International Journal of Fisheries and Aquaculture Research

Vol.3, No.1, pp.1-20, February 2017

Published by European Centre for Research Training and Development UK (www.eajournals.org)

HISTORICAL RECORDS OF THE LESSEPSIAN MIGRANTS, THE DUSKY SPINEFOOT FISH *SIGANUS LURIDUS* (RUPPELL, 1829) AND THE MARBLED SPINEFOOT *S. RIVULATUS* (FORSSKAL, 1775), IN THE EASTERN COAST OF LIBYA MEDITERRANEAN SEA

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ABSTRACT: *A brief comprehensive account on Lessepsian migration is given in the present study. Earlier publications reported that the dusky spinefoot fish Siganus luridus (Ruppell, 1829) and the marbled spinefoot S. rivulatus (Forsskal,1775) were recorded in Libya Mediterranean coastal waters for the first time in 1968 and 1970 in order. The present study however, shows that they were in Libya since the 1950ties: in Tobrok in 1950, in Darna in 1954 and in Benghazi in 1960. These findings were based on questionnaires filled by middle age and elderly fishers (located in Tobrok, Ein Ghazala, At Timimi, Ras Ettin, Darna, Khalij Bumba, Susah, Benghazi fishing sites on eastern Libya), on reports and documents of "Darna Fishers Trade Union", "Tobrok Fishers Trade Union" and "Office of Marine Resources in Darna" and* on consultations *with members of these institutions. Estimates of monthly catch from the two Siganids per fisher per fishing site shortly after they established themselves in the eastern coast ranged between 2 to 60 kg (average = 17.25 kg) with S. luridus been more abundant than S. rivulatus. Both fishes are residents of shallow coastal water, 1 – 8 meters deep (average = 4.25 meters). Average total length of the initial population the two Siganids was 23.44 cm. Questionnairing fishers, in particularly elderly ones, is a powerful technique for establishing records of first entry and scientists are encouraged to use it. However, this technique is limited by the scarcity in elderly fishermen who are inventory of information of the old times but are unfortunately eliminated through time.*

KEYWORDS: Lessepsian migrants, dusky spinefoot fish, *Siganus luridus,* marbled spinefoot, *Siganus rivulatus*, eastern Libya, Mediterranean Sea

INTRODUCTION

Both the Mediterranean Sea and the Red Sea are semi closed basins that are connected to adjacent oceans by narrow and shallow gates, the Mediterranean Sea to the Atlantic ocean through the strait of Gibraltar, and the Red Sea to the Indian Ocean through the Gulf of Aden and

Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760

Vol.3, No.1, pp.1-20, February 2017

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Bab el Mandeb straits. In addition, the Red has acquired an artificial connection to the Mediterranean Sea via the Suez Canal since 1869. The Canal is 193km long, 24m deep and 205m wide. The 2014-2016 expansion and widening of the Canal doubled its ship passage capacity by allowing sailing in both directions.

The Canal provides a limited chance for Red Sea species to migrate to the Mediterranean Sea (Lessepsian migrants) and vice versa (anti-Lessepsian migrants). The number of Lessepsian migrant exceeds by far the number of anti-Lessepsian migrants (Cevik *et al*., 2002). According to the Mediterranean Action Plan for Invasive Species UNEP-MAP-RAC/SPA, 2005; Bazairi *et al*., 2013 and Katsanevakis *et al*., 2014a,b, the main known pathway/vector of species introduction into the Mediterranean Sea is the Suez Canal followed by shipping (ballast water and sediments, anchoring and fouling), aquaculture (both marine and brackish species) and trade in live marine species (aquarium activities, fishing baits, seafood).

