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Food and feeding habits of the Lessepsian migrants *Siganus luridus* Rüppell, 1828 and *Siganus rivulatus* Forsskål, 1775 (Teleostei: Siganidae) in the southern Mediterranean (Libyan coast)

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The stomach contents, feeding habits and seasonality of two Erythrean herbivorous Siganid fish species were studied along the Libyan coast. In total, 253 specimens of *Siganus rivulatus* from the eastern region, and 394 specimens of *S. luridus* from the western region were collected by trammel nets. *Siganus luridus* fed with more or less the same intensity during all seasons, while *S. rivulatus* displayed the highest feeding intensity during spring and summer. *Siganus luridus* consumes mostly Phaeophyceae in spring and summer (85.1% and 63.5%, respectively), Chlorophyta (84.7%) in autumn, and Rhodophyta (97.0%) and Phaeophyceae (68.3%) in winter. *Siganus rivulatus* fed mostly on Chlorophyta in spring and summer (58.3%), on Phaeophyceae in autumn (55.6%), and on Rhodophyta in winter (65.3%). *Posidonia oceanica* is an important part of the diet in all seasons for both species. As for the most frequent food categories, *S. luridus* fed mostly on Phaeophyceae (60.1%) and Chlorophyceae (55.3%), whereas the most frequent food category for *S. rivulatus* was Chlorophyceae (50.6%). Both species showed strong similarities in the most frequent food categories, with the only difference being that *S. rivulatus* fed less on Phaeophyceae and slightly less on seagrass. The most frequently consumed food categories have not changed considerably in the new environment (compared to the Red Sea). *Siganus luridus* showed a stronger affinity for brown algae while *S. rivulatus* targets a broader range of food items, with Rhodophyta and Chlorophyta algae playing a pronounced role in its diet. The diet overlap between both species was high. Both species seem to be well established in the south-central Mediterranean.

Key words: invasive species, Lessepsian migration, Libya, Mediterranean, rabbitfish.

INTRODUCTION

A variety of species from the Red Sea invaded the Mediterranean since the completion of the Suez Canal in 1869. These organisms are referred to as Lessepsian migrants (Por, 1978). Siganidae (rabbitfish) constitute a family of herbivorous fishes distributed throughout the Indo-West and Pacific Oceans (Woodland, 1983). *Siganus rivulatus* and *S. luridus*, both occurring in the Red Sea, have invaded the eastern Mediterranean Sea and are very successful Lessepsian migrants (Bariche *et al*., 2004). The two siganids were first recorded in Palestine in 1927 (Steinitz, 1927), and in 1956 (Ben-Tuvia, 1964). Although they were mainly found in the Levantine basin, their distribution expanded to the west [Libya (Stirn, 1970) and

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Tunisia (Ktari & Ktari, 1974)]. They have gained commercial importance in the eastern and central south Mediterranean Sea (Papaconstantinou, 1990; Bariche, 2005; Shakman *et al*., 2008), while, in some areas, *Siganus* spp. are discarded as bycatch in the coastal fisheries (Bardamaskos *et al.,* 2008).

The abundance of the two siganid species varies along the ~2000 km long Libyan coast with its diverse topography and its wide range of habitats. *Siganus luridus* occurs in a higher abundance than *S. rivulatus* in the western part, while *S. rivulatus* is more common in the eastern part (Shakman & Kinzelbach, 2007a). Along the Libyan coast, *S. rivulatus* is found in several different algae dominated habitats (rocks with algae, sand with algae, and seagrass meadows with algae) while *S. luridus* is found almost exclusively around algae-covered rocks (Shakman & Kinzelbach, 2007a). Bariche *et al.* (2004) reported that *S. rivulatus* is occupying a wide range of substrates and habitats along the Lebanese coast, including rock pools, muddy harbours and *Cymodocea nodosa* seagrass beds.

The diet of *S. rivulatus* and *S. luridus* has been studied both in the Red Sea, which is their original habitat (Lundberg & Lipkin, 1979; Lundberg, 1981) and in the eastern Mediterranean (Lundberg, 1980; Stergiou, 1988; Lundberg & Golani, 1993; Lundberg & Lipkin, 1993; Lundberg & Golani, 1995; Lundberg *et al*., 1999a, b; Hamza *et al*., 2000; Lundberg *et al*., 2004). Comparative studies on the diet of these species have also been conducted between the native populations in the Red Sea environment and the populations in the eastern Mediterranean (Lundberg, 1989; Lundberg & Golani, 1995; Bariche, 2006); both siganid species are characterised as being primarily herbivorous fishes that feed on seagrass and the majority of available algae.

