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Abstract

The increasing diversity of the Greek Polychaete fauna over the last seven decades, as illustrated graphically, shows an increasing trend which is proportionately related to the research effort exerted. On going research activities mainly in the depths of the N. Aegean Sea, as a result of which 13 new records have been added to the Greek Polychaete fauna, confirming the above statement. The new species records are presented along with their geographical distribution and habitat. According to the latest checklist of the Greek Polychaeta, 753 species of Polychaetes have been recorded in Greek waters. Finally, it should be noted that 6 Lessepsian migrants and 16 species have been recorded in the Mediterranean for the first time. Their distribution within Greece and worldwide is given and their presence in Greek waters is discussed.

Keywords: Polychaeta; Biodiversity; Greece; Lessepsians; Exotic; Checklist.

Introduction

Worldwide, marine biodiversity research is suffering from an extremely fragmented approach. The eastern Mediterranean and Black Seas are among the areas which have received a low level of scientific research on biodiversity issues (CEC/EERO, 1996). Polychaetes are an important component of marine fauna worldwide and in the Mediterranean Sea which hosts approximately 10-12000 marine species (EEA, 1999), the estimate of 1037 Polychaete species (ARVANITIDIS *et al.*, 2002), accounts for 10% of the total.

Nowadays, when quality of life has become synonymous with a sustainable environment the role of polychaetes as structuring species in marine communities cannot be overlooked. In the eastern Mediterranean it is estimated that, in undisturbed environments, Polychaetes comprise up to 65% of the macrobenthic fauna both qualitatively and quantitatively (EEA, 1999). Under environmental 'stress', Polychaete diversity falls dramatically, whereas the abundance of some species, the so-called 'instability/pollution indicators', increases approaching the level of 70-95%.

The first documents available on benthic Polychaeta (Annelida) collected from Greek

seas dates back to 1832 (BRULLÉ, 1832) followed by FORBES (1842, 1844), QUATREFAGES (1865), (STEINDACHNER, 1891) and MARENZELLER (1893). A great amount of research has been carried out in the Greek Seas (ARVANITIDIS, 1994; SIMBOURA, 1996) resulting in a number of papers which focus on Polychaete taxonomy. The most recent inventory of polychaetes of the Aegean Sea enumerates 592 species (ARVANITIDIS, 2000). However, the increasing number of Polychaete findings has revealed the need to update the previous works, adding also documentations and records from the Ionian Sea. Thus, a review of the documented reportings of Polychaete species in the Greek seas was accomplished in the form of a monograph including a comprehensive checklist (SIMBOURA & NICOLAIDOU, 2001). The present paper presents some recent additions to the Greek Polychaete fauna and also, based on the above checklist, attempts to quantify the increasing richness of diversity of the Greek Polychaete fauna over the last seven decades, which is apparently a result of increasing research effort.

Materials and Methods

The diversity of Polychaete fauna in terms of species numbers was primarily assessed from two major scientific works (ARVANITIDIS, 1994; SIMBOURA, 1996). However, the species lists included in the afore-mentioned works have been updated based on recent publications, unpublished technical reports, students' theses, recent findings, and a new checklist was published (SIMBOURA & NICOLAIDOU, 2001). The list considered here takes into account all Polychaete species recorded from 1930 to 2000 in Greek waters. The full reference list for constructing the diagram is too extensive to be fully cited in this paper. Only the literature citations from 1996 to 2000 are cited in the reference list.

The nomenclature used is primarily based on FAUCHALD (1977); CASTELLI *et al.* (1995) and recent review works such as FIEGE et al. (2000), LICHER (2000), and ROUSE & PLEIJEL (2001).

The new Polychaete records occurred in samples collected within the framework of various recent research projects carried out by the National Centre for Marine Research (NCMR, 1995; NCMR, 1997; NCMR, 2001; ZENETOS *et al.*, 1999). The samples were collected from soft bottoms using various benthic samplers such as the Van Veen grab (sampling surface of 0.2 or 0.1 m^2), the McIntyre grab (0.1 m^2), the Ponar grab (0.05 m^2), the box corer (0.1 m^2) or a dredge. The grab samples were mostly sieved through a 1mm mesh size. The sampling areas included enclosed gulfs such as S. Evvoikos Gulf, N. Evvoikos Gulf, Korinthiakos Gulf, open gulfs such as Petalioi Gulf and open sea areas like the area off Limnos Island in the northern Aegean. The geographical coordinates and sediment characteristics of the stations are given in Table 1. All identifications were confirmed by specialists. For each species information on habitat, worldwide distribution and distribution in Greek waters is given. Information on the exotic polychaetes (Lessepsian migrants and first records for the Mediterranean) is given separately because of their importance in assessing biodiversity changes caused by anthropogenic and climatic alterations.

Table 1
Stations co-ordinates and sediment characteristics, where new records have been found.