Golani, 2010, stated that frequently, invasive species are discovered after they have already been in the new habitat for extended period of time making it difficult to determine how the invasion started and when. The two Siganids rabbit fishes, the dusky spinefoot *S. luridus* (Ruppell, 1829) and the marbled spinefoot *S. rivulatus* (Forsskal, 1775) were recorded in in Libya for the first time in 1968 and 1970 in order (Stirn,1970; Lamboeuf, 2000; Bazairi *et al*., 2013). However, some elderly Libyan fishers insisted that they have known the two fishes in the eastern coast since the beginning of the 1950ties. The objectives of the present study were, therefore, to:

i- Give a comprehensive account on Lessepsian migration in the Mediterranean Sea with emphasis on Libya, in particular of the two Siganids: *S. luridus* and *S. rivulatus.*

ii- Investigate date of first appearance of *S. luridus* and *S. rivulatus* in the eastern coast of Libya using:

- questioners filled by some fishers of the eastern coast of Libya Mediterranean Sea.
- reports and documents of "Darna Fishers Trade Union", "Tobrok Fishers Trade Union" and "Office of Marine Resources in Darna" and on consultations with members of these institutions

LITERATURE REVIEW

Problems caused by aliens

In addition to alterations in ecosystem functioning and biodiversity loss, alien species can also cause serious economic (fisheries, tourism and aquaculture) and health impacts. Many of the marine alien species exhibit aggressive invasive behavior (Pimentel *et al*., 2000; Vilà *et al*., 2010; Bazairi *et al*., 2013; Katsanevakis *et al*., 2014a, b,). However it is generally assumed that lessepsian migrants do not seem to influence the abundance of native species (Madl, 2011). This particularly warring at today rate of introduction into the Mediterranean Sea of 1 new species every 10–14 days (Zenetos, 2010; Zenetos *et al*., 2012; Galil *et al*., 2014).

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Mitigation measures for introducing alien species

Mitigation measures for introduction of aliens in the Mediterranean Sea were discussed by Galil, 2007. Although many international laws, conferences, agreements and treaties (e.g. CBD, 1992, Article 8h; IMO; UNCLOS, 1982; Barcelona Convention, 1995; SPA, 1982; UNEP; RAC/SPA) have called for or adopted such measures yet progress is slow and rudimentary and an effective policy of prevention is hardly enforced (Occhipinti-Ambrogi, 2004), even the appreciation of the problem by politicians and the causative sectors is limited.

Indigenous, alien and Lessepsian biota of the Mediterranean Sea

The biota of the Red Sea is of tropical Indo-Pacific origin, while that of the Mediterranean is primarily of Atlanto-Mediterranean species (62%) derived from the adjacent Atlantic biogeographic provinces beyond the strait of Gibraltar. Many Mediterranean species are endemic (28%) (Shakman, 1969; Fredj *et al*., 1992) while others are cosmopolitan, Circum-tropical (13%) or Indo-Pacific (5%). Boudouresque *et al*., 2005, reported flora and fauna of the Mediterranean Sea as around 12 000 species. Coll *et al*., 2010, reported 17000. Based on Zenetos *et al*., 2010, 2011a, b,, 2012; Bazairi *et a.l*, 2013, a total of 986 alien species were known in the Mediterranean by 2012: 775 in the Eastern basin, 308 in the Western basin, 249 in the Central basin and 190 in the Adriatic Sea. About 54% of these species are Lessepsian (Catsanevakis, 2012). According to Samuel and Frotté, 2015, the number of Mediterranean marine fishes is currently about 750 (Golani *et al*. 2013), almost 90 of them are Lessepsian migrant (Belmaker *et al*., 2013; Golani *et al*., 2002), with new species regularly being added to the list (Golani, 2006). Generally, the richness of Mediterranean species diversity including fishes decreases from the West to the East (Ketchum,1983; Quignard and Tomasini, 2000). In contrast, there is a clear east to west gradient for Lessepsian species richness (Coll *et al*., 2010). The majority of the farthest spread species are early settlers (Oral , 2010). An invasive species (= invasive alien) is an introduced species which is ecologically and/or economically harmful (Boudouresque and Verlaque, 2002a,b; Occhipinti-Ambrogi and Galil, 2004; Sala *et al*., 2011; Giakoumi, 2014). On average, 10% of introduced species become invasive (Williamson and Fitter, 1996; Boudouresque and Verlaque, 2002a). However in certain areas of the eastern Mediterranean some alien fishes are commercially exploited (Kallianiotis and Lekkas, 2005; Giakoumi, 2014; Tsikliras and Stergiou, 2014).

