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Floristic Composition of some Drains, South Lake Manzala

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Abstract : The aim of this study is to describe the floristic composition of the three drains south of Lake Manzala . These drains were namely, Faraskour, Al-Etaiwy, and Ramsis.A total of 50 species had been identified. These species may be divided into four groups: three submerged hydrophytes, six floating hydrophytes, thirteen emergent species, and 28 terrestrial species. Data on the spatial and seasonal variation in the species composition of hydrophytes and canal bank species was gathered from several locations along three drains

Key words: Drains, floristic composition, species, hydrophytes, Nile Delta

1.Introduction

In rainy countries, agriculture depends principally upon rainfall and rivers are rarely used to irrigate the crops. In desert (arid) countries, like Egypt, rainfall is negligible and does not provide enough water necessary to meet the agricultural requirements. In Egypt, the River Nile is the primary source of fresh water "Egypt is a gift of the Nile [1]. Egypt is also reusing an important portion of the effluent generated from irrigation and domestic water uses; thus, while Egypt is increasing the overall water use efficiency, it is also approaching a closed water system which brings with it all possible environmental problems [2]. Furthermore, the Nile Delta, with its 2.27 million hectares of irrigated land, accounts for two-thirds of Egypt's agricultural area. It is also the end of a river basin that stretches over 11 nations and feeds them. Increased dam and irrigation construction in the basin's upstream areas is expected to clash with Egypt's agricultural expansion and population increase. [3].

While Egypt is boosting overall water usage efficiency, it is also nearing a closed water system, which brings with it all conceivable environmental challenges [4]. Furthermore, the Nile Delta accounts for two-thirds of Egypt's agricultural area, with 2.27 million hectares of irrigated land. It is also the end of a river basin that stretches over 11 nations and feeds them. Increased dam and irrigation construction in the basin's upstream areas is expected to clash with Egypt's agricultural expansion and population increase [2,3].

In Egypt, the total length of canals and drains is approximately 4700 km [5]. These canals and drains are infested by aquatic weeds. The degree of infestation is affected by environmental factors, including water transparency, depth of water, physico-chemical properties, water quality, water currents and air temperature. Problems in Egyptian irrigation canals have increased since 1965 due to the construction of the Aswan High Dam [6]. However, [7] attributed the increasing spread of aquatic weeds in the irrigation and drainage canals of the Nile Delta to some other ecological factors.

Vegetation along Nile Delta shores is characterized by a range of physically distinct and dynamic habitats which are close to each other. The aquatic plant community is characterized by its species composition and by

additional features derived of this such as life- and growth- form, species diversity, etc. It can be considered as structural frame which, as a unit, can be related to abiotic and biotic surroundings. Many authors have focused their efforts on the study of aquatic vegetation, particularly that of irrigation and canal banks, [8] studied the main type of habitats and plant communities of weeds in the irrigated lawn gardens, streets, canal banks, etc. [9] gave more information about the vegetation and weed communities of small canals and drains along the Cairo-Alexandria agricultural road. [10] Studied the vegetation structure and floristic composition of canals and drains in the middle Delta. Recently, [11] the floristic status and ecological characteristics of the macrophytic plant vegetation in the Damietta Branch, River Nile in Egypt. [12] Assessed the relationship between vegetation and environmental factors along Rosetta Branch of the River Nile in Egypt. The current study's goal is to explain the floristic composition of the three drains, south of Lake Manzala.

2. M aterials and Methods

2.1. Study area

The Nile Delta is Egypt's most populous region, with 41% of the country's people living there. It spans 2% of Egypt's land area and accounts for 63% of all agricultural land (29600 km2). Furthermore, the Nile Delta is home to 40% of Egypt's industry. [13]. The Nile River is the delta region's principal supply of water, with agriculture accounting for 80% of its flow [14]. The northern lakes of the Nile Delta have a unique environment, however they are polluted as a result of wastewater discharged into the waters from municipal, agricultural, and industrial wastes [15]. As a result, the Nile Delta has a large drainage system that benefits the agricultural sector. El-Gharbia, Sabal, Elhoks, El Shakhlouba, Elkashaa, Bahr Tira, Al-Etaiwy drain, Faraskour drain, El-Serw, Hadous, and Bahr El-Baqar are the main drains in the Nile Delta.