Station code	Geographic area	Longitude	Latitude	Depth in m	Sediment type
KC1	N. Aegean	390 48, 43	250 28, 90	97	Muddy sand
KC2	N. Aegean	390 47, 10	250 23, 70	79	Sand
KC3	N. Aegean	390 40, 88	250 26, 84	132	Sandy mud
KC4	N. Aegean	390 34, 11	250 23, 88	184	Muddy sand
KC5	N. Aegean	390 26, 10	250 27, 60	307	Mud
KC6	N. Aegean	390 40, 02	250 23, 79	120	Sandy mud
KC7	N. Aegean	390 41, 80	250 41, 00	151	Muddy sand
KC8	N. Aegean	390 34, 15	250 45, 60	156	Muddy sand
KC10	N. Aegean	390 48, 10	250 42, 15	82	Sandy mud
KC11	N. Aegean	390 46, 50	250 16, 50	69	Muddy sand
KC12	N. Aegean	400 02, 70	250 31, 70	63	Sand
KC13	N. Aegean	400 06, 69	250 29, 97	142	Silty sand
KC14	N. Aegean	400 10, 20	250 26, 50	300	Mud
KC18	N. Aegean	400 27, 50	250 16, 80	110	Clayey sand
KC20	N. Aegean	400 43, 60	250 28, 00	63	Muddy sand
KC21	N. Aegean	400 39, 20	250 16, 30	100	Muddy sand
KC22	N. Aegean	400 34, 50	250 05, 80	151	Muddy sand
KC23	N. Aegean	400 28, 50	240 58,, 90	300	Clay
KC24	N. Aegean	400 14,00	250 11,00	1250	Mud
KC25	N. Aegean	390 58,70	250 44,50	84	Sandy clay
KC26	N. Aegean	390 25,73	250 44,71	355	Sandy clay
KC32	N. Aegean	390 40,44	250 45,38	125	Muddy sand
sta D	Petalioi G.	380 08,90	24o 04,90	49	Silty sand
sta E	Petalioi G.	380 06,20	24o 10,80	68	Silty sand
sta F	Petalioi G.	380 01,00	24o 04,00	58	Silty sand
K1	Korinthiakos G.	380 22,85	22o 39,07	34	Silty sand
K5	Korinthiakos G.	380 21,05	22o 40,16	52	Sandy mud
K11	Korinthiakos G.	380 20,02	22o 37,12	68	Silty sand
K17	Korinthiakos G.	380 18,49	22o 41,08	75	Muddy sand
K20	Korinthiakos G.	380 17,14	22o 36,88	87	Muddy sand
K33	Korinthiakos G.	380 14,36	22o 23,93	820	Clay
K35	Korinthiakos G.	380 13,12	22o 53,14	90	Sandy mud
UNTR0	S. Evvoikos G.	380 18,23	24o 01,85	66	Silt
OR	S. Evvoikos G.	380 20,34	23o 46,36	3	Muddy sand
AV	S. Evvoikos G.	380 21,29	23o 39,34	2	Muddy sand
D	S. Evvoikos G.	380 20,53	23o 40,74	5	Muddy sand
KL	Kalymnos isl.	-	-	14	Posidonia bed
BE1	N. Evvoikos G.	38 o 39,04	23 o 19,50	70	Muddy

Results

A. New additions to the Greek Polychaete Fauna

Thirteen new records for the Greek fauna along with comments on their taxonomy, distribution and habitat are presented below.

Family Paraonidae Cerruti, 1909
Aricidea wassi Pettibone, 1965

Material examined: 2 individuals. N. Aegean Sea, st. KC32, muddy sand, 125m.
Distribution: Atlantic (N. America) (CASTELLI, 1987), North Sea (HANSSON, 1998), Iberian Peninsula (ARIÑO, 1987). In the Mediterranean reported only from Italy (CASTELLI *et al.*, 1995).
Habitat: muddy bottoms (in the north Atlantic coast it is typical of sandy bottoms), 50-150m.

Spionidae Grube, 1850
Prionospio salzi Laubier, 1970

Material examined: 30 individuals, S. Evvoikos Gulf (st. Oropos, Avlida, Dilesi), 3-5 m, sandy material. Kalymnos st. 2 (1 specimen), 14m, on *Posidonia* bed.
Distribution: E. Mediterranean-Israeli coasts (LAUBIER, 1970).
Habitat: In the Levantine basin it has been reported from shallow waters (0.5-1.5m), in artificial substrate.

Family Capitellidae Grube, 1862
Neomediomastus glabrus (Hartman, 1960)

Material examined: 18 individuals. N. Aegean Sea, st. KC24, mud, 1250m.
Distribution: Pacific (deep basins off California) (HARTMAN, 1960), Atlantic (Capbreton Canyon, Bay of Biscay) (R. Capaccioni, pers. commun). This is the first documented record for Mediterranean waters.
Habitat: Deep water form 500-1000m (HARTMAN, 1960; R. Capaccioni, pers. commun).

Family Syllidae Grube 1850
Eusyllis blomstrandi Malmgren, 1867

Material examined: 2 individuals. Petalioi Gulf, sts E, F, silty sand, 58-68m.
Distribution (HANSSON, 1998; PARAPAR *et al.*, 1994): Pacific (Japan). Arctic Seas. Atlantic: NE Atlantic (Scandinavia), N.&W. Br. Isles, Spain. In the Mediterranean from Spain, France and the Levantine basin.
Habitat: Found among bryozoa and hydrozoa, intertidal.

Exogone campoyi San Martin, Ceberio & Aguirrezabalaga, 1996

Material examined: 3 individuals. N. Aegean Sea, sts KC24, KC26, silt, 355-1250m.
Distribution: N. Atlantic: Capbreton Canyon, Bay of Biscay (SAN MARTIN *et al.*, 1996). This is the first documented record in Mediterranean waters.
Habitat: at depths of 500 and 1100m, deep-water species (SAN MARTIN *et al.*, 1996).

Exogone gambiae Lanera, Sordino & San Martin, 1994

Material examined: Frequent >20 specimens. Petalioi Gulf, sts D, E, F, silty sand, 49-68m. Korinthiakos Gulf, sts K1, K5, K11, K17, K20, K35, silty sand, sandy mud, muddy sand, 34-90m. N. Aegean Sea, sts KC1, KC2, KC3, KC4, KC6, KC7, KC8, KC10, KC11, KC12, KC13, KC18, KC20, KC21, KC32, muddy sand, sand, sandy mud, 63-184m. N. Evvoikos Gulf, st. BE1, muddy sand, 70m.
Distribution: Western Mediterranean: from Italy and Spain (CASTELLI *et al.*, 1995). Eastern Mediterranean: from Cyprus (CINAR *et al.*, 2003).
Habitat: In the western Mediterranean it was found in coastal waters (3-20m depth) on hard substrate and in *Posidonia oceanica* beds (LANERA *et al.*, 1994). In Cyprus it is reported in coastal waters on muddy sand with *C. racemosa* (CINAR *et al.*, 2003).

Exogone lopezi San Martin, Ceberio & Aguirrezabalaga, 1996

Material examined: 2 individuals. N. Aegean, sts KC14, KC24, mud, 306-1280m.

Distribution: N. Atlantic: Capbreton Canyon, Bay of Biscay (SAN MARTIN *et al.*, 1996). The first documented record in Mediterranean waters.
Habitat: In mud, at depths of 500 and 1100m, deep-water species (SAN MARTIN *et al*., 1996).

Exogone sorbei San Martin, Ceberio & Aguirrezabalaga, 1996

Material examined: 2 individuals. N. Aegean Sea, sts KC24, mud, 1230-1280m.
Distribution: N. Atlantic: Capbreton Canyon, Bay of Biscay (SAN MARTIN *et al.*, 1996). First report in the Mediterranean.
Habitat: In mud, at depths of 500 and 1100m, deep-water species (SAN MARTIN *et al.*, 1996).