Factors that limit/facilitate introduction and spread of Lessepsian migrants

These factors were discussed by Shakman, 1969; Ben-Tuvia, 1972; Golani, 1996; Golani, 1998; Kovalev, 2006; Ben Rais *et al*., 2008; Madl, 2011.

1- Narrowness and shallowness of the canal

The Suez canal is not conducive to Lessepsian migration because it is shallow, narrow, very long, lack rocky bottom substrates and polluted from maritime activity (Por, 1978; Golani, 1998). However, it has been substantially deepened and broadened (Kovalev, 2006) during the 1960s, the 1980s and 2014-2016.

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2- The hypersaline lakes

Just after completion of the Suez Canal in 1869, Lessepsian migration was blocked by the presence of hypersaline lakes (a remnant of the once landlocked evaporated seas that connected the Mediterranean to the Red Sea) inside the canal. After the salinity of these lakes equalized through years, the barrier is eliminated and species began migrating into the Mediterranean Sea (George and Athanassiou, 1967; Kovalev, 2006; Ben Rais *et al*., 2008; Madl, 2011) via the Suez Canal.

3- Aswan Dam: Decreased salinity at Port Saeed

Before construction of Aswan dam across the Nile River in 1964, floodwater used to spread as a surface layer off the northern entrance of the Canal (off Port Saeed). This low salinity water acted as a barrier to lessepsian migrants. After the construction the dam influx from the Nile was reduced and the salinity barrier disappeared and Lessepsian migration is facilitated (Galil, 2006; Kovalev, 2006; Ben Rais *et al*., 2008; Madl, 2011).

4- Prevailing temperature

Red sea organisms are tropical; the Mediterranean environment is subtropical-temperate and therefore is not hospitable to Lessepsian species. However, the global rise in temperatures during the present and the last century (IPCC, 2013; Jones *et al*., 2013; Marras *et al*., 2015) has led to "tropicalization" of the Mediterranean, resulting in the present day high rate of introduction of Lessepsian species (Bianchi, 2007; Ben-Tuvia, 1972; Raitsos *et al*., 2010; Madl, 2011; Hiddink *et al*., 2012; Bazairi *et al*., 2013; Marras *et al*., 2015; Libralato *et al*., 2015).

5- Salinity

Salinity is higher in the Red Sea than in the Mediterranean. This made it easier to Lessepsian migrants to flourish in the Mediterranean Sea (Ben-Tuvia, 1966; Kovalev, 2006).

6- Hydrostatic Pressure/currents

The general northwardly flow of water along the Suez Canal caused by prevailing winds and currents and the higher surface level of the Red Sea compared to that of the Mediterranean Sea has aided Lessepsian migration and attenuated anti-Lessepsian migration (Hassan *et al*., 2003; Ben Rais *et al*, 2008; Madl, 2011).

7- Oligotrophic

Red Sea fauna are used to living in nutrient poor environments of the Red Sea, and therefore, are able to flourish in the relatively nutrient rich oligotrophic waters of the Mediterranean.

8- Time factor

Immigration is a continuous process, and over time the probability of suitable species of fishes entering the Suez Canal and colonizing the new region increases (Ben-Tuvia, 1972).

9- unsaturated niche

The successful colonization of the Mediterranean by Lessepsian Migrants is in some cases facilitated by their ability to compete with local species on the same resources and by filling an unsaturated niche in their new habitat (Madl, 2011).

Potential migrants are "R-strategist" (Madl, 2011).

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10- The east west gradient

The east west gradient of invasive species was studied by Golani 1998. Time is a factor in westward distribution. At present there is no conclusive explanation why some species continue westward and others do not. A cording to Harmelin-Vivien and Harmelin, 1990; Wootton, 1992 and the combination of temperature regime and thermal tolerance of fish species determines distribution.

