200	D	31°58.453N; 34°30.976E	31°54.420N; 34°25.286E
14 Nov. 2017	7	200	N	31°54.963N; 34°25.695E	31°58.660N; 34°31.132E
14 Nov. 2017	8	200	N	31°58.110N; 34°29.789E	31°54.457N; 34°25.795E
23 Nov. 2017	1	600	D	31°58.940N; 34°22.970E	32°05.889N; 34°24.354E
23 Nov. 2017	2	600	D	32°05.190N; 34°23.570E	32°00.028N; 34°21.907E
23 Nov. 2017	3	600	N	32°01.100N; 34°22.548E	32°06.189N; 34°25.307E
23 Nov. 2017	5	400	N	32°04.850N; 34°26.800E	31°59.501N; 34°24.525E
23 Nov. 2017	4a	600	N	32°01.748N; 34°22.772E	32°06.500N; 34°27.130E
10 Dec. 2017	1	300	D	31°59.498N; 34°27.310E	32°04.830N; 34°32.045E
10 Dec. 2017	2	300	D	32°03.738N; 34°32.194E	31°58.409N; 34°26.810E
10 Dec. 2017	3	300	N	31°58.889N; 34°26.883E	32°05.766N; 34°31.570E
10 Dec. 2017	4	300	N	32°04.730N; 34°31.840E	31°58.660N; 34°26.800E
18 Dec 2017	1	450	D	32°00.347N; 34°24.538E	32°05.050N; 34°26.655E
18 Dec 2017	2	450	D	32°04.500N; 34°25.531E	32°58.684N; 34°24.393E
18 Dec 2017	3	450	N	32°00.096N; 34°24.617E	32°04.944N; 34°27.426E
18 Dec 2017	4	200	N	32°05.704N; 34°33.909E	31°57.933N; 34°30.039E
18 Dec 2017	5	200	D	31°57.988N; 34°29.795E	32°04.529N; 34°33.829E
19 Dec. 2017	6	200	D	32°05.112N; 34°33.112E	31°57.407N; 34°28.485E
19 Dec. 2017	7	200	N	31°57.430N; 34°28.103E	32°02.444N; 34°33.500E

Supplement S2. List of species collected, % of individuals at each depth zone, and their total number.