Exogone wolfi San Martin, 1991

Material examined: 1 individual, N. Aegean, st. KC6, sandy mud, 120m.
Distribution: N. Atlantic: Florida, Gulf of Mexico, Capbreton Canyon (Bay of Biscay) (SAN MARTIN *et al*., 1996). In Mediterranean waters only reported from Cyprus (CINAR *et al.*, 2003).
Habitat: In muddy sand, coarse sand, and mud from 106 to 1000m depth, deep-water species (SAN MARTIN *et al.*, 1996). In Cyprus it was found in mud at 70m.

Family Polynoidae Malmgren 1867
Perolepis sp.

Material examined: 5 individuals. N. Aegean Sea, sts KC11, KC14, KC22, KC5, KC32, muddy sand, mud, 69-300m.
Taxonomic comments:
The species has the characteristic setae of the genus *Perolepis* Ehlers 1908. It differs, however, from the remaining species of the genus in that the elytrophores are shorter than the cirrophores. One of the morphological features characterising the genus is that elytrophores and cirrophores do not differ in size and are highly elongated (USHAKOV, 1982). Also the superior setae with a bifurcate tip possess finer spines than the inferior with a simple tip, while in *Perolepis* sp. the spines of these setae do not differ in length or size.
Another difference from all described species is that the individuals from the Aegean bear in the superior fascicle of the neuropodium some bipectinate simple setae with unidentate but a very elongated and sharp tip. Only HORST (1917) cites the presence of similar setae in the species *Lepidasthenia sibogae* Horst, 1917 which was recently (JAE *et al.*, 1987) made synonymous to *Perolepis stylolepis* (WILLEY, 1907). However, the drawing provided by HORST (1917) depicts a different kind of bipectinate setae with a shorter and blunter tip arranged in the inferior fascicle of the neuropodium. AMOUREUX (1977) describes a *Lepidasthenia* sp. individual from the entrance of the Channel which appears to be more similar to these individuals. However, he does not comment on the comparative length of the elytrophores and the cirrophores, or on the presence of bipectinate simple superior neurosetae.

Family: Lumbrineridae Schmarda 1861
Lumbrinerides laubieri Miura, 1980

Material examined: 5 individuals. N. Aegean Sea, sts KC8, KC4, KC23, muddy sand, clay, 156-300m.
Distribution: Atlantic-Golfe de Gascogne (MIURA, 1980). This is the first documented record in the Mediterranean.
Habitat: In the Atlantic (France) it was found in abyssal depths (1894-2775m).

Family Ampharetidae Malmgren 1866
Adercodon pleijeli Mackie, 1994

Material examined: More than 10 individuals. Petalioi Gulf, sts D, E, F, silty sand, 49-68m. S. Evvoikos Gulf: st. Untr0, silt, 66m. Korinthiakos Gulf, sts K33, clay, 820m.; N. Aegean Sea, sts KC7, KC13, KC25, KC32, sandy mud, mud, 84-152m.
Distribution: W. Mediterranean: Italy, France (MACKIE, 1994).
Habitat: The species was described (MACKIE, 1994) from muddy sediments with or without

terrestrial/seagrass detritus, in shallow shelf depths (<100m). However, its finding in the N. Aegean and Korinthiakos Gulf widens its range of distribution to significantly deeper areas and in mixed sediments.

Family: Sabellidae Latreille 1825

Pseudofabricia aberrans Cantone, 1970

Material examined: Frequent >20 individuals. Petalioi Gulf, sts E, F, silty sand, 58-68m. N. Aegean Sea : KC1, KC2, KC3, KC4, KC6, KC7, KC8, KC10, KC12, KC13, KC20, KC21, KC32, sandy mud, muddy sand, sand, mud, 63-184m.

Distribution: Atlantic. Mediterranean: Italy (GIANGRANDE & CANTONE, 1972).

Habitat: In the western Mediterranean it was found in shallow waters among Posidonia rhizomes.

B. Cumulative number of Polychaete species over time

Figure 1 shows the cumulative number of Polychaete species reported in Greek waters over the years by decades. Figure 2 shows the

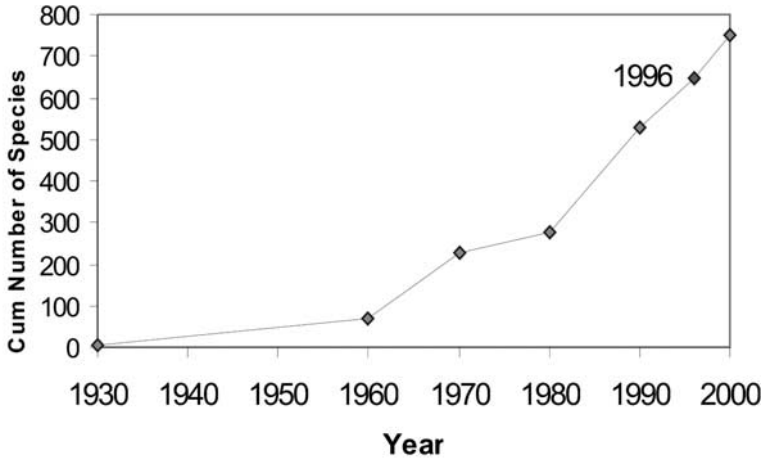

Fig. 1: Curve line showing the increasing number of recorded polychate species in Greek Seas over the years.

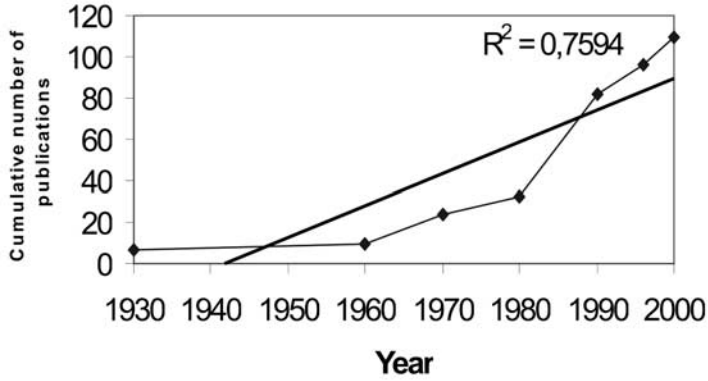

Fig. 2: Curve line and linear regression (R2=0,7594) showing the increasing number of recorded polychate species in Greek Seas as correlated with increasing scientific effort.

curve and the regression line correlating the increasing Polychaete species number with the scientific effort exerted over time. The corresponding regression coefficient value $R^2 = 0,7594$ shows a statistically significant linear correlation between the above variables.