The northern Egyptian coastal lagoons (Mariout, Idku, Burullus, Manzala and Bardawil Lake) are among the most productive natural systems in Egypt and are known globally for their abundant birdlife and fish production. A high level of lake water pollution, due to the industrial, agricultural and sewage wastes poured into the lakes through the drains [16, 17]. One of these coastal lakes is Manzala Lake, located at the northeastern part of Nile Delta, Egypt. There are different drains in the southern part of the Lake. The studied three drains are distributed as Figure (1); Faraskour drain is located at the southwestern part of lake, Al-Etaiwy drain is located among central part to the southeastern part of the lake and Ramsis drain in the southeastern part of the lake.

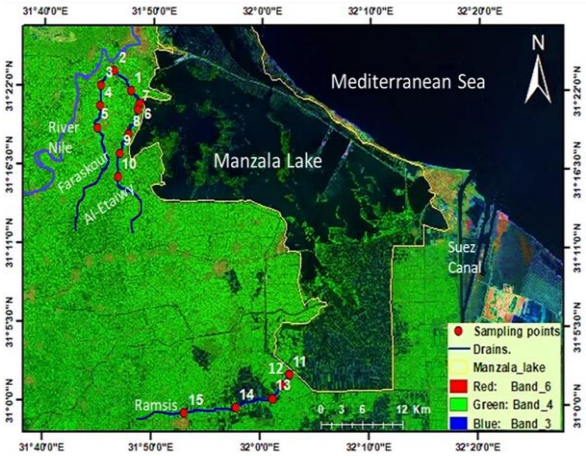

Fig 1. Map of the study area in east Nile Delta showing 1- Faraskour drain, 2- Al-Etaiwy drain and 3- Ramsis drain and sampling sites.

2.2. Selection of Stands and Estimation of Species Abundance

The present study is represented by 15 stands along the drains of Lake Manzala (Faraskour, Al-Etaiwy and Ramsis). The stands are distributed in the studied drains to represent their different habitats and to ensure sampling of wide range of floristic variatios. The total number of sites is fifteen; as each drain was covered within five geo-referenced sites. The distribution of these sites is from 1 to 5; 6 to 10 and 11 to 15 for Faraskour, Al-Etaiwy and Ramsis, respectively (Figure 1).

The stands are dispersed throughout the drains being examined to represent their various habitats

and to guarantee that a diverse range of plants is sampled. Plant specimens were collected from several stands for identification on each trip. All of the samples were maintained in the Botany Department's Herbarium at Mansoura University's Faculty of Science. The description and classification of their life-forms were according to Raunkiaer [18,19]. The identification, classification and floristic composition were according to Tutin et al. [20], Davis [21], Zohary [22], Täckholm [23], Meikle [24], Feinbrun-Dothan [25] updated by Boulos [26].

3.Results and Discussion

Floristic Features

1.1. Floristic composition and distribution of the plant life.

The recorded hydrophytes and canal bank species in the three studied drains of the study area are shown in (Table 1). As mentioned before these drains are as follows: Faraskour, Al-Etaiwy, and Ramsis drains, all are located in east Nile delta, south Manzala Lake. The total number of the recorded species is 50. These species can be divided into four groups, namely: a) three submerged hydrophytes, b) six floating hydrophytes, c) thirteen emergent species and d) 28 terrestrial species. Data on the spatial and seasonal variation in the species composition of hydrophytes and canal bank species was collected from several locations along three drains are given in (Table 1).

a) The submerged hydrophytes include one species, *Ceratophyllum demersum* recorded in three drains, *Myriophyllum spicatum* recorded in Al-Etaiwy drain and *Potamogeton pectinatus* recorded in Faraskour drain (Table 1).

b) The six floating hydrophytes are: *Eichhornia crassipes, Lemna gibba, Lemna minor, Ludwigia stolonifera, Pistia stratiotes* and *Potamogeton nodosus*. Out of these hydrophytes, two species have

c) been recorded in Faraskour, Al-Etaiwy, and Ramsis drains these species are: *Eichhornia crassipes, Ludwigia stolonifera*, while *Lemna minor,* recorded in Al-Etaiwy and Ramsis drains but *Pistia stratiotes, Nymphaea lotus,* has been recorded in Faraskour, and Al-Etaiwy drains. While *Azolla filiculoides* has been recorded in only Al-Etaiwy drain (Table 1).