Until now, the diet of these immigrant species has not been studied in the central Mediterranean. In this study, we analysed food frequency and feeding habits of specimens from the southern Mediterranean (Libyan coast). The stomach contents were monitored during different seasons of the year and results are discussed with respect to observations from the Red Sea and the eastern Mediterranean. Our data complement previous studies from other areas of the Mediterranean and will contribute in gaining more information on how these species cope with their new environments and what role they might play in Mediterranean ecosystems in the future.

MATERIALS AND METHODS

This study was carried out along the Libyan coast from March 2005 to February 2006 for *Siganus rivulatus* and to March 2006 for *S. luridus*. Monthly samples were collected by trammel nets (inner mesh 26 mm, outer mesh 120 mm) in coastal waters down to 30 m depth. A total of 253 specimens of *S. rivulatus* were collected from the eastern region (Tubruk and Benghazi) and 394 specimens of *S. luridus* were collected from the western region (Zwara and Tripoli) and Sirt gulf (Musrata) (Fig. 1, Table 1). The samples were transported immediately in an ice box to the laboratory for analysis. The total weight (W_T) was measured to the nearest 0.1 g and total length (L_T) to the nearest mm. The stomach samples were removed, weighed and preserved in a 4% formaldehyde-seawater solution. The stomachs were opened afterwards in a petri dish and food items were carefully grouped in different categories and identified to the lowest taxonomic level possible.

The Feeding Index (FI) was calculated as FI = NF / NE × 100, where NF is the number of individuals with food in the stomach, and NE is the number of individuals examined (Suresh *et al*., 2006).

The Occurrence Frequency (F%) was calculated as F% = n × 100/N, where n is the number of stomachs in which a particular food item was observed, and N is the number of full stomachs (Hyslop, 1980; Lima-Junior & Goitein, 2001).

While the seasonal F% is based on the number of stomachs per season, the overall F% is based on the total number of stomachs. The overall F% represents the most frequently consumed food categories. Diet overlap between *S. luridus* and *S. rivulatus* was determined using Schoener's diet overlap index (Schoener, 1970): $C_{xy} = 1 - 0.5\ (\Sigma\,|\,P_{xi} - P_{yi}\,|)$, where C_{xy} is the index value, P_{xi} is the relative percentage of food type *I* used by species *Y*, and the vertical bars indicate absolute values of the difference; C_{xy} values range from 0 (no overlap) to 1 (perfect overlap). Diet overlap values above 0.60 were considered biologically significant (Wallace, 1981). A chi-square (χ^2) test was used to compare the FI in the different seasons for each species. F% was compared in the different seasons for each species using one-way ANOVA and the Tukey post hoc test (SPSS software, SPSS Inc., USA).

RESULTS

The total length (L_T) of individuals ranged from 11.2 to 24.6 cm for *S. luridus* and from 10.4 to 27.4 cm for