The species number slowly rises up to 1960 and more rapidly through the next two decades reaching 275 species in 1980. During the decades of the eighties and nineties the number of Polychaete species increases at higher rates climbing up to 645 in 1996 and finally, with the addition of the most recent findings, to 753 in 2000.

C. Exotic species

1. Lessepsian migrants

The following species occurring in Greek waters have been documented as Lessepsian migrants (BEN-ELIAHU, 1972; BEN-ELIAHU & FIEGE, 1996; HARMELIN, 1969; POR, 1978). Their detailed distribution in the Greek seas and worldwide is given below.

1. *Branchiosyllis exilis* (Gravier, 1900)

Worldwide distribution:
Circumtropical (SAN MARTIN, 1984). Mediterranean: Levant basin: coasts of Israel (BEN-ELIAHU, 1972), coasts of Cyprus (CINAR & ERGEN, 2003). Western Basin: Italy (CASTELLI *et al.*, 1995); Spain (ARIÑO, 1987). Suez Canal. Red Sea: Gulf of Elat (BEN-ELIAHU, 1976a). Atlantic and Pacific oceans (SAN MARTIN, 1984). Considered as high probability Lessepsian migrant by POR (1978) and SAN MARTIN (1984). However, current unpublished review on exotic species have considered that the probability of this species being a Lessepsian migrant is very low due to its extended geographical distribution.
Distribution in Greece:
N. Sporades (SIMBOURA *et al.*, 1995b)

2. *Lysidice collaris* Grube, 1870

Worldwide distribution:
Mediterranean, Cyprus, Gulf of Suez, Gulf of Elat, Red Sea, Indian Ocean, Pacific (Australia, South Vietnam) BEN-ELIAHU, 1976b. Atlantic, West Africa (KIRKEGAARD, (1988). Considered as low probability Lessepsian migrant by BEN-ELIAHU (1972) and POR (1978). Its current worldwide distribution have actually very much lowered the probability of this species being a Lessepsian migrant.
Distribution in Greece:
Sea of Kriti (ELEFTHERIOU *et al.*, 1990); N. Aegean Sea (KOUKOURAS *et al.*, 1985; N. Sporades (SIMBOURA *et al.*, 1995b); Kalymnos isl. (SIMBOURA, 1996).

3. *Metasychis gotoi* (Izuka, 1902)

Worldwide distribution: Red sea (Sinai). N. Pacific and Indian oceans (LIGHT, 1991). Mediterranean: W. Mediterranean: France (BELLAN, 1964), Spain (ARIÑO, 1987), Italy (CASTELLI *et al.*, 1995). Adriatic (BEN-ELIAHU, 1972; CASTELLI *et al.*, 1995). Levant basin: Israel (BEN-ELIAHU, 1972). Considered as low probability Lessepsian migrant by BEN-ELIAHU (1972) and POR (1978). However, according to Bellan (pers.commun.) the probability of this species being a Lessepsian migrant is very low.
Distribution in Greece: Elefsis Gulf (ZENETOS & BOGDANOS, 1987); Geras Gulf (BOGDANOS, *et al.*, 2002); Ionian Sea (Kalamitsi) (ZENETOS *et al.*, 1997); Gulf of Kavala (PAPAZACHARIAS, 1991); Kerkyra (NCMR, 1992b); Korinthiakos Gulf (NCMR, 1995); Kyclades (NCMR, 1989); N. Evvoikos Gulf, Rodos (SIMBOURA, 1996); Navarino Bay (IOFR, 1984); S. Evvoikos Gulf (NCMR, 1997); Saronikos Gulf (SIMBOURA *et al.*, 1995a); Sea of Kriti (PÉRÈS, 1959; ELEFTHERIOU *et al.*, 1990); Strymonikos Gulf (DOUNAS, 1986); Thermaikos Gulf (TSELEPIDIS, 1992).

4. *Notomastus aberans* Day, 1957

Worldwide distribution:
South Eastern Atlantic (South Africa), western Indo-Pacific sector, Crete, W. Mediterranean (Italy, Marseille), Adriatic (CASTELLI *et al.*, 1995; CAPACCIONI-AZZATI, 1988; HARMELIN, 1969). Considered as low probability Lessepsian migrant by HARMELIN (1969) and POR (1978).
Distribution in Greece:
Sea of Kriti (HARMELIN, 1969); Agios Nikolaos (Kriti) (SIMBOURA, 1996).

5. *Timarete anchylochaeta* (Schmarda, 1861)

Worldwide distribution:
Indopacific (MESNIL & FAUVEL, 1939; WESENBERG-LUND, 1949; RULLIER, 1972).
Mediterranean: Levant basin-Lebanon (BEN-ELIAHU, 1972). Sea of Marmara, Bosporus (RULLIER, 1963). Considered as low probability Lessepsian migrant by POR (1978). It should be noted that current review on exotic species have considered this species as very low probability Lessepsian migrant.
Distribution in Greece:
Aegean Sea (ARVANITIDIS, 2000).

6. *Spirobranchus tetraceros* (Schmarda, 1861)

Worldwide distribution:
Mediterranean: Western Levant, Egypt, Suez Canal, Israel, Lebanon, Rhodes (BEN-ELIAHU, 1972; BEN-ELIAHU & FIEGE, 1996). Lessepsian migrant (BEN-ELIAHU & TEN-HOVE, 1992; BEN-ELIAHU & FIEGE, 1996).
Distribution in Greece:
Rodos isl. (BEN ELIAHU & FIEGE, 1996).

2. First records for the Mediterranean Sea

Table 2 presents the species that are newly recorded in the Mediterranean. Their distribution in the Greek seas associated by the relevant literature, are provided below.