	Family	Species	% individuals				Total No.
			200 m	320 m	440 m	570 m	
Anthozoa	Alcyoniidae	*Alcyonium palmatum* (Pallas, 1766)	100	0	0	0	4
	Epizoanthidae	*Epizoanthus arenaceus* (Delle Chiaje, 1823)	100	0	0	0	1
	Funiculinidae	*Funiculina quadrangularis* (Pallas, 1766)	0	0	41	59	2,560
	Hormathiidae	*Hormathia alba* (Andrès, 1880)	0	0	0	100	1
	Pennatulidae	*Pennatula rubra* (Ellis, 1761)	100	0	0	0	1
	Pennatulidae	*Pteroeides spinosum* (Ellis, 1764)	100	0	0	0	4
Brachiopoda	Terebratulidae	*Gryphus vitreus* (von Mühlfeld, 1811)	0	0	0	100	72
Chondrichthyes	Centrophoridae	*Centrophorus granulosus* (Bloch & Schneider, 1801)	0	0	54	46	13
	Chimaeridae	*Chimaera monstrosa* (Linnaeus, 1758)	0	0	0	100	1
	Pentanchidae	*Galeus melastomus* (Rafinesque, 1810)	0	0	0	100	6
	Rajidae	*Dipturus oxyrinchus* (Linnaeus, 1758)	4	34	38	24	146
	Rajidae	*Raja clavata* (Linnaeus, 1758)	17	43	34	6	764
	Rajidae	*Raja montagui* (Fowler, 1910)	0	100	0	0	1
	Squalidae	*Squalus acanthias* (Linnaeus, 1758)	1	85	14	0	134
	Torpedinidae	*Tetronarce nobiliana* (Bonaparte, 1835)	0	0	100	0	1
	Torpedinidae	*Torpedo marmorata* (Risso, 1810)	21	79	0	0	53
Crustacea	Aristeidae	*Aristaeomorpha foliacea* (Risso, 1827)	0	60	18	21	3,423
	Aristeidae	*Aristeus antennatus* (Risso, 1816)	0	9	46	45	2,005
	Crangonidae	*Aegaeon lacazei* (Gourret, 1887)	6	17	61	17	18
	Cymothoidae	*Ceratothoa steindachneri* (Koelbel, 1879)	1	34	58	7	1,704
	Diogenidae	*Dardanus arrosor* (Herbst, 1796)	40	60	0	0	5
	Goneplacidae	*Goneplax rhomboides* (Linnaeus, 1758)	0	0	100	0	1
	Homolidae	*Homola barbata* (Fabricius, 1793)	0	0	100	0	1
	Paguridae	*Pagurus alatus* (Fabricius, 1775)	0	0	0	100	1
	Pandalidae	*Chlorotocus crassicornis* (A. Costa, 1871)	83	11	4	2	46
	Pandalidae	*Plesionika edwardsii* (Brandt, 1851)	0	13	56	31	7,485
	Pandalidae	*Plesionika heterocarpus* (A. Costa, 1871)	0	48	42	10	568
	Pandalidae	*Plesionika martia* (A. Milne-Edwards, 1883)	0	0	8	92	376
	Pasiphaeidae	*Pasiphaea multidentata* (Esmark, 1866)	0	0	25	75	4
	Pasiphaeidae	*Pasiphaea sivado* (Risso, 1816)	0	0	9	91	11
	Penaeidae	*Parapenaeus longirostris* (Lucas, 1846)	40	45	9	6	42,029
	Polybiidae	*Liocarcinus depurator* (Linnaeus, 1758)	75	25	0	0	4
	Polybiidae	*Macropipus tuberculatus* (Roux, 1830)	0	40	60	0	5
	Polychelidae	*Polycheles typhlops* (Heller, 1862)	0	0	0	100	18
	Sergestidae	*Sergestes* sp.	0	0	0	100	1
	Solenoceridae	*Solenocera membraneacea* (Risso, 1816)	78	0	22	0	9
Echinodermata	Mesothuriidae	*Mesothuria intestinalis* (Ascanius, 1805)	0	0	100	0	1
Hydrozoa	Aglaopheniidae	*Lytocarpia myriophyllum* (Linnaeus, 1758)	0	0	50	50	140
Mollusca	Arcidae	*Anadara transversa* (Say, 1822)	100	0	0	0	1
	Cassidae	*Galeodea echinophora* (Linnaeus, 1758)	74	18	8	0	39
	Enoploteuthidae	*Abralia veranyi* (Rüppell, 1844)	0	100	0	0	1
	Histioteuthidae	*Histioteuthis bonnellii* (Férussac, 1834)	0	0	100	0	3
	Loliginidae	*Loligo forbesi* (Steenstrup, 1856)	0	0	100	0	2
	Loliginidae	*Loligo vulgaris* (Lamarck, 1798)	100	0	0	0	1,762
	Nuculidae	*Nucula sulcate* (Bronn, 1831)	0	100	0	0	1
	Octopodidae	*Octopus salutii* (Vérany, 1836)	50	0	0	50	2

Supplement S2. Continued.