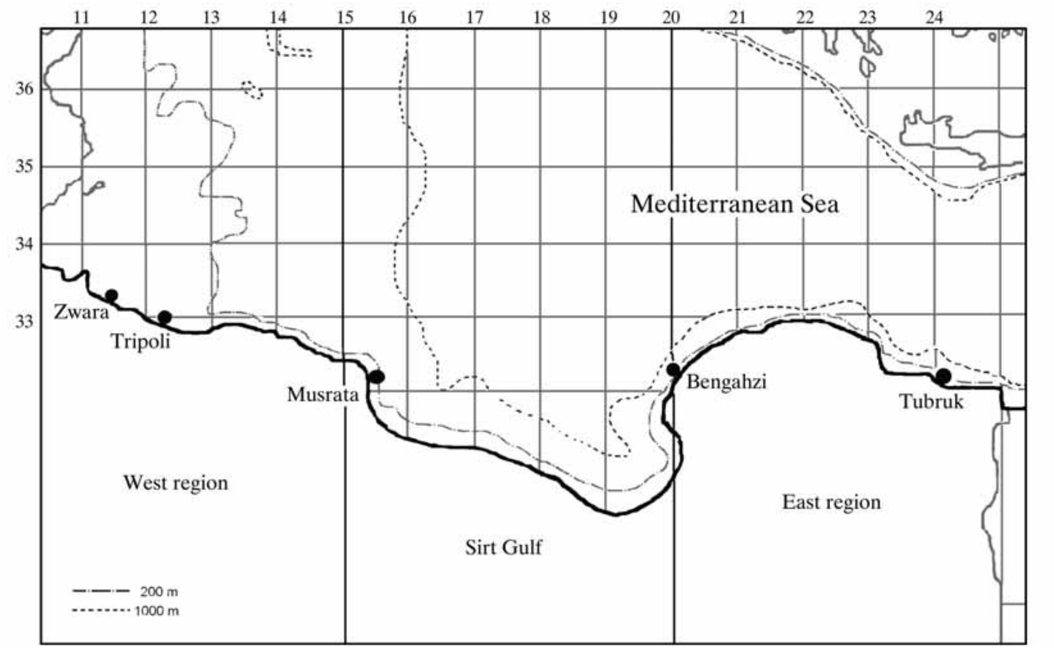

FIG. 1. Map of the Libyan coast showing the sampling sites.

TABLE 1. Seasonal sample size and total length data of *S. rivulatus* and *S. luridus*

Season	*S. rivulatus*		*S. luridus*	
	Individuals	Total length (cm)	Individuals	Total length (cm)
Spring	86	13.3-27.4	77	13.0-23.8
Summer	61	10.4-23.8	68	13.3-24.6
Autumn	16	15.8-22.2	121	11.2-23.8
Winter	90	10.8-25.3	128	13.4-24.3
Total	253	10.4-27.4	394	11.2-24.6

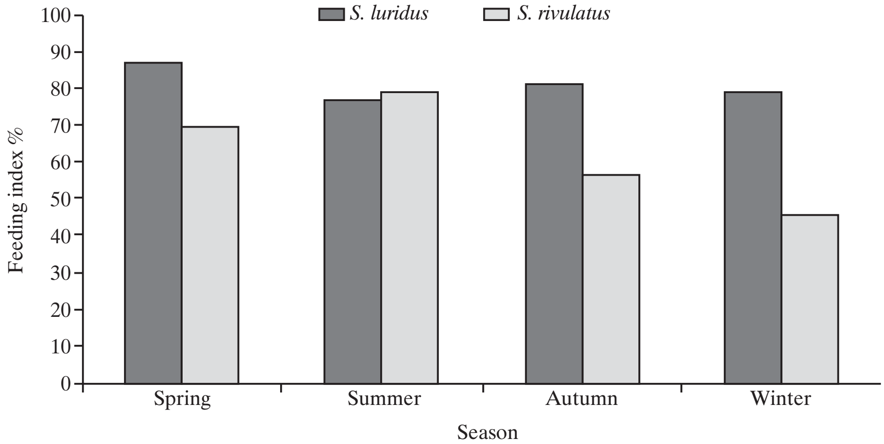

FIG. 2. Seasonal changes in the Feeding Index of *S. rivulatus* and *S. luridus*.

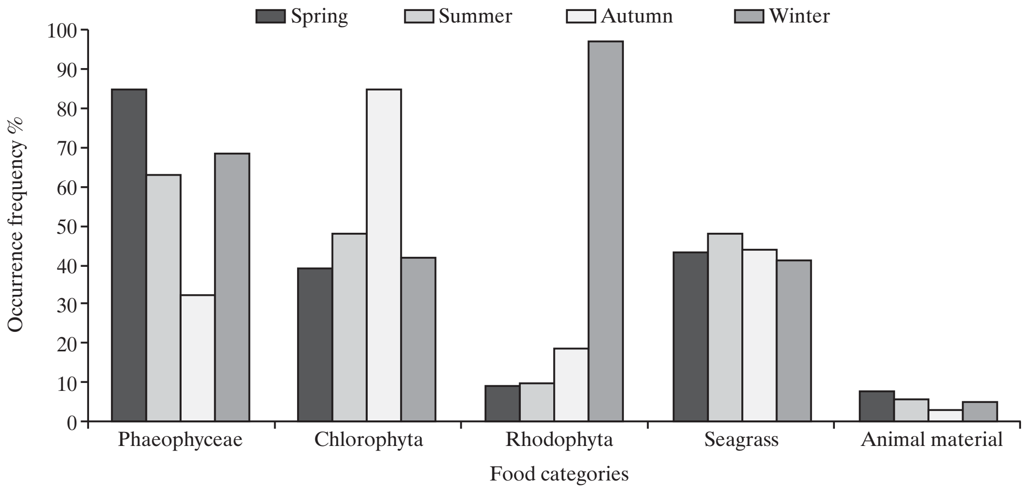

FIG. 3. Seasonal Occurrence Frequencies of different food categories for *S. luridus*.