Discussion

The cumulative curve of reported Polychaete species over time clearly illustrates the increasing species diversity of the Greek Polychaete fauna over a 70 years span of research. It appears that data slowly accumulated up to 1960 and faster during the next two decades when the results of some foreign expeditions in the Greek seas, for example: PÉRÈS, 1959; BELLAN, 1961; KISSELEVA, 1963; HARMELIN, 1969, largely contributed to the knowledge of the Polychaete fauna of Greece at that time.

However, during the 80s the information on Polychaete species distribution and occurrence increased dramatically. This increase is apparently the result of the flourishing activities of Greek marine biologists in those years. The correlation coefficient among the species number and number of publications over time shows a positive linear correlation among the two variables illustrating that the species number is analogous to the research effort exerted. As for other marine animals, the number of species constantly increases with the inputs of new studies in either unexplored bathymetric zones or overlooked geographic areas (ZENETOS, 1977). It is indicative that up to 1980 only 32 documents containing polychaete records can be traced, while by 2000, 114 documents concerning Polychaetes from Greek waters have been accumulated.

Pioneering works are those published by ARVANITIDIS (1994) and SIMBOURA (1996) which focus exclusively on the taxonomy of the Polychaeta of the N. Aegean (the former) and of the Polychaeta of Greece in general (the latter). They largely contributed to the knowledge of the Polychaete fauna of Greece by adding new records for Greece (53 and 56 species, respectively) and for the Mediterranean and by describing new species. Recently, a checklist of the Polychaeta from the Aegean, incorporating also some data collected from the Turkish coast, has added

Table 2
New findings for the Mediterranean Sea, distribution.

Species	Reference	Distribution in Greece	Distribution worldwide
Ascleirocheilus capensis Day, 1963	Simboura, 1996	Chalkis, Kalymnos, N. Evvoikos	S. Atlantic (S. Africa)
Dispio magna Day, 1955	Simboura, 1996	Zakynthos, Kefalonia	S. Atlantic (S. Africa)
Lumbrinerides amoureuxi Miura, 1980	Simboura, 1996; Simboura & Nicolaidou, in prep.	N. Aegean (Nestos Delta), Ionian (Kalamitsi), Saronikos	NE Atlantic (France)
Neomediomastus glabrus (Hartman, 1960)	Present paper	N. Aegean	Pacific N. Atlantic (Bay of Biscay)
Opisthodonta pterochaeta Southern, 1914	Simboura, 1996	Ionian (Kalamitsi)	NE Atlantic (France; Spain, Ireland); North Sea; Gibraltar Strait
Pionosyllis dionisi Nunez & San Martin, 1991	NCMR, 1992a; NCMR, 1995; Simboura, 1996	Korinthiakos, Kyklades, Oreoi Channel	NE Atlantic (Canary Islands); Gibraltar Strait
Polycirrus plumosus Wollebaeck, 1912	Simboura, 1996	Kalymnos, N. Evvoikos, Rodos	NE Atlantic (Spain, Norway, Sweden). S. Atlantic (S. Africa)
Malmgreniella andreapolis (Mc Intosh, 1874)	Arvanitidis, 2000	Thermaikos Gulf	N. Atlantic
Nephtys pulchra Rainer, 1991	Arvanitidis, 2000	N. Aegean	Northern Europe
Polydora spongicola Berkeley & Berkeley, 1950	Arvanitidis, 2000	N. Aegean (Chalkidiki)	Pacific Canadian, USA, Mexican coasts
Pista lornensis (Pearson, 1969)	Arvanitidis, 2000	N. Aegean	West coasts of Scotland, Yellow Sea
Euchone southerni incisa Banse, 1970	Arvanitidis, 2000	N. Aegean	South Atlantic (S. Africa)
Exogone campoyi San Martin, Ceberio & Aguirrezabalaga, 1996	Present paper	N. Aegean	N. Atlantic (Bay of Biscay)
Exogone lopezi San Martin, Ceberio & Aguirrezabalaga, 1996	Present paper	N. Aegean	N. Atlantic (Bay of Biscay)
Exogone sorbei San Martin, Ceberio & Aguirrezabalaga, 1996	Present paper	N. Aegean	N. Atlantic (Bay of Biscay)
Lumbrinerides laubieri Miura, 1980	Present paper	N. Aegean	N. Atlantic (Golfe de Gascogne-France)

some more species (ARVANITIDIS, 2000). However, the recent extensive research projects of HCMR carried out in unexplored geographic areas such as the Korinthiakos Gulf, N. Aegean and new bathymetric zones (open areas down to 820 and 1250m) offered rich material. More information coming from the Ionian Sea has also enriched the Polychaeta fauna of Greece.

According to the comprehensive checklist of SIMBOURA & NICOLAIDOU (2001), 753 benthic Polychaete species have been recorded in Greek waters. This number accounts for 75% of the Polychaete species estimated for the whole Mediterranean enumerating 1037 species (ARVANITIDIS *et al.*, 2000), 42% of the European marine Polychaete species numbering 1800 species (ERMS, 1999) and about 10% of the worldwide number of Polychaetes estimated as 8000 species (BIANCHI & MORRI, 2000; FREDJ *et al.*, 1992).

It is worth noticing the occurrence in Greek waters of 6 exotic species that have more or less passively entered through the Suez Canal, the so-called Lessepsians. Some of these have established viable populations and are widely distributed such as *Metasychis gotoi*, while others have a very restricted distribution in the Aegean: *Notomastus aberans, Spirobranchus tetraceros*.

A total of 16 Polychaete species (5 of those are among the new records presented here) seem to be distributed only in the Greek seas. Their absence from the Western Mediterranean, Adriatic and the occurrence of the great majority of them in the N. Aegean may imply that they are exotic species presumably introduced by shipping: Big ports (Thessaloniki, Izmir) are located in the northern Aegean which is also a significant shipping route for oil transportation. Consequently, accidental introduction cannot be excluded, although future research may reveal these species may well have a continuous distribution from the Western to Eastern Mediterranean.

Conclusions

The diversity of the Polychaeta reported from Greek waters has amazingly increased over the last seven decades, a fact clearly attributed to the increasing research effort. The most recent estimation of the Polychaete species number reported from Greek waters (Aegean and Ionian Seas) up-to-date accounts for 753 species. On going research projects in unexplored areas rendered some new findings adding 13 more species to the Greek Polychaete fauna list. It is also interesting to note the presence in the Greek polychaete fauna of 22 exotic species of which 6 are considered as Lessepsian migrants (introduced in the Mediterranean through the Suez Canal) and 16 species are the first recorded in the Mediterranean, being reported so far only outside the Mediterranean.