	Family	Species	% individuals				Total No.
			200 m	320 m	440 m	570 m	
	Ommastrephidae	*Todaropsis eblanae* (Ball, 1841)	30	50	18	3	1,187
	Onychoteuthidae	*Ancistroteuthis lichtensteinii* (Férussac [*in* Férussac & d'Orbigny], 1835)	0	0	0	100	1
	Pyroteuthidae	*Pyroteuthis margaritifera* (Rüppell, 1844)	0	0	100	0	1
	Sepiidae	*Sepia officinalis* (Linnaeus, 1758)	100	0	0	0	32
	Sepiidae	*Sepia orbignyana* (Férussac [*in* d'Orbigny], 1826)	100	0	0	0	19
	Sepiolidae	*Heteroteuthis dispar* (Rüppell, 1844)	0	100	0	0	1
	Sepiolidae	*Neorossia caroli* (Joubin, 1902)	0	0	100	0	1
	Sepiolidae	*Rondeletiola minor* (Naef, 1912)	13	0	75	13	8
	Sepiolidae	*Sepietta oweniana* (d'Orbigny, 1839-1841)	0	100	0	0	13
	Tonnidae	*Tonna galea* (Linnaeus, 1758)	35	65	0	0	20
Osteichthyes	Argentinidae	*Argentina sphyraena* (Linnaeus, 1758)	91	5	3	1	425
	Blenniidae	*Blennius ocellaris* (Linnaeus, 1758	100	0	0	0	1
	Bothidae	*Arnoglossus kessleri* (Schmidt, 1915)	100	0	0	0	18
	Bothidae	*Arnoglossus rueppelii* (Cocco, 1844)	92	8	0	0	66
	Bregmacerotidae	*Bregmaceros atlanticus* (Goode & Bean, 1886)	50	0	0	50	2
	Callionomidae	*Synchiropus phaeton* (Günther, 1861)	0	7	93	0	15
	Caproidae	*Capros aper* (Linnaeus, 1758)	92	7	2	0	192
	Carangidae	*Trachurus mediterraneus* (Steindachner, 1868)	100	0	0	0	6
	Carangidae	*Trachurus picturatus* (Bowdich, 1825)	100	0	0	0	2
	Carangidae	*Trachurus trachurus* (Linnaeus, 1758)	100	0	0	0	502
	Centriscidae	*Macroramphosus scolopax* (Linnaeus, 1758)	76	24	0	0	1,056
	Champsodontidae	*Champsodon nudivittis* (Ogilby, 1895)	100	0	0	0	9
	Chlorophthalmidae	*Chlorophthalmus agassizi* (Bonaparte, 1840)	1	33	61	6	34,432
	Citharidae	*Citharus linguatula* (Linnaeus, 1758)	100	0	0	0	111
	Congridae	*Conger conger* (Linnaeus, 1758)	30	70	0	0	23
	Congridae	*Rhynchoconger trewavasae* (Ben-Tuvia, 1993)	0	100	0	0	1
	Cynoglossidae	*Symphurus nigrescens* (Rafinesque, 1810)	50	50	0	0	2
	Dussumieriidae	*Etrumeus golanii* (DiBattista, Randall & Bowen, 2012)	100	0	0	0	1
	Epigonidae	*Epigonus constanciae* (Giglioli, 1880)	0	0	0	100	20
	Epigonidae	*Epigonus denticulatus* (Dieuzeide, 195)0	0	0	0	100	3
	Gobiidae	*Lesueurigobius friesii* (Malm, 1874)	95	4	2	0	55
	Gobiidae	*Lesueurigobius suerii* (Risso, 1810)	48	0	52	0	23
	Gobiidae	*Trypauchen vagina* (Bloch & Schneider, 1801)	100	0	0	0	1
	Heterenchelyidae	*Panturichthys fowleri* (Ben-Tuvia, 1953)	100	0	0	0	1
	Lophiidae	*Lophius budegassa* (Spinola, 1807)	2	20	48	31	130
	Macrouridae	*Coelorinchus caelorhincus* (Risso, 1810)	0	52	40	8	3,831
	Macrouridae	*Coryphaenoides guentheri* (Vaillant, 1888)	0	0	5	95	171
	Macrouridae	*Hymenocephalus italicus* (Giglioli, 1884)	0	35	36	29	1,388
	Merlucciidae	*Merluccius merluccius* (Linnaeus, 1758)	51	35	12	2	1,393
	Mullidae	*Mullus barbatus* (Linnaeus, 1758)	100	0	0	0	8
	Muraenidae	*Leptocephalus* sp.	0	0	100	0	1
	Myctophidae	*Diaphus holti* (Tåning, 1918)	0	18	6	76	17
	Myctophidae	*Diaphus rafinesquii* (Cocco, 1838)	0	0	5	95	20
	Myctophidae	*Electrona risso* (Cocco, 1829)	0	33	67	0	3
	Myctophidae	*Hygophum benoiti* (Cocco, 1838)	0	0	0	100	2

Supplement S2. Continued.