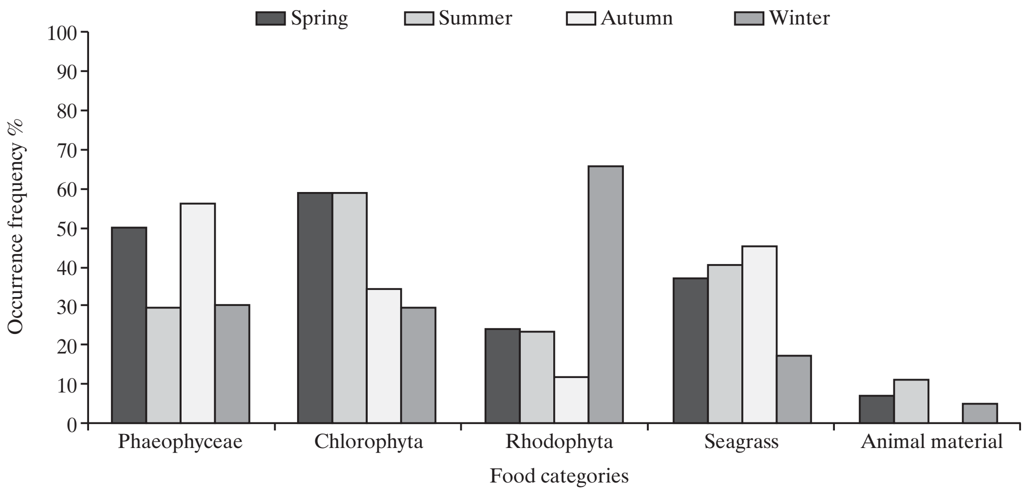

FIG. 4. Seasonal Occurrence Frequencies of different food categories for *S. rivulatus*.

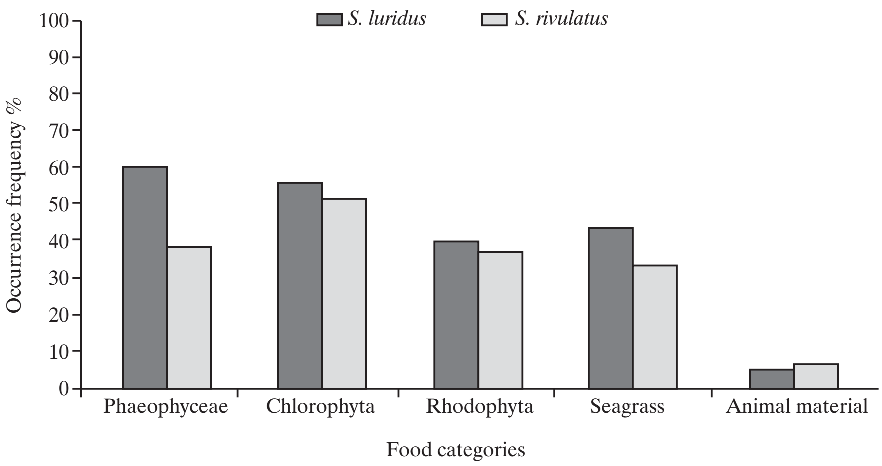

FIG.5. Overall Occurrence Frequencies of different food categories for *S. rivulatus* and *S. luridus.*

S. rivulatus (Table 1). The Feeding Index (FI) was slightly elevated in the spring for *S. luridus*, but did not change significantly between seasons ($\chi^2 = 3.024$, $p > 0.05$); the percentage of full stomachs always ranged between 75% and 85%. A significant decrease ($\chi^2 = 20.04$, $p < 0.05$) from ~70% in spring and summer to less than 50% in winter was observed in *S. rivulatus* (Fig. 2).