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References

AMOUREUX, L., 1977. Annelides Polychètes errantes recueillies sur les pentes du talus continental, a l'entrance de la Manche, avec la description de deux espèces nouvelles. Campagne 1973 de la 'Thalassa'. *Cahiers de Biologie Marine*, 18 : 391-411.

ARIÑO, A.H., 1987. Bibliographia iberica de poliquetos base de datos y catalogo de especies. Publicaciones de Biologia de la Universidad de

Navarra. Serie Zoologica 16: 171 pp. EUNSA. Pamplona.

ARVANITIDIS, C., 1994. Systematic and bionomic study of the macrobenthic Polychaete (Annelida) of the Northern Aegean. *Ph.D. Thesis, Aristot. Univ. Thessaloniki:* 1-512+ annex (in greek).

ARVANITIDIS, C., 2000. Polychaete fauna of the Aegean Sea: inventory and new information. *Bulletin of Marine Science*, 60(1) : 73-96.

ARVANITIDIS, C., BELLAN, G., DRAKOPOULOS, P., VALAVANIS, V., DOUNAS, C., KOUKOURAS, A. & ELEFTHERIOU, A., 2002. Seascape biodiversity patterns along the Mediterranean and the Black Sea: lessons from the biogeography of benthic polychaetes. *Marine Ecology Progress Series*, 244: 139-152.

BELLAN, G., 1961. Campagne de la 'Calypso': Méditerranée Nord-Orientale. 4. Annelides Polychètes. *Annales de l'Institut Oceanographique*, 39:161-178.

BELLAN, G., 1964. Campagne de la 'Calypso': Méditerranée Nord-Orientale. 6.Annelides Polychètes. *Annales de l'Institut Oceanographique.*, 41, 271-288.

BEN-ELIAHU, M.N., 1972. Studies on the migrations of the Polychaete through the Suez Canal., 17e Congr. Intern. Zool. (Monte Carlo, 25-30 Sept. 1972). Section 'Biological effects of Interoceanic Canals' 8 pp (mimeo).

BEN-ELIAHU, M.N., 1976a. Polychaete cryptofauna from rims of similar intertidal vermetid reefs on the Mediterranean coast of Israel and in the Gulf of Elat: Syllinae and Eusyllinae (Polychaeta Errantia:Syllidae). *Israel Journal of Zoology*, 25: 1-58.

BEN-ELIAHU, M.N., 1976b. Errant Polychaete cryptofauna (excluding Syllidae and Nereidae) from rims of similar intertidal vermetid reefs on the Mediterranean coast of Israel and in the Gulf of ELAT. *Israel Journal of Zoology*, 25: 156-177.

BEN-ELIAHU, M.N., & TEN-HOVE, H.A., 1992. Serpulids (Annelida: Polychaeta) along the Mediterranean coast of Israel – New population build-ups of Lessepsian migrants. *Israel Journal of Zoology*, 38: 35-53.

BEN-ELIAHU, M.N., & FIEGE, D. 1996. Serpulid tube-worms (Annelida: Polychaeta) of the Central and Eastern Mediterranean with particular attention to the Levant Basin. *Senckenbergiana Maritima*, 28 (1/3): 1-51.

BIANCHI, C.N. & MORI, C., 2000. Marine biodiversity of the Mediterranean Sea: situation, problems and prospects for future research. *Marine Pollution Bulletin*, 40 (5): 367-376.

BOGDANOS C. SIMBOURA N. & ZENETOS, A., 2002. The benthic fauna of Geras gulf (Lesvos Isl., Greece): inventory, distribution and some zoogeographical considerations. *Hellenic Zoological Archives*, 6: 1-22.

BRULEÉ, G.A., 1832. Description de la Sabella graeca. Arachnida, Myriopoda, Insecta et Annélides. *Expedition scientifique de Morée*, Paris, 3: 197.

CAPACCIONI-AZZATI R., 1988. *Prionospio multibranchiata* (Polychaeta, Spionidae), *Notomastus aberans y N. formianus* (Polychaeta, Capitellidae) en el litoral de la Peninsula Iberica. *Miscellania Zoologica*, 12:47-56.

CASTELLI A., ABBIATI M., BADALAMENTI F., BIANCHI C.N., CANTONE G., GAMBI M.C., GIAGRANDE A., GRAVINA M.F., LANERA P., LARDICCI C., SOMASCHINI A. & SORDINO P., 1995. *Annelida Polychaeta, Pogonophora, Echiura, Sipuncula. In*: Checklist delle specie della fauna italiana, Minelli, A., S. Ruffo & S. La posta eds, 19, Calderini, Bologna.

CASTELLI A., 1987. Censimento dei Policheti dei mari Italiani: Paraonidae Cerruti, 1909. *Atti Soc. Tosc. Sci. Nat., Mem.*, Serie B, 94 : 319-340.

CEC/EERO 1996. An inventory of marine biodiversity research projects in the EU/EEA member states. (WARWICK R., R. GONI & C. HEIP Eds) Report of the Plymouth Workshop on marine biodiversity sponsored by CEC/MAST and EERO, Plymouth 4-6/3/96, 93p.

CINAR, M.E. & ERGEN, Z., 2003. Eusyllinae and syllinae (Annelida: Polychaeta) from Northen Cyprus (Eastern Mediterranean Sea) with a checklist of species reported from the Levant Sea. *Bulletin of Marine Science*, 72(2): 769-793.

CINAR, M.E., ERGEN, Z. & BENLI, H.A., 2003. Autolytinae and Exogoninae (Polychaeta: Syllidae) from Northern Cyprus (Eastern Mediterranean Sea) with a checklist of species reported from the Levant Sea. *Bulletin of Marine Science*, 72(3): 741-767.

DOUNAS, C.G., 1986. Study of the macrofaunal assemblages of Strymonikos gulf. *Ph.D. Thesis, Univ. Thessaloniki,* 185 pp. (in Greek).

EEA, 1999. State and Pressures of the marine and coastal Mediterranean environment. Environmental Assessment Series, No 5, 137p.