	Family	Species	% individuals				Total No.
			200 m	320 m	440 m	570 m	
	Myctophidae	*Lampanyctus crocodilus* (Risso, 1810)	0	22	0	78	37
	Myctophidae	*Notoscopelus bolini* (Nafpaktitis, 1975)	0	0	0	100	1
	Nemichthyidae	*Nemichthys scolopaceus* (Richardson, 1848)	0	0	0	100	2
	Nettastomatidae	*Facciolella oxyrhyncha* (Bellotti, 1883)	31	24	45	0	29
	Nettastomatidae	*Nettastoma melanurum* (Rafinesque, 1810)	25	0	0	75	4
	Ophichthidae	*Echelus myrus* (Linnaeus, 1758)	100	0	0	0	7
	Ophidiidae	*Ophidion barbatum* (Linnaeus, 1758)	100	0	0	0	40
	Paralepididae	*Sudis hyalina* (Rafinesque, 1810)	0	0	100	0	1
	Peristediidae	*Peristedion cataphractum* (Linnaeus, 1758)	0	31	63	6	62
	Phycidae	*Phycis blennoides* (Brünnich, 1768)	29	7	57	7	14
	Scophthalmidae	*Lepidorhombus boscii* (Risso, 1810)	0	0	50	50	4
	Scophthalmidae	*Lepidorhombus whiffiagonis* (Walbaum, 1792)	0	100	0	0	1
	Scorpaenidae	*Scorpaena elongata* (Cadenat, 1943)	9	16	32	43	117
	Scorpaenidae	*Scorpaena notata* (Rafinesque, 1810)	100	0	0	0	2
	Sebastidae	*Helicolenus dactylopterus* (Delaroche, 1809)	13	26	27	34	836
	Sparidae	*Dentex macrophthalmus* (Bloch, 1791)	99	1	0	0	1,791
	Sparidae	*Dentex maroccanus* (Valenciennes, 1830)	82	18	0	0	39
	Sparidae	*Pagellus acarne* (Risso, 1827)	100	0	0	0	123
	Sternoptychidae	*Argyropelecus hemigymnus* (Cocco, 1829)	0	0	31	69	16
	Sternoptychidae	*Maurolicus muelleri* (Gmelin, 1789)	50	50	0	0	2
	Stomiidae	*Chauliodus sloani* (Bloch & Schneider, 1801)	0	3	8	90	118
	Stomiidae	*Stomias boa* (Risso, 1810)	0	1	11	88	105
	Synaphobranchidae	*Dysomma* brevirostre (Facciolà, 1887)	100	0	0	0	2
	Trachichthyidae	*Hoplostethus mediterraneus* (Cuvier, 1829)	0	3	57	40	231
	Trichiuridae	*Lepidopus caudatus* (Euphrasen, 1788)	0	0	100	0	45
	Trichiuridae	*Trichiurus lepturus* (Linnaeus, 1758)	100	0	0	0	2
	Triglidae	*Chelidonichthys lucerna* (Linnaeus, 1758)	100	0	0	0	38
	Triglidae	*Lepidotrigla cavillone* (Lacepède, 1801)	65	35	0	0	72
	Triglidae	*Trigla lyra* (Linnaeus, 1758)	0	36	64	0	11
	Triglidae	*Trigloporus lastoviza* (Bonnaterre, 1788)	100	0	0	0	32
Polychaeta	Sternaspidae	*Sternaspis scutata* (Ranzani, 1817)	15	8	77	0	13
Porifera	Suberitidae	*Rhizaxinella pyrifera* (Delle Chiaje, 1828)	0	0	0	100	1

Supplement S3. New and uncommon records

PORIFERA

Rhizaxinella pyrifera (Delle Chiaje, 1828)

Material examined: Off Tel-Aviv, 23.10.2017, 600 m, 1 spec., SMNH PO-26305.

Remarks: The erect, pedunculated sponge was originally described from the Mediterranean Sea (Delle Chiaje, 1828). It is common in the western and central Mediterranean, the Aegean Sea, and the Mediterranean Ridge, mostly at depths from 100 to 250 m, but was recorded as deep as 1900 m and in a shallow littoral cave (Vachet 1960, Vacelet, 1969, Voultsiadou-Koukoura & van Soest 1993, Pansini & Musso 1991, Carlier, Ritt, Rodrigues, Sarrazin, Olu, Grall & Clavier 2010, Topaloğlu & Evcen 2014). A cluster of large *R. pyrifera* was recorded on the 'Napoli' *mud volcano* (Olu-Le Roy, Sibuet, Fiala-Médioni, Gofas, Salas, Mariotti & Woodside 2004). It is absent from the recent list of mesophotic sponges collected off the Mediterranean coast of Israel (Idan, Shefer, Feldstein, Yahel, Huchon & Ilan 2018).