Macroalgae and seagrass (*Posidonia oceanica*) are the dominant constituents of the diet of both species (Figs 3-5). The Occurrence Frequency illustrates that *S. luridus* feeds mainly on Phaeophyceae in spring and summer (85.1% and 63.5%, respectively), on Chlorophyta in autumn (84.7%), and mainly on Rhodophyta (97.0%) and Phaeophyceae (68.3%) in winter and there was no significant difference (F = 0.284, $p > 0.05$) among the seasons (Fig. 3). Rhodophyta presented high Occurrence Frequency values in winter, while seagrass consumption is important in all seasons and did not change substantially over the year. *Siganus rivulatus* feeds mostly on Chlorophyta in spring and summer (58.3%), on Phaeophyceae in au-

TABLE 2. Seasonal Occurrence Frequencies for identified taxa from the stomach contents of *S. luridus*. ∅: absent

Taxa	**Order**	**Seasonal Occurrence Frequencies**			
		Spring	Summer	Autumn	Winter
Chlorophyta					
Caulerpa racemosa	Bryopsidales	∅	1.9	1.0	1.0
Codium spp.	Bryopsidales	∅	∅	14.3	16.8
Cladophora spp.	Cladophorales	34.3	15.4	22.5	9.9
Dasycladus vermicularis	Dasycladales	∅	∅	12.2	10.9
Ulva spp.	Ulvales	32.8	44.2	52.0	29.7
Rhodophyta					
Asparagopsis armata	Bonnemaisoniales	∅	∅	∅	9.0
Hypoglossum hypoglossoides	Ceramiales	∅	∅	∅	3.0
Polysiphonia spp.	Ceramiales	∅	∅	∅	5.0
Corallina officinalis	Corallinales	6.0	∅	18.4	34.7
Contarinia squamariae	Gigartinales	6.0	9.6	9.2	60.4
Phaeophyceae					
Sauvageaugloia griffithsiana	Chordariales	∅	∅	∅	3.0
Dictyota spp.	Dictyotales	28.4	5.8	9.2	37.6
Padina sp.	Dictyotales	3.0	5.8	∅	1.0
Taoina/Spatoglossum	Dictyotales	58.2	53.9	∅	21.8
Unidentified Dictyotales	Dictyotales	3.0	∅	∅	5.9
Unidentified Ectocarpales	Ectocarpales	1.5	∅	8.2	∅
Cystoseira spp.	Fucales	∅	∅	3.1	1.0
Sargassum sp.	Fucales	4.5	11.5	22.5	1.0
Halopteris filicina.	Sphacelariales	26.9	3.9	7.1	5.9
Sphacelaria spp.	Sphacelariales	6.0	1.9	∅	∅
Stypocaulon scoparium	Sphacelariales	17.9	1.9	∅	7.9
Seagrass					
Posidonia oceanica		43.3	48.1	43.9	41.6
Animal material					
Polychaeta		4.5	1.9	∅	5.0
Larvae		∅	∅	2.0	1.0
Mollusca		4.5	3.6	1.0	∅

tumn and spring (55.6% and 50.0%, respectively), and on Rhodophyta (65.3%) in winter. No significant difference was observed ($F = 0.099$, $p > 0.05$) among the seasons (Fig. 4). The most frequently consumed food categories (expressed as overall F% values, Fig. 5) of *S. luridus* were Phaeophyceae and Chlorophyta (60.1% and 55.3%, respectively), followed by seagrass (43.7%) and Rhodophyta (39.9%). Small amounts of animal material (5.0%) were also found. The most frequently consumed food categories of *S. rivulatus* were quite similar, with Chlorophyta being the most frequent (50.6%), followed by Phaeophyceae (38.6%), Rhodophyta (36.7%) and seagrass (33.5%). Animal material represents only a small fraction of the diet (6.3%). The only differences between the two species were that *S. rivulatus* feeds less on Phaeophyceae and

TABLE 3. Seasonal Occurrence Frequencies for identified taxa from the stomach contents of *S. rivulatus*. ∅: absent