ELEFTHERIOU A., DOUNAS K., PAPADOPOULOU K., KARAKASSIS I., ANASTASIADIS P., KOUTSOUBAS D., LAZARIDOU TH., & LABROPOULOU M., 1990. Research Programme: 'Study of the coasts of Crete with ecological disturbance. II Marine Section'. Final Report. University of Crete, 92 pp. (in greek).

ERMS, 1999. ERMS Newsletter. European Register of Marine Species. Issue 1.12p.

FAUCHALD K., 1977. The Polychaete worms: definitions and keys to the orders, families and genera. *Nat. Hist. Mus. of Los Angeles County-Alan Hancock Foundation*, univ. Southern California, Ser. 28.

FIEGE D., LICHER F. & MACKIE A., 2000. A partial review of the European Magelonidae (Annelida: Polychaeta): *Magelona mirabilis* redefined and *M. johnstoni* sp. nov. distinguished. *Journal of the Marine Biological Association of the United Kingdom*., 80: 215-234.

FORBES, E., 1842. On two remarkable marine Invertebrata inhabiting the Aegean Sea. *Annals of the Natural History Magazine, London*, 8: 244-245.

FORBES, E., 1844. Report on the Mollusca and Radiata of the Aegean Sea, and on their distribution, considering as bearing on ecology. *Rep. Brit. Assoc. Adv. Sci.*, 13: 130-193.

FREDJ, G., BELLAN-SANTINI D. & MEINARD M., 1992. Etat des connaissances sur la faune marine méditerranéenne. *Bulletin de l'Institut Oceanographique, Monaco*, no special 9:133-145.

GIANGRANDE A. & CANTONE G., 1972. Redescription and systematic position of *Pseudofabricia aberrans* Cantone, 1972 (Polychaeta, Sabellidae, Fabriciinae. *Bollettino di Zoologia*., 57: 361-364.

HANSSON H.G., 1998. NEAT (North East Atlantic taxa): South Scandinavian marine Annelida Checklist. Internet pdf Ed., 1998. [http://www.tmbl.gu.se]. 33 p.

HARMELIN J.G., 1969. Contribution a l'etude de l'endofaune des prairies d'*Halophila stipulacea* de Meditarranee Orientale. I.-Annelide Polychetes. *Rec. Trav. stn. Mar. Endoume*, 45 (61) : 305-316.

HARTMAN O., 1960. Systematic account of some marine invertebrate animals from the deep basins off southern California. *Allan Hancock Pacific Exped.*, 22: 69-216.

HORST R., 1917. Polychaeta errantia of the SIBOGA expedition. Part 2. Aphroditidae and Chrysopetalidae. *SIBOGA-Esped. Leyden* 24b: 1-140.

IOFR, 1984. The quality of the marine environment in Navarino Bay. Institute of Oceanography and Fisheries Research (IOFR), *Technical Report*, C. Bogdanos (Ed.), (in Greek).

JAE J.-G., LEE J.-H. & NOH Y.-T., 1987. Taxonomic study on Polynoid polychaetes in Korea. *Bull. Korean Fish. Soc.* 20(1): 1-15.

KIRKEGGARD, J.B., 1988. The polychaeta of West Africa. Part II. Errant species. 2. Nephtyidae to Dorvilleidae. Atlantide Report 14: 1-82.

KISSELEVA M.I., 1963. Qualitative and quantitative distribution of benthos in the Aegean Sea. *Trudy Sevasopolskoj Biol. Stantsii* XVI: 191-200, (in Russian).

KOUKOURAS A., VOULTSIADOU-KOUKOURA E., CHINTIROGLOU H. & DOUNAS C., 1985. Benthic bionomy of the North Aegean Sea. III. A comparison of the macrobenthic animal assemblages associated with seven sponge species. *Cahiers de Biologie Marine*, XXVI: 301-319.

LAUBIER, L., 1970. *Prionospio salzi* sp. nov., un spionidien (Annelide Polychète) des cotes Méditerranéennes d'Israël. *Israel Journal of Zoology*, 19(4): 183-190.

LANERA P. SORDINO P. & SAN MARTIN G., 1994. *Exogone (Parexogone) gambiae*, a new species of Exogoninae (Polychaeta, Syllidae) from the Mediterranean Sea. *Bollettino di Zoologia*, 61: 235-240.

LICHER F., 2000. Revision of the genus *Typosyllis* Langerhans 1879 (Polychaeta: Syllidae): Morphology, taxonomy and phylogeny. *Abh. Senckenb. Nat. Gesellschaft* 551:1-336.

LIGHT W.J.H., 1991. Systematic revision of the genera of the Polychaete subfamily Maldaninae Arwidsson. *Ophelia* suppl. 5: 133-146.

MACKIE A.S.Y., 1994. *Adercodon pleijeli* gen. Et sp. nov. (Polychaeta: Ampharetidae) from the Mediterranean Sea. In: J.-C. Dauvin, L. Laubier & D.J. Reish (Eds), Actes de la 4eme Conf. Int. Polychetes. *Memoires du Museum National d'histoire Naturelle*, 162 : 243-250.

MARENZELLER von E., 1893. Polychaetes den Grundes, gesammelt 1890, 1891 und 1892. Berichte der commission für erforschung des östlichen Mittelmeeres. *Denkschr. K. Akad. Wiss., Wien, math-naturw*. Cl., 60: 25-48.

MESNIL, F. & FAUVEL, P., 1939. Polychètes sedentaires de l'expedition du 'Siboga'. Maldanidae, Cirratulidae, Capitellidae, Sabellidae et Serpulidae. *Siboga Expeditie*, 24: 1-42.

MIURA T., 1980. Lumbrineridae (Annelides Polychètes) abyssaux recoltés au cours de campagne du Centre Oceanologique de Bretagne dans l'Atlantique et la Mediterranée. *Bulletin du Musee d'Histoire Naturelle de Paris*, sect.A, no4: 1019-1057.

NCMR, 1989. A survey of the benthic fauna in the Central Aegean Sea (Cyclades-Saronikos). A. ZENETOS, ed, National Centre for Marine Research (NCMR) Technical Report: 1- 106 (in Greek).

NCMR, 1992a. Environmental study of the Northern Evoikos Gulf. E. Papathanasiou, ed, NCMR Technical Report: 1- 243 (in Greek).