11- The Gulf of Suez, the Suez canal and the south eastern Mediterranean Sea are temporary "resting" (acclimation) sites for lessepsian migrants on their way. From the latter site they can spread to other parts of the Mediterranean Sea. The Mediterranean Sea also has its own resting sites which might someday lead to the Atlantic Ocean. Resting sites do not work well in the opposite direction (anti-Lessepsian migration). Much fewer species have crossed the Suez Canal from the Mediterranean Sea to the Red Sea.

Alien marine species of Libya

The list of alien species of Libya Mediterranean was updated by Bazairi *et al*, 2013 (but see Stirn, 1970; Zupanovic and El-Buni, 1982; Al-Hassan and El-Silini, 1999; Lamboeuf, 2000; Ben-Abdallh *et al*, 2005): until now 63 marine aliens species have been recorded along the Libyan coastline, the majority been of Indo-Pacific origin (53%), followed by Red Sea – Indian Ocean species (16%), Red Sea species (14%), Circum-tropical (3%) and less than 5% in the Atlantic (Bazairi *et al*. 2013).

The through studies of Lessepsian fish in Libya by Shakman and Kinzelbach (e.g. Shakman, 1969; Shakman and Kinzelbach, 2007) showed that sixteen Lessepsian fish species, representing 14 families, were found in Libya versus 107 in Tunisia and 232 in Egypt (Katsanevakis *et al*., 2012; UNEP-MAP-RAC/SPA, 2013). The low number in Libya is probably an underestimate due to the limited effort of investigation (Shakman, 1969) the percentage of exotic fish species relative to native fish species decreases from east to west along the Libyan coast. Approximately 50% of the Libyan lessepsian migrants were found along the entire coast, 12.5% in the east and central regions, and 37.5% restricted to the eastern coast (Shakman, 1969). This means that there is a correlation between early arrival and greater abundance which can be explained (Shakman and Kinzelbach, 2007): (a) because the longer a species is in the Mediterranean, the greater the opportunity to build up its population, or (b) by the greater research effort, which was much less intense in the past (Golani, 2002). More than 37% of the recorded Lessepsian fish species in Libya are of commercial value, especially rabbitfish (Shakman, 1969).

***S. luridus* and *S. rivulatus*: General description**

S. luridus and *S. rivulatus* are medium size coastal fishes. Body ellipsoid, oval and compressed. Their maximum lengths are about 30cm for the former and 27 cm for the latter but a more common length for both is 20 cm (Sommer *et al*., 1996; Bariche, 2002). The meristic formulae are: D, XIV+10; A, VII + 8-9; P, 16-17; V, I+3+I
and D, XIV+10; A, VII + 8-10; P, 15-17; V, I+3+I in order (Golani, 2006). Both fishes are often

Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760

Vol.3, No.1, pp.1-20, February 2017

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found in small schools feeding on benthic algae in shallow water with compacted sand substrates. The dorsal and anal fin spines contain venom that is not life-threatening to humans but causes severe pain (FishBase, WRMS).

Distribution of *S. luridus* and *S. rivulatus* in the Mediterranean Sea and in Libya

The two Siganids, *S. luridus* and *S. rivulatus* are widely distributed in the Indian Ocean and the Red Sea, respectively (Bazairi *et al*., 2013). They were initially found in the Levantine basin, but later on they spread to the north and west where they became established in the central Mediterranean and constituted important fisheries (Stirn, 1970; Ktari and Ktari, 1974; Golani *et al*., 2002; Ben Abdallah *et al*., 2003; Streftaris and Zenetos, 2006; Shakman *et al*., 2008). Their spread from the east to different parts of the Mediterranean sea was reviewed by Shakman, 1969; Ismen *et al*., 2015. The two fishes were first recorded in Palestine in 1927 (Steinitz, 1927), then off the coast of Syria in 1931 (Gruvel, 1931). *S. luridus* was recorded in in Libya in 1968 (Stirn,1970; Lamboeuf, 2000; Bazairi *et al*., 2013), in Tunisia in 1971, but crossed the Strait of Sicily only in 2004; it reached the French coast in 2008 (Ktari and Bouhalal, 1971; Ktari and Ktari, 1974; Daniel *et al*., 2009). The most recent record was in the Aegean Sea in 2014 (Ismen *et al*., 2015). The first record of S. rivulatus in Libya was in 1970 (Stirn, 1970).