Taxa	**Order**	**Seasonal Occurrence Frequencies**			
		Spring	Summer	Autumn	Winter
Chlorophyta					
Codium spp.	Bryopsidales	15.0	29.2	33.3	∅
Cladophora sp.	Cladophorales	21.7	16.7	∅	29.3
Dasycladus vermicularis	Dasycladales	∅	12.5	∅	∅
Ulva spp.	Ulvales	51.7	50.0	∅	17.1
Rhodophyta					
Asparagopsis armata	Bonnemaisoniales	∅	∅	∅	12.2
Antithamnion sp.	Cermiales	∅	∅	∅	4.9
Griffithsia cf. opuntioides	Cermiales	13.3	∅	∅	9.8
Heterosiphonia cf. crispella	Cermiales	3.3	6.3	∅	9.8
Polysiphonia spp.	Cermiales	3.3	∅	∅	4.9
Corallina officinalis	Corallinales	1.7	16.7	∅	29.3
Jania rubens	Corallinales	20.0	∅	∅	∅
Contarinia squamariae	Gigartinales	∅	12.5	11.1	9.8
Rhodophyllis sp.	Gigartinales	∅	∅	∅	56.1
Botryocladia sp.	Rhodymeniales	∅	∅	11.1	4.9
Phaeophyceae					
Dictyota spp.	Dictyotales	26.7	4.2	∅	7.3
Taoina/Spatoglossum	Dictyotales	∅	16.7	∅	∅
Giffordia sp.	Ectocarpales	1.7	4.2	∅	∅
Unidentified Ectocarpales	Ectocarpales	3.3	6.3	33.3	∅
Sauvageaugloia griffithsiana	Chordariales	46.7	6.3	∅	19.5
Cartilaginous brown algae	Fucales	∅	∅	33.3	∅
Sargassum sp.	Fucales	3.3	8.3	∅	∅
Halopteris filicina	Sphacelariales	∅	∅	22.2	9.8
Sphacelaria spp.	Sphacelariales	1.7	6.3	∅	∅
Stypocaulon scoparium	Sphacelariales	26.7	∅	44.4	2.4
Seagrass					
Posidonia oceanica		36.7	39.6	44.4	19.5
Animal material					
Polychaeta		∅	6.3	∅	4.9
Larvae		3.3	4.2	∅	∅
Mollusca		5.0	4.2	∅	∅

seagrass than *S. luridus*. Schoener's index values between both species varied from 0.73 (autumn) to 0.88 (winter), while it was 0.79 in summer and spring.

In the present study, 21 taxa that were ingested have been identified to the level of classes or below for *S. luridus* (Table 2). Frequent taxa (F% > 50%) were members of the Dictyotales (Phaeophyceae) in spring and summer, *Ulva* spp. (Chlorophyta) in autumn and *Contarinia squamariae* (Rhodophyta) in winter (Table 2). Among the green algae, *Cladophora* spp. and *Ulva* spp. were an integral part of the diet in all seasons, while *Codium* spp. and *Dasycladus vermicularis* were only ingested in autumn and winter. As for the red algae, *Corallina officinalis* played an additional role in autumn and winter. Brown algae were an important food source during all seasons; mostly Dictyotales were consumed [except in autumn, when they were replaced by *Sargassum* spp. (22.5%)]. Other moderately frequent (F% > 10%) brown algae were *Halopteris filicina* and *Stypocaulon scoparium* (Sphacelariales) in spring.

Twenty four taxa have been identified from the stomach samples to the level of classes or below for *S. rivulatus* (Table 3). The most frequent food item was *Ulva* spp. (Chlorophyta) in spring and summer, but *Sauvageaugloia griffithsiana* (Phaeophyceae) was also frequently found in spring. No strong preference for a particular group was observed in autumn, with *Stypocaulon scoparium* (Phaeophyceae) being most frequently ingested. *Rhodophyllis* spp. (Rhodophyta) was the most frequent algal food source in winter. Green algae (*Cladophora* spp. and *Ulva* spp.) were classified as being moderately frequent (F% > 10%) in all seasons but autumn, *Codium* spp. in all seasons but winter, while small amounts of *Dasycladus vermicularis* were detected in summer. Among the red algae, *Griffithsia* cf. *opuntioides* and *Jania rubens* were ingested in spring, *Corallina officinalis* and *Contarinia squamariae* in summer, and *Contarinia squamariae* and *Botryocladia* spp. in autumn. Only in winter red algae were chosen as a food source more frequently, with *Corallina officinalis* and *Asparagopsis armata* being target species in addition to *Rhodophyllis* spp. Additional ingested brown algal taxa were *Dictyota* spp. and *Stypocaulon scoparium* in spring, some Dictyotales in summer, and *Stypocaulon scoparium*, *Halopteris filicina*, Ectocarpales and cartilaginous species (cf. Fucales) in autumn. In winter, *Sauvageaugloia griffithsiana* was being found moderately frequently. In all seasons, seagrass was an important food source.