c) The emergent species are 13 species (Table 1). Out of these, seven species namely *Cyperus alopecoroids, Cyperus articulates, Echinochloa stagnina, Persicaria salicifolia, Typha domingensis, Ranunculus sceleratus, Phragmites australis,* had been recorded in three drains. Five species namely *Alternanthera sessilis, Persicaria lapathifolia, Paspalidium geminatum, Pennisetum setaceum, Saccharum spontaneum,* had been recorded in Faraskour and Al-Etaiwy drains. Whereas only *Rorippa palustris* was recorded in Faraskour drain.

d) The terrestrial species represent the main bulk of the flora (28 species) in the study area (Table 1). These species occur either as weed flora associating the field rops or canal bank plants of the cultivated lands. Eleven species have been recorded in three drains. They are *Amaranthus lividus, Chenopodium album, Chenopodium murale, Conyza bonariensis, Cynanchum acutum, Cynodon dactylon, Malva parviflora, Sonchus oleraceus, Rumex dentatus, Symphyotrichum squamatum* and *Tamarix nilotica.* Four species have been recorded in Faraskour, and Al-Etaiwy drains these species are *Arundo donax, Cyperus rotundus, Melilotus indicus* and *Pluchea dioscoridis,* while *Atriplex prostrate, Spergularia marina* recorded in Al-Etaiwy and Ramsis drains, while *Bassia indica* and *Ipomoea carnea* have been recorded in Faraskour and Ramsis drains. Nine species have been recorded in one drain only, these taxa are *Alhagi graecorum* and *Imperata cylindrica* recorded in Ramsis drain, *Eclipta prostrata, Polypogon monspeliensis, Portulaca oleracea,* and *Solanum nigrum* recorded in Faraskour drain, *Mentha longifolia, Plantago major* and *Sesbania sesban* recorded in Al-Etaiwy drain (Table1).

During this investigation, fifteen different hydrophyte and canal bank species were

identified, and the distribution of these species along three drains varied from one site to the next and from summer to winter. The number of hydrophyte species recorded in the summer was higher than those recorded in the winter (Figure 2). During the summer, the sampling sites along the Faraskour and Al-Etaiwy drains reported the highest numbers of species (33 and 30 species, respectively) (Table 1). The most dominant species which were recorded almost during the summer and the winter seasons were *Cyperus alopecoroids*, *Eichhornia crassipes*, *Echinochloa stagnina*, *Phragmites australis*, *Typha domingensis* and *Malva parviflo*

Table 1 Vegetation composition, life forms and plant diversity of three main drains (n=15) south Manzala Lake of Egypt.