In Libya *S. luridus* seems to be more present in central and western parts of the littoral (Shakman and Kinzelbach, 2007c) while *S. rivulatus* is mostly common in the east. Both fishes are common in the artisanal catch of Libya but their abundance decrease towards the west. They are captured by trammel and gill nets (Ben Abdallah *et al*., 2003; Galil, 2006; Bazairi *et al*., 2013; Khamis, 2008). The rapid westward spread of the two Siganids can be explained (Bariche *et al*., 2003; Castriota and Andaloro, 2005; Bianchi, 2007; Corsini-Foka *et. al*., 2010; Poloniato *et al*., 2010 ; Por, 2010; Raitsos *et al*., 2010; Marras *et al*., 2015)**:**

- The rise in water temperature of the whole Mediterranean made this sea more receptive to Lessepsian emigrants which are of tropical origin.
- Introduced Siganids, for example *S. luridus*, successfully outcompetes its main indigenous counterpart herbivores (Bariche *et al*., 2004)
- The increased productivity of the Mediterranean as one moves from east towards west favors the westward spread of Lessepsian migrants, especially herbivores.
- Eco-physiological plasticity: Its spawning season is shortened, probably in relation to the varied seawater temperatures that are found in the Mediterranean Sea (Bariche *et al*., 2003; Castriota and Andaloro, 2005).

METHODS

First appearance of *S. luridus* and *S. rivulatus* in the artisanal catch from the eastern coast of Libya Mediterranean Sea was investigated by two methods:

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i- By questionnaires filled by 50 fishers

These fishers were located in the major fish landing sites of the eastern coast of Libya. The study area (Figure 1) extends from Burde in the east of Libya coast to Breka in the west, an approximately 500km shore line. The landing sites investigated were Tobrok, Ein Ghazala, At Timimi, Ras Ettin, Darna, Khalij Bumba, Susah, Benghazi. The questionnaire was filled by six to seven fishers present in each of these sites. Most fishers questionnaired were 60 years old and above. Names, locations, addresses and cell phone numbers of the chosen fishers were provided by “Darna Fishers Trade Union”, “Tobrok Fishers Trade Union” and “Office of Marine Resources in Darna”. These institutions also helped in delivering the questionnaires to individual fishers and in retrieving them after been filled. The questionnaire contained the following questions:

- What is the name of the area you fish in or used to fish in?
- When did you first see *S. luridus* and *S. rivulatus* in your catch?
- What gear is most effective in catching *S. luridus* and *S. rivulatus*?
- At what depth is *S. luridus* and *S. rivulatus* are most common?
- Give average length and weight of *S. luridus* and *S. rivulatus.*
- Rate abundance of *S. luridus* and *S. rivulatus* in your catch: (-) rare, (1) present, (2) common, (3) abundant.

The fishers, however, stipulated that we do not mention any of their personal information including names and ages in our study.