DISCUSSION

Information about food and feeding habits of *Siganus luridus* and *S. rivulatus* in the Mediterranean Sea allows to investigate whether fundamental changes in the diet occurred compared to the original habitats, and to make future predictions for these species in their new environments.

It has been claimed that both species have changed their diet in the Mediterranean Sea compared to the populations in the Red Sea (e.g., Lundberg, 1981, 1989). In the Red Sea, *S. luridus* consumed mainly large tough brown algae (Lundberg & Golani, 1995), such as *Lobophora variegata* (Dictyotales), *Cystoseira myrica* and *Sargassum* spp. (Fucales) (Lundberg & Lipkin, 1979). A study in the gulf of Aqaba has shown that even though brown algae are the preferred food source, a broad range of algal and seagrass species (28 taxa) are utilised (Lundberg & Golani, 1995). Red algae contributed to more than half of the diet of *S. rivulatus* diet in the Red Sea (Lundberg & Lipkin, 1979; Lundberg & Golani, 1995), with fleshy and soft taxa such as *Laurencia* spp., *Hypnea* spp., *Champia irregularis* and *Digenea simplex* being most frequently consumed. Phaeophyceae (i.e. *Sargassum dentifolium*) and Chlorophyta (i.e. *Caulerpa racemosa*) are also an important part of the diet (Lundberg & Golani, 1995). The diet of *S. rivulatus* was found to be more diverse compared to *S. luridus*; 39 algal and seagrass taxa were found in stomach contents from the gulf of Aqaba (Lundberg & Golani, 1995). Even though the data available for the Red Sea is not extensive and lacks information on seasonality, both species can be characterised as feeding on a range of taxa from all three major algal groups. *Siganus luridus* shows a stronger preference for brown algae while *S. rivulatus* feeds on a broader range of species and green and red algae play a more pronounced role in the diet. This might be due to the specialised morphology of the alimentary tract which may provide *S. luridus* with a greater ability to utilize coarse brown algae (Lundberg & Golani, 1995).

Previous studies on the composition of the diet of *S. luridus* in the eastern Mediterranean reported 25 to 32 algal and seagrass taxa (Stergiou, 1988; Lundberg & Golani, 1995). These numbers are close to the number of taxa that has been found in the Red Sea, and also of the results presented here (22 taxa). Brown algae are being reported as the most frequently consumed food category of *S. luridus* in the eastern Mediterranean, but green and red algae can make up large percentages of the diet too (Lundberg & Golani, 1995). In the present study, a similar trend was observed, with brown algae being frequently consumed, especially in spring, but green algae are the most important food source in autumn and red algae in winter (Fig. 4). The same switch from brown to red and green algae in autumn and winter was observed in Greek waters (Stergiou, 1988). In Lundberg *et al.* (2004), brown algae were still the most frequently ingested food source in autumn. In contrast to the data from the Red Sea, only small amounts of *Caulerpa racemosa* was consumed even though occurring along the Libyan coast (Table 2). Bariche (2006) reported that *S. luridus* selects some of most common macrophytes found in the eastern Mediterranean and occasionally ingests the exotic macrophyte *Caulerpa racemosa*.

For *S. rivulatus*, 41 algal and seagrass taxa have been found in stomach and gut content analyses from the eastern Mediterranean (Lundberg & Golani, 1995), a similar value to what has been found in the Red Sea (39 taxa). From the Libyan samples a somewhat less diverse diet was reconstructed (24 taxa were identified – Table 3). Mediterranean populations of *S. rivulatus* have been found to feed mainly on fleshy red algae and *Ulva* spp. (Lundberg & Golani, 1995) or coarse brown algae (Lundberg *et al.*, 1999b). Green algae contributed more than 60% to the diet of *S. rivulatus* in Israeli waters during spring, while brown algae are the most frequently consumed food source in autumn (89%) (Lundberg *et al.*, 2004). In the present study, brown and green algae were the most frequently ingested algal groups. Green algal consumption was most pronounced in spring and summer (60%, see Fig. 4), with *Ulva* sp. being the mainly targeted taxon (Table 3). Brown algae are the most frequent food source in autumn, and a switch to red algae was observed in winter. Seasonal variation in the abundance and availability of the important food items of *Siganus* species could be a major factor leading to variations in the diet of these species. Also, the observed variations could be attributed to the behavioural changes of the fish such as targeting different taxa in different seasons due to specific metabolic needs. In the eastern Mediterranean, *S. rivulatus* grazes on majority of existing macrophytes with a preference for certain taxa (Bariche, 2006).