This is the first record in the Levant Sea.

CNIDARIA

Lytocarpia myriophyllum (Linnaeus, 1758)

Material examined: Off Tel-Aviv, 23.10.2017, 26.11.2017, 18.12.2017, 440-600 m, 140 spec. (20 preserved), SMNH CO-37706, CO-37707, CO-37708

Remarks: The large leptomedusan hydroid is an ecologically important ecosystem engineer and habitat former, as its complex root-like system stabilizes the sediment. It was recently proposed *L myriophyllum* also induces changes in the adjacent soft bottoms biota (Cerrano, Bianchelli, Di Camillo, Torsani & Pusceddu 2015). The species is threatened by anthropogenic stressors (Di Camillo, Boero, Gravili, Previati, Torsani & Cerrano 2013). It has been recorded from the North Atlantic and the Mediterranean Sea, where it is common in the western and central parts, as well as the Adriatic and Aegean, at depths of 50-750 m (Di Camillo, Boero, Gravili, Previati, Torsani & Cerrano 2013). Only two records are known from the Levant: off the Israeli coast (Picard 1958) and off Konacik, Turkey (Gönülal & Dalyan 2017). This is the second record in the southern Levant Sea.

Funiculina quadrangularis (Pallas, 1766)

Material examined: Off Tel-Aviv, 23.10.2017, 18.12.2017, 450-600 m, 2560 spec (35 preserved), SMNH CO-37704, CO-3375.

Remarks: The meadow-forming tall sea pen, the largest of the Mediterranean Sea pens, is a critically endangered essential habitat former for some commercially important crustaceans, including the pink deep water prawn *Parapenaeus longirostris* (Fabri, Pedel, Beuck, Galgani, Hebbeln & Freiwald 2014, Lauria, Garofalo, Fiorentino, Massi, Milisenda, Piraino & Gristina 2017). In consequence, the impacts of bottom contact fisheries brought about the steep decline in the spatial extent of *F. quadrangularis* meadows (Lauria, Garofalo, Fiorentino, Massi, Milisenda, Piraino & Gristina 2017). The species is distributed in the Atlantic Ocean and the Mediterranean Sea, at depths of 20-2000 m, though typically ranging from 100 to 250 m. It was recorded from the western and central Mediterranean, Adriatic and Aegean Seas, but so far unknown from the Levant, save for two records at its northwestern margin: near Rhodes, Greece, and Konacik, Turkey (Cecchini, 1917, Pérès & Picard 1958, Vafidis *et al*. 1994, Gönülal & Güreşen 2014, Gönülal & Dalyan 2017; Bastari, Pica, Ferretti, Micheli & Cerrano 2018). The species is sensitive to physical disturbance (Porporato *et al*. 2009), and therefore is considered to be of the greatest conservation importance within the Greater North Sea (Greathead, González-Irusta, Clarke, Boulcott, Blackadder. Weetman & Wright 2014) and included in the IUCN list of vulnerable species. Material collected in 2002-2003 at depths of 200-340 m off the southern Israeli coast went unpublished (Galil & Herut 2003). This is the first published record in the southern Levant Sea.

BRACHIOPODA

Gryphus vitreus (Born, 1778)

Material examined: Off Tel-Aviv, 23.10.2017, 26.11.2017, 550-600 m, 72 spec, SMNH BR-47.