No.	Species	Life span	Life form	Chorotype	Three drains of south Manzala Lake					
					Faraskour		Al-Etaiwy		Ramsis	
					Winter	Summer	Winter	Summer	Winter	Summer
Hydrophytes										
1. Submerged hydrophytes										
1	Ceratophyllum demersum L.	Per	Hy	COSM	-	+	-	+	+	+
2	Myriophyllum spicatum L.	Per	Hy	COSM	-	-	-	+	-	-
3	Potamogeton pectinatus L.	Per	Hy	ME+IR-TR	-	+	-	-	-	-
2. Floating Hydrophytes										
4	Azolla filiculoides Lam.	Ann	Hy	COSM	-	-	-	+	-	-
5	Eichhornia crassipes (C. Mart.) Solms	Per	Hy	NEO	+	+	+	+	+	+
6	Lemna minor L.	Per	Hy	COSM	-	-	-	+	-	+
7	Ludwigia stolonifera (Guill. & Perr.) P.	Per	He	S-Z	-	+	+	+	-	+
8	Pistia stratiotes L.	Per	Hy	PAN	+	-	+	+	-	-
9	Nymphaea lotus L.	Per	Hy	PAL	-	+	+	+	-	-
3. Emergent species										
10	Alternanthera sessilis (L.) DC.	Per	He	PAN	+	+	+	+	-	-
11	Cyperus alopecoroids L.	Per	He	PAN	+	+	+	+	+	+
12	Cyperus articulatus L.	Per	G, He	PAL	+	+	+	+	-	+
13	Echinochloa stagnina (Retz.) P. Beauv	Per	G, He	PAL	+	+	+	+	+	+
14	Persicaria lapathifolia (L.) Gray	Per	G	PAL	+	+	+	-	-	-
15	Persicaria salicifolia (Willd) Assenov	Per	G	PAL	+	+	-	+	-	+
16	Phragmites australis (Cav.) Trin. ex Steud	Per	G, He	COSM	+	+	+	+	+	+
17	Ranunculus sceleratus L.	Ann	Th	ME+IR-TR+ER-SR	+	+	+	+	+	-
18	Typha domingensis (Pers.) Poir. ex Steud	Per	He	PAN	+	+	+	+	+	+
19	Paspalidium geminatum (Forssk)	Per	He	PAL	-	+	-	+	-	-
20	Pennisetum setaceum (Forssk.)	Per	H	ME+PAL	-	+	-	+	-	-
21	Rorippa palustris (L.) Besser.	Bi	Th	ME+IR-TR+ER-SR	-	+	-	-	-	-
22	Saccharum spontaneum L. Mant. Alt	Per	G, He	ME+PAL	+	-	-	+	-	-
Terrestrial										
23	Alhagi graecorum Boiss.	Per	H	ME+SA-SI	-	-	-	-	+	+
24	Amaranthus lividus L.	Ann	Th	ME+IR-TR	-	+	-	+	+	+
25	Arundo donax L.	Per	He, G	Cult. & Nat.	+	+	+	-	-	-
26	Atriplex prostrata Boucher ex DC.	Ann	Th	ME+ER-SR+IR-TR	-	-	+	-	+	-
27	Bassia indica (Wight) A. J. Scott	Ann	Th	S-Z+IR-TR	-	+	-	-	-	+
28	Chenopodium album L.	Ann	Th	COSM	+	+	+	+	-	+
29	Chenopodium murale L.	Ann	Th	COSM	+	-	+	+	+	+
30	Conyza bonariensis (Willd.) Tackh.	Ann	Th	NEO	+	+	+	-	-	+
31	Cynanchum acutum L.	Per	H	ME+IR-TR	-	+	-	+	-	+
32	Cynodon dactylon (L.) Pers.	Per	G	COSM	+	+	-	+	+	+
33	Cyperus rotundus L	Per	G	PAN	-	+	-	+	-	-
34	Eclipta prostrata (L.) L.	Ann	Th	NEO	+	+	-	-	-	-
35	Imperata cylindrica (L.) Raeusch.	Per	H	PAL	-	-	-	-	-	+
36	Ipomoea carnea Jacq.	Per	Ch	Cult. & Nat.	+	+	-	-	+	+
37	Malva parviflora L.	Ann	Th	ME+IR-TR	+	+	+	+	+	+
38	Melilotus indicus (L.) All.	Ann	Th	ME+IR-TR+SA-SI	+	-	+	-	-	-
39	Mentha longifolia (L.) Muds.	Per	He	PAL	-	-	-	+	-	-
40	Plantago major L.	Per	H	COSM	-	-	+	-	-	-

41	Pluchea dioscoridis (L.) DC.	Per	Nph	SA-SI+S-Z	+	-	+	-	-	-
42	Polypogon monspeliensis (L.) Desf.	Ann	Th	COSM	+	-	-	-	-	-
43	Portulaca oleracea L.	Ann	Th	SA-SI+IR-TR	-	+	-	-	-	-
44	Rumex dentatus L.	Ann	Th	ME+ IR-TR +ER-SR	+	-	+	-	+	-
45	Sesbania sesban (L.) Merr.	Ann	Th	PAL	-	-	-	+	-	-
46	Solanum nigrum L.	Ann	Th	COSM	+	+	-	-	-	-
47	Sonchus oleraceus L.	Ann	Th	COSM	+	+	+	+	+	-
48	Spergularia marina (L.) Griseb.	Bi	Th	ME+IR-TR+ER-SR	-	-	+	-	+	-
49	Symphyotrichum squamatum (Spren.) Nesom	Per	Ch	NEO	+	+	+	-	-	+
50	Tamarix nilotica (Ehrenb). Bunge	Per	Nph	SA-SI+S-Z	-	+	+	+	+	+
Number of stands					5		5		5	
Number of plots					25		25		25	
Number of perennials					16	22	16	22	10	17
Number of biennials					-	1	1	-	1	-
Number of annuals					11	10	9	8	7	6
Total number of recorded species					27	33	26	30	18	23

Legend to life-span:	Legend to life-form:	Legend to chorotype:	
Per: Perennials	Nph: Nanophanerophytes	COSM: Cosmopolitan	SA-SI: Saharo-Sindian
Bi: Biennials	Ch: Chamaephytes	PAN: Pantropical	IR-TR: Irano-Turanian
Ann: Annuals	H: Hemicryptophytes	PAL: Palaeotropical	Cult. & Nat.: Cultivated and Naturalized
	G: Geophytes	NEO: Neotropical	S-Z: Sudano-Zambezian
	H: Helophytes	ME: Mediterranean	
	Hy: Hydrophytes	ER-SR: Euro-Siberian	
	Th: Therophytes		

Other hydrophytes, for example, were restricted to a single sampling site, Myriophyllum spicatum, Potamogeton pectinatus, Rorippa palustris, Mentha longifolia and Sesbania sesban were recorded at the summer season while, Polypogon monspeliensis and Plantago major were recorded at the winter season along Faraskour and Al-Etaiwy drains.