In the present study the Feeding Index shows no significant differences ($p > 0.05$) between seasons for *S. luridus*, while *S. rivulatus* showed a significantly increased feeding intensity in spring and summer before a decline in winter ($p < 0.05$). The stronger preference of *S. luridus* for perennial brown algae could be a factor explaining the observed differences in winter. Conversely, the Feeding Index was found to be high in the summer and spring and low in winter for both species along the Egyptian Mediterranean coast (Hamza *et al.*, 2000). However, a study undertaken in the north-eastern Mediterranean observed the degree of stomach fullness to be at a maximum in spring and at a minimum in summer for *S. luridus* (Stergiou, 1988). Why *S. luridus* has a higher feeding activity all year round in the southern Mediterranean remains to be answered.

For the eastern Mediterranean, Lundberg & Lipkin (1993) and Lundberg *et al.* (1999a) reported that the two *Siganus* species are selective when macrophyte assemblages are diverse and abundant and will consume whatever is available during the unfavourable season (October-November), such as *Sargassum* spp., *Padina* spp. or *Sphacelaria* spp. It is common in nature that animals feed on species when abundant and ignore them when scarce; a behaviour termed "switching" (Murdoch & Oaten, 1975).

Apart from the availability of resources, other seasonal parameters affect feeding intensity such as changes in the life cycle. The spawning time was found to be during the summer season for both species in Libyan waters, for *S. luridus* from May to July and for *S. rivulatus* from June to July (data not shown), and does not correlate with observed trends in feeding intensity. The timing agrees with other studies from the southeastern Mediterranean (Egypt) for *S. rivulatus*, but is quite different for *S. luridus* (Mohamed, 1991; Hamza *et al.*, 2000). The difference in meristic counts between Red Sea and Mediterranean populations is a combination of both shifting and shortening of the spawning season as a result of the different temperature regimes prevailing in the two seas (Golani, 1990). It has been showed that the feeding activity declines during the spawning period (Khumar & Siddiqui, 1989), a trend not observed in the present study.

Even if the consumed algal and seagrass taxa differ on the species (or genus) level between the Red Sea and the eastern Mediterranean, and other authors have regarded the diet to be considerably different in the Mediterranean (Lundberg, 1981, 1989), the composition of the two *Siganus* species diet appears to be very similar in the Red Sea and the eastern Mediterranean according to most literature data and the results presented here. The results on the food frequency from the Libyan coast are in agreement with the majority of studies from other parts of the eastern Mediterranean (Stergiou, 1988; Mohamed, 1991; Lundberg & Golani, 1995; Lundberg *et al*., 1999b; Hamza *et al*., 2000; Lundberg *et al*., 2004). Most studies show that even though certain food sources are clearly preferred, members of all three major macroalgal groups are consumed at different times. Both species are able to utilise a broad range of food sources and can switch between preferred groups according to availability, e.g. between seasons. Most genera of macroalgae that *Siganus* species feed on occur in both the Red Sea and the Mediterranean, so the main difference they face in the new environments with regards to their diet is the different algal community structures and abundances, as well as different seasonality. One interesting difference possibly indicating scarcity of available food items is the consumption of calcified algae (Corallinales, Rhodophyta) in the Mediterranean (Tables 2 and 3), while for the Red Sea fleshy algae were mainly reported (Lundberg, 1980). The differences in food frequencies between the two species has also not changed considerably in the new environment; *S. luridus* shows a stronger preference for brown algae while *S. rivulatus* displays a broader range of targeted food items and red and green algae play a more pronounced role in its diet. Significant overlap (Schoener's Index ≥ 0.60) occurred in two species, these results led us to consider that these fishes should present mechanisms to avoid competitive interactions when the resources are scarce (Hutchinson, 1965).

Species with a wide range of possible food preferences are more restricted in their distribution into new environments by other factors, most probably temperature (especially with regards to reproduction). Herbivorous species are exposed to much less competition in the Mediterranean compared to the Red Sea (Bariche *et al*., 2004; Shakman & Kinzelbach, 2007b), so the pressure to make drastic adjustments to the diet is not very high as long as food resources similar to the original area of distribution are available.

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