Remarks: The eurybathic brachiopod is widespread in the Mediterranean Sea. It inhabits detritic soft bottoms with coarse shelly debris and moderate near-bottom currents on the circalittoral-bathyal, as well as deeper rocky bottoms (Logan 1979, Emig 1987, 1989, Emig & García-Carrascosa 1991). However, the species is exceedingly rare in the Levant Sea (Logan 1979: fig. 7, Logan, Bianchi, Morri, Zibrowius & Bitar 2002). It was previously reported off Tel Aviv and Herzliyya, Israel, at 650 m (SMNH-BR 46, 17/7/1962, Coll. Gilat) (Brunton 1988), off Syria, at 500 m (Kuznetsov *et al*. 1993), Cyprus (Mienis 2003) and off Konacik, Turkey (Gönülal & Dalyan 2017).

CRUSTACEA

Pagurus alatus Fabricius, 1775

Material examined: Off Tel-Aviv, 23.10.2017, 600 m, 1 spec, SMNH AR-29870.

Remarks: The record of *P. alatus* collected in Haifa Bay (Hothuis & Gottlieb 1958) actually refer to *P. excavatus* (Herbst, 1791). The species was collected at 480-530 m depth, off Antalya, Turkey (Deval & Froglia 2016). This is the first record in the southern Levant Sea.

MOLLUSCA

Ancistroteuthis lichtensteinii (Férussac [*in* Férussac and d'Orbigny], 1835)

Material examined: Off Tel-Aviv, 26.11.2017, 600 m, 1 spec, SMNH MO-82704.

Remarks: The angel squid was recorded from the western and central Mediterranean, Adriatic and Aegean Seas, but unknown from the entire Levant, (Lefkaditou, Politou & Papaconstantinou 2000, Lefkaditou, Peristeraki, Bekas, Tserpes, Politou & Petrakis 2004, Salman, Katagan & Benli 2002, Sifner, Bošnjak & Petrić 2018). Mandibles of *A. lichtensteinii* were identified form the stomach contents of a sperm whale corpse found south of Crete (Roberts 2003). This is the first record in the Levant Sea.

Pyroteuthis margaritifera (Rüppell, 1844)

Material examined: Off Tel-Aviv, 24.10.2017, 440 m, 1 spec., SMNH MO-82705.

Remarks: There are few records of the jewel enope squid from the Levant Sea. It was recorded over a century ago off Libya and Rhodes (Degner, 1925), and its beaks were recovered from dolphins' stomachs entangled in fishing nets off Marmaris, southwestern Turkey (Öztürk, Salman, Öztürk & Tonay 2007). It had been recorded previously off the Mediterranean coast of Israel from depths of 1330 and 1470 m (Galil & Goren 1994).

PISCES

Champsodon nudivittis (Ogilby, 1895)

Material examined: Off Tel-Aviv, 14.11.2017, 18.12.2017, 200 m, 9 spec., SMNH P-15947/ 15948.

Remarks: An Indo-Pacific species recently reported from the eastern Mediterranean. It was initially recorded in Iskenderun Bay, Turkey, in 2008, at 50 m depth (Çiçek & Bilecenoğlu 2009), and subsequently off Rhodes, Greece, at 150 m (Kalogirou & Corsini-Foka 2012). New depth record (Galil, Danovaro, Rothman, Gevili & Goren 2019).

Coryphaenoides guentheri (Vaillant, 1888)

Material examined: Off Tel-Aviv, 23.10.2017, 26.11.2017, 550-600 m, 171 spec., SMNH P-15934/ 15935.

Remarks: Sole validated record from the Levant reported by Goren & Galil (1997, 2002, 5 specimens) from the depth of 1400 m. In the present study 171 specimens were collected at depths of 550-600 m.

Epigonus constanciae (Giglioli, 1880)

Material examined: Off Tel-Aviv, 26.11.2017, 600 m, 20 spec., SMNH P-15936/ 15937. Remarks: Rarely recorded from the Levant: Israel (Golani (1996, 3 specimens) and Syria (Saad 2005). Golani (1996) suggested that the specimen identified as *E. denticulatus* Dieuzeide, 1950 from Lebanon (Mouneimne 1977) is "probably a misidentification of *E. canstanciae*". On comparing Mouneimne's drawing with freshly collected *E. constanciae*, we concur.

***Epigonus denticulatus* (Dieuzeide, 1950)**

Material examined: Off Tel-Aviv, 26.11.2017, 600 m, 3 spec., SMNH P-15938.