1.2 Life-Span in studied drains

As shown in (Figure 2), The 50 species that have been identified in the research area can be divided into three categories: perennials (31 species), annuals (17 species) and biennial (2 species). The flora in Faraskour drain comprises 40 species which can be divided into 25 perennials, 14 annuals and one biennial. The total number of recorded species in Al-Etaiwy drain, 40 species which can be categorized into 27 perennial, 12 annuals and one biennial. While, the total number of recorded species in Ramsis drain reached 28 species. These species are represented by perennial species 17, annual species 10 and one biennial. Ramsis drain is floristically considered the poor habitat type among all drains in the study area.

The above mentioned results reveal that, the major bulk of the recorded species in the present study is mainly represented by perennials, followed by annuals and partly biennial. It is also clear that, the terrestrial plants are the most frequent species in the different studied three drains, followed by the emergent species, then the floating hydrophytes and finally the submerged hydrophytes

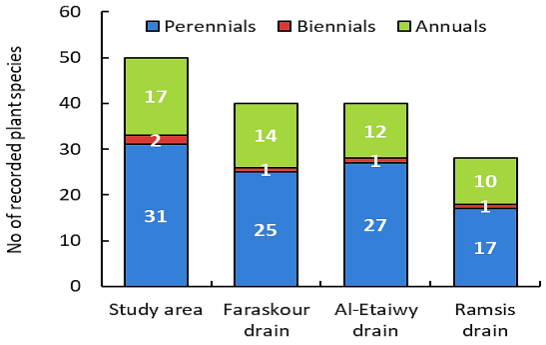

Fig 2. Life-span in study area and three drains.

1.1. Life-Forms in studied drains

The species found in this study are classified into five categories: therophytes, cryptophytes, hemicryptophytes, chamaephytes, and nanophanerophytes. The majority of plants are mainly therophytes (18 species), then helophytes (11 species), geophytes (9 species), hydrophytes

(8 species), hemicryptophytes (5 species), chamaephytes and nanophanerophytes (2 species each). The percentages of the life-form spectra clearly differ from one drain to another (Figure 3). In Faraskour drain, the recorded species (45) can be classified into the following life-forms: therophytes (15 species), helophytes (10 species), geophytes (9 species), hydrophytes (5 species), hemicryptophytes, chamaephytes and nanophanerophytes (2 species each). In Al-Etaiwy drain the recorded species (46) can be grouped into the following types of life forms: therophytes (12 species), helophytes (11 species), geophytes (9 species), hydrophytes (8 species), hemicryptophytes (3 species), nanophanerophytes (2 species) and chamaephytes (one species). While, in Ramsis drain, the recorded species (31) are classified into the following life-forms: therophytes (11 species), helophytes (6 species), geophytes (5 species), hydrophytes and hemicryptophytes (3 species each), chamaephytes (2 species) and nanophanerophytes (one species)

It's worth noting that therophytes, cryptophytes, and chamaephytes, nanophanerophytes, and hemicryptophytes make up the majority of the life-form spectrum in the research area's three drains.

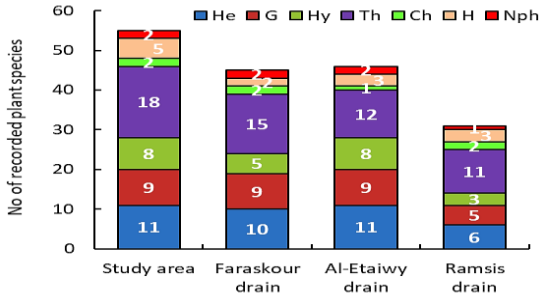

fig 3. Plant life form in the study area and three drains

1.3 analysis of the study area

In the current study area, 50 flowering plant species have been identified, which are divided into 46 genera and 28 families. (Figure 4) Poaceae (9 species), Asteraceae (5 species) and Chenopodiaceae (4 species) are the main families being represented collectively by 18 species or about 35.29 % of the total number of the recorded species. Cyperaceae, Fabaceae and Polygonaceae are represented by 3 species each, while Amaranthaceae family represented by 2 species. One species represents each of the remaining 24 families (Figure 4).