NCMR, 1992b. Biological oceanographical characteristics of the Corfu Sea. C. Biological oceanography; Technical Report, O. Gotsis (Ed.), 111pp. (in Greek).

NCMR, 1995. Study of the impact of dumping bauxite mining residues on the benthic communities of Korinthiakos Gulf. A. ZENETOS ed, NCMR Technical Report: 1- 93 (in Greek).

NCMR, 1997. Trawling impact on benthic ecosystems. DG-XIV Contract No 95/14. A. ZENETOS ed, NCMR Technical Report: 1- 112.

NCMR, 2001. Study of the long-term and mid-term effects of oil pollution in the Southern Evvoikos Gulf. G. Chatzianestis ed, NCMR Technical report: 32p (in Greek).

PAPAZACHARIAS A.S., 1991. Ecological study of the soft substratum macrofauna in the infralittoral and circalittoral zone of the Gulf of Kavala. *Ph.D. Thesis, Univ. Thessaloniki* (in greek).

PARAPAR J., SAN MARTIN G., BESTEIRO C. & URGORRI V., 1994. Aspectos sistematicos y ecologicos de las Subfamilias Eusyllinae y Exogoninae (Polychaeta, Syllidae) en la Rıa de Ferrol (Galicia, NO España). *Bol. R. Soc. Esp. Hist. Nat. (Sec. Biol.)*, 91 (1-4): 91-101.

PÉRÈS J.M., 1959. Contribution a la connaisance des Polychètes benthiques des profondeurs moyennes de la Méditerranée. *Rec. Trav. St. Mar. Endoume,* Fasc.25 (15): 103-135.

POR F.D., 1978. Lessepsian migration. The influx of Red Sea biota into the Mediterranean by way of the Suez Canal. *Ecol. Stud.*, 23: 1-228, Springer-Verlag, Berlin-Heidelberg-N.Y.

QUATREFAGES de M.A., 1865. Histoire naturelle des Annéles marins et d' eau douce. Annélides et Gephyriens. *Librerie d' Encyclopedie de Rôret, Paris* 2: 1-562.

ROUSE, G. & PLEIJEL, F., 2001. *Polychaetes*. Oxford University Press Inc., New York.

RULLIER F., 1963. Les Annélides Polychètes du Bosphore, de la mer de Marmara, et de la Mer Noire de relation avec celles de la Méditerranée. *Rapports et Proces-Verbaux des Reunions*, 17(2): 162-260.

RULLIER, F., 1972. Annélides Polychètes de Nouvelle Calédonie. Editions de Fondation Singer-Polignac, Paris, 6: 1-170.

SAN MARTIN G., 1984. Biogeography of the Syllidae (Polychaeta) from the Spanish Mediterranean coasts. In: *Proc. First International Polychaete Conference (P. Hutchings, ed), Linn. Soc. of New South Wales*: 303-322.

SAN MARTIN G., CEBERIO A. & AGUIRREZABALAGA F., 1996. *Exogone* species (Polychaeta: Syllidae: Exogoninae) from the Capbreton Canyon (Bay of Biscay, NE Atlantic). *Cahiers de Biologie Marine*, 37: 249-258.

SIMBOURA N., 1996. Merine macrobenthic Polychaetes (Annelida, Polychaete) of Greece: systematics, ecology, and zoogeography. *PhD thesis, Univ. Athens:* 1- 241 + annex (in Greek).

SIMBOURA, N. & NICOLAIDOU, A., 2001. The Polychaetes (Annelida, Polychaeta) of Greece: checklist, distribution and ecological characteristics. *Monographs on Marine Sciences*, Series no 4. NCMR, 115 p.

SIMBOURA N., ZENETOS, A., PANAYOTIDIS P. & MAKRA A., 1995a. Changes of benthic community structure along an environmental pollution gradient. *Marine Pollution Bulletin*, 30(7) : 470-474.

SIMBOURA N., ZENETOS, A., THESSALOU-LEGAKI M., PANCUCCI M.A. & NICOLAIDOU A., 1995b. Benthic communities of the infralittoral in the N. Sporades (Aegean sea): a variety of biotopes encountered and analysed. P.S.Z.N.I., *Marine Ecology*, 16(4): 283-306.

STEINDACHNER F., 1891. Veroffentlichungen der Commission fur Erforschung des ostlichen Mittelmeeres. Vorlanflger bericht uber die zoologischen Arbeiten im Sommer 1891. *Sber. Akad. Wiss. Wien, math-naturw. KI. Abt.* I, 100(1-10): 435-443.

TSELEPIDES, A., 1992. Ecological study of the bathyal ecosystem of the Aegean Sea. P*hD Thesis, Univ. of Crete*: 264 p (in Greek).

ZENETOS, A., 1977. Diversity of marine bivalvia in Greek Waters: Effects of geography and environment *Journal of the Marine Biological Association of the United Kingdom*, 77: 463-472.

ZENETOS, A. & BOGDANOS, C., 1987. Benthic commuinty structure as a tool in evaluating effects of pollution in Elefsis Bay. *Thalassographica*, 10(1): 7-21.

ZENETOS A. CHRISTIANIDIS S., PANCUCCI M.A., SIMBOURA N. & TZIAVOS CH., 1997. Oceanologic study of an open coastal area in the Ionian Sea with emphasis on its benthic fauna and some zoogeographical remarks. *Oceanologica Acta*, 20(2): 437-451.

ZENETOS A., SIMBOURA N., PANCUCCI-PAPADOPOULOU M.A. & STREFTARIS N., 1999. Preliminary survey of the benthic ecosystem in the NE Aegean Sea. A. ZENETOS ed, NCMR, Interim Technical report for KEYCOP. April, 1999.

USHAKOV, P.V., 1982. Polychaetes of the suborder Aphroditiformia of the Arctin Ocean and the northwestern part of the Pacific, families Aphroditidae and Polynoidae. In: Fauna of the USSR Polychaetes, 2(1). *Acad. Sci. USSR Zool. Inst.*:1-272 (in Russian).

WESENBERG-LUND, E., 1949. Polychaetes of the Iranian gulf. Danish Scientific Investigation of Iran, 4: 247-400.

WILLEY, A., 1907. Notes on phosphorescence in marine animals with a description of a new polychaete worm. *Record of the Indian Museum*, I: 257-260.