Remarks: As the specimen recorded from Lebanon is considered a misidentification (see preceding note) the first record of this species from the Levant Sea was collected in Mersin Bay, Turkey (Erguden, Bayhan & Altun 2017, 2 specimens, 446 and 522 m). The present record is the second of *E. denticulatus* in the Levant.

Etrumeus golanii (DiBattista, Randall & Bowen 2012)

Material examined: Off Tel-Aviv, .14.11.2017, 200 m, 1 spec, SMNH P-15949

Remarks: Recorded from the upper shelf in the northern Red Sea, it was first recorded in the Mediterranean Sea from Israel in 1961 (Whitehead 1963). Collected on the upper shelf across the Mediterranean, it was recorded in the Cyclades, Greece, at 110 m (Kallianiotis & Lekkas 2005). New depth record (Galil, Danovaro, Rothman, Gevili & Goren 2019).

Facciolella oxyrhyncha (Bellotti, 1883)

Material examined: Off Tel-Aviv, 24.10.2017, 14.11.2017, 10.12.2017, 18.12.2017, 200-450 m, 29 spec, SMNH P-15939/15940/15941/15942.

Remarks: The first Levantine record was collected in Antalya Bay, Turkey (Golani, Gökoglu & Güven 2006, 3 specimens, 300 m). Subsequently, a single specimen was reported from Israel (Edelist, Salameh, Sonin & Golani 2010). The 27 specimens collected during the recent survey points to the presence of an established population on the southern Levantine continental slope.

Lepidorhombus boscii (Risso, 1810)

Material examined: Off Tel-Aviv, 23.10.2017, 26.11.2017, 18.12.2017, 450-600 m, 4 spec., SMNH P-15930/15931/15932/ 15933.

Remarks: This species is of a commercial importance in the Aegean Sea and elsewhere in the Mediterranean (Cengiz, Ozekinci, Ismen & Oztekin 2013, Vassilopoulou & Ondrias 1999, Vassilopoulou 2000, Sartor, Sbrana, Ungaro, Marano, Piccinetti & Manfrin 2002), is has been rarely recorded from the Levant Sea: Turkey (Bilecenoğlu, Kaya, Cihangir & Çiçek 2014), Israel (Ben Tuvia 1971) and Syria (Saad 2005).

Nemichthys scolopaceus (Richardson, 1848)

Material examined: Off Tel-Aviv, 23.10.207, 26.11.2017, 600 m, 2 spec., SMNH P-15943/ 15944.

Remarks: The species was reported previously from Antalya Bay, Turkey (Gökoglu, Güven, Balci, Çolak & Golani 2009, 2 specimens, 350 m). This is the second record of *N. scolopaceus* from the Levant Sea.

Notoscopelus bolini (Nafpaktitis, 1975)

Material examined: Off Tel-Aviv, 23.10.2017, 550 m, 1 spec, SMNH P-15946.

Remarks: Golani (2005: 7, Table III) and Bilecenoğlu, Kaya, Cihangir & Çiçek (2014: Table) refer to an unsubstantiated record (Whitehead, Bauchot, Hureau, Nielsen & Tortonese 1984: 86). This is the first validated record in the Levant Sea.

Tetronarce nobiliana (Bonaparte, 1835)

Material examined: Off Tel-Aviv, 24.10.2017, 440 m, 1 spec., SMNH P-15945.

Remarks: The species has been rarely recorded from the Levant Sea: Israel (Golani 1996, 1 specimen, 350 m), and Turkey (Bilecenoğlu, Kaya, Cihangir & Çiçek 2014).

Trypauchen vagina (Bloch & Schneider, 1801)

Material examined: Off Tel-Aviv, 14.11.2017, 200 m, 1 spec, SMNH P-15950.

Remarks: *Trypauchen vagina* occurs in the Indo-west Pacific Ocean in shallow estuarine and coastal areas (Murdy 2006). Off the Turkish coast specimens were collected on the upper shelf (Akamca, Mavruk, Ozyurt & Kiyaga 2011; Siokou, Ates, Ayas, Ben Souissi, Chatterjee, Dimiza & Zenetos 2013), and off Israel they were previously recorded as deep as 120 m (Galil, Danovaro, Rothman, Gevili & Goren 2019). New depth record.

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