According to the floristic analysis of the research area (Table 2), 30 species, or around 60% of the total number of reported species, are worldwide taxa. These taxa are either COSM (12 species =24%), PAN (5 species =10%), NEO (4 species =8%) or PAL (9 species =18%). It has been also found that, 13 species (26% of the total number of recorded species) are Mediterranean taxa. These taxa are either pluriregional (5 species =10 %) or biregional (8 species =16%). The other floristic categories are underrepresented, with only a few species representing each chorotype (Table 2).

The floristic analysis of Faraskour drain reveals that, 23 species are worldwide (57.5% of the total species) and the Mediterranean taxa represented 10 species (10% of the total species), (Table 2). The chorotype analysis of Al-Etaiwy drain reveals that, 26 species worldwide (65% of the total species) and the Mediterranean taxa represented 10 species (10% of the total species). While, the floristic analysis of Ramsis drain as shown in (Table 2) reveals that, 16 species are worldwide (57.14% of the total species) and the Mediterranean taxa represented 8 species (28.57% of the total species)

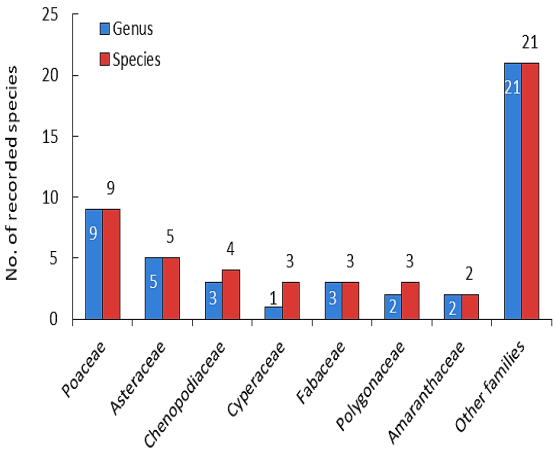

Fig 4. The total number of genera and species of plants that have been identified in the families

4.Conclusion

It can be concluded that, the aquatic plants have been extensively utilized in the last decades to clean pollutant water almost all over the world. During this investigation, fifteen different hydrophyte and canal bank species were identified, and the distribution of these species along three drains varied from one site to the next and from summer to winter. The number of hydrophyte species recorded in the summer was higher than those recorded in the winter. Perennials make up the vast majority of the species found in this study, followed by annuals and partially biennials. It is also clear that, the terrestrial plants are the most frequent species in the different studied three drains, followed by the emergent species, then the floating hydrophytes and finally the submerged hydrophytes. The life-form spectrum in the three drains of the study area is mainly represented by therophytes, then cryptophytes and partly by chamaephytes, nanophanerophytes and hemicryptophytes

Table 2. Number of species and percentage of various floristic categories in three drains of the study area.

Chorotype	Study area		Three drains of south Lake Manzala					
			Faraskour		Al-Etaiwy		Ramsis	
	No.	%	No.	%	No.	%	No.	%
World wide								
COSM	12	24	8	20	10	25	7	25
PAN	5	10	4	10	5	12.5	2	7.14
NEO	4	8	4	10	3	7.50	3	10.71
PAL	9	18	7	17.5	8	20	4	14.29
Pluri-regional elements								
ME+IR-TR+ER-SR	4	8	3	7.50	4	10	4	14.29
ME+IR-TR+SA-SI	1	2	1	2.50	1	2.50	-	-
Bi-regional elements								
ME+IR-TR	5	10	4	10	3	7.50	3	10.71
ME+SA-SI	1	2	-	-	-	-	1	3.57
ME+PAL	2	4	2	5	2	5	-	-
IR-TR+S-Z	1	2	1	2.50	-	-	1	3.57
IR-TR+SA-SI	1	2	1	2.50	-	-	-	-
SA-SI+S-Z	2	4	2	5	2	5	1	3.57
Mono-regional elements								
Cult. & Nat.	2	4	2	5	1	2.5	1	3.57
S-Z	1	2	1	2.50	1	2.5	1	3.57
Total	50	100	40	100	40	100	28	100

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