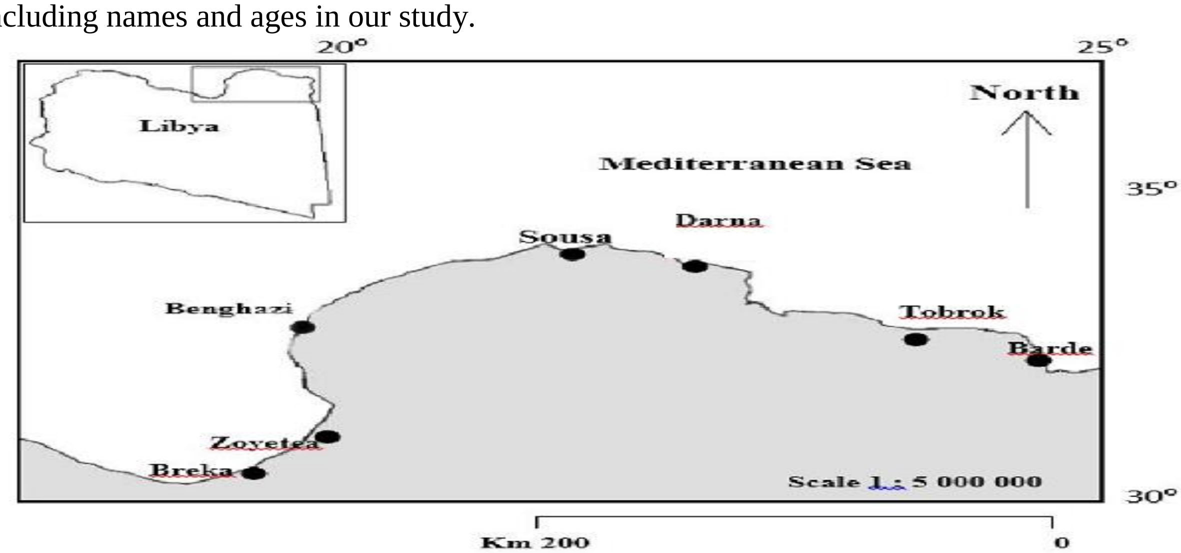


Figure 1. Map of the shore line of the eastern coast of Libya (the study area)

ii- **By investigating reports and records available in old files of** “Office of Marine Resources in Darna”, “Darna Fishers Trade Union” and “Tobrok Fishers Trade Union” for first mentioning of *S. luridus* and *S. rivulatus,* and on consultations with members of these institutions. The activities of these three institutions covers all the eastern coast of Libya (the study area).

RESULTS

Records of first appearance of *S. luridus* and *S. rivulatus* in the artisanal catch of the eastern coast of Libya is documented in Tables 1 to 5. Data presented in these tables were compiled by integrating data obtained from the questionnaire with that obtained from the "Office of Marine Resources in Darna" and the Fishers Trade Unions of Darna and Tobrok. The two Siganids were first observed in Libya in Tobrok in 1950, in Darna in 1954 and in Benghazi in 1960 (Table 1). These three sites are the most prominent fishing and landing sites of the eastern coast of Libya. The two new comers appeared simultaneously in the catch for the first time. Elderly fishers from Tobrok, Darna and Benghazi still recall their painful stings when they attempted to remove them from their nets and lines, the main fishing gears in use at that date. Initially they were called "Alsamakah um Shoak" meaning in Arabic "the fish with spines" and were not marketed but thrown away. However, after their numbers increased in the catch they became acceptable by local consumers; *S. luridus* soon became known locally as "Batata soada" (Arabic for "black potatoes") and *S. rivulatus* as "Batata baida" ("white potatoes").

Table 1. Records of first appearance of *S. luridus* and *S. rivulatus* in the studied sites.

location	**Geographic coordinates**		**Fishing gear**	**Record date**
	Latitude ºN	**Longitude ºE**		
Tobrok	32°10'75.92	23º98'76.28	Gill net	1950 – 1960
Ein Ghazala	32º12'30.23	23°16'58.33	small hooks, Gill net	1967-1975
At Timimi	32º20'25.68	23º5'28.45	Hand line, gill net	1970 -1980
Ras Ettin	32º31'35.08	23º6'13.01	Gill net	1960 -1980
Darna	32º46'3.61	22º39'8.21	Gill net	1954 - 1960
Khalij Bumba	32 º 33' 13.5	23° 05' 57.2	small hooks	1990
Susah	32º54'13.30	21º58'2.15	Gill net	1970

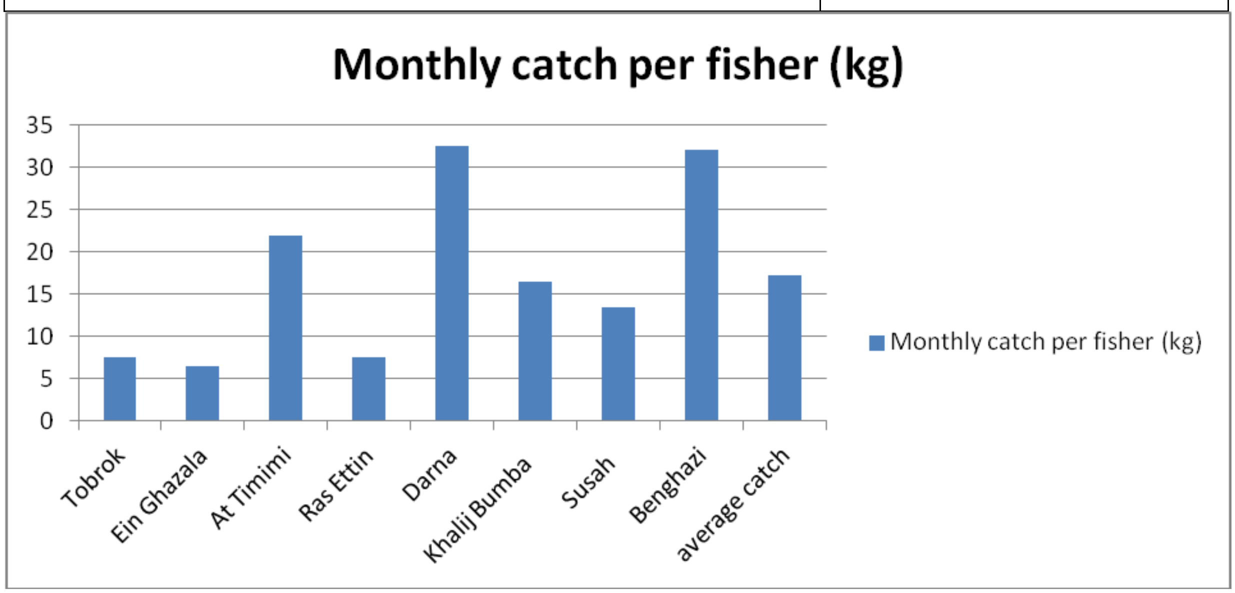
Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760

Benghazi	32º5'28.05	20º2' 30.89	Gill net	1960 - 1965

Estimates of monthly catch from the two Siganids per fisher per fishing site (Table 2 and Figure 2) shortly after they established themselves in the eastern coast ranged between 2 to 60 kg (average = 17.25 kg) with *S. luridus* been more abundant than *S. rivulatus* (Table 3 and Figure 3). Both fishes are residents of shallow coastal water (Table 4 and Figure 4), 1 to 8 meters deep (average = 4.25 meters).

Table 2. Estimates of monthly catch from *S. rivulatus* and *S. luridus* per fisher per site shortly after their introduction.

Fishing/Landing site	**Monthly catch in kg per fisher from *S. luridus* and *S. rivulatus***	
	Average	**Range**
Tobrok	**7.5**	**5 - 10**
Ein Ghazala	**6.5**	**3 - 10**
At Timimi	**22**	**4 - 40**
Ras Ettin	**7.5**	**6 - 9**
Darna	**32.5**	**5 - 60**
Khalij Bumba	**16.5**	**3 - 30**
Susah	**13.5**	**2 - 25**
Benghazi	**32**	**4 - 60**
Grand average catch in kg/month/fisher/site	**17.25**	**2 - 60**



Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760

Figure 2. Estimates of monthly catch from *S. rivulatus* and *S. luridus* per fisher per site shortly after their introduction.

Table 3. Relative abundance of S. luridus and S. rivulatus in the studied sites. (-) rare, (1) present, (2) common, (3) abundant

Fishing/Landing site	**Relative abundance**	
	S. luridus	***S. rivulatus***
Tobrok	**2**	**1**
Ein Ghazala	**2**	**2**
At Timimi	**3**	**2**
Ras Ettin	**3**	**2**
Darna	**2**	**-**
Khalij Bumba	**2**	**1**
Susah	**3**	**-**
Benghazi	**1**	**2**
Grand average length	**3.35**	**1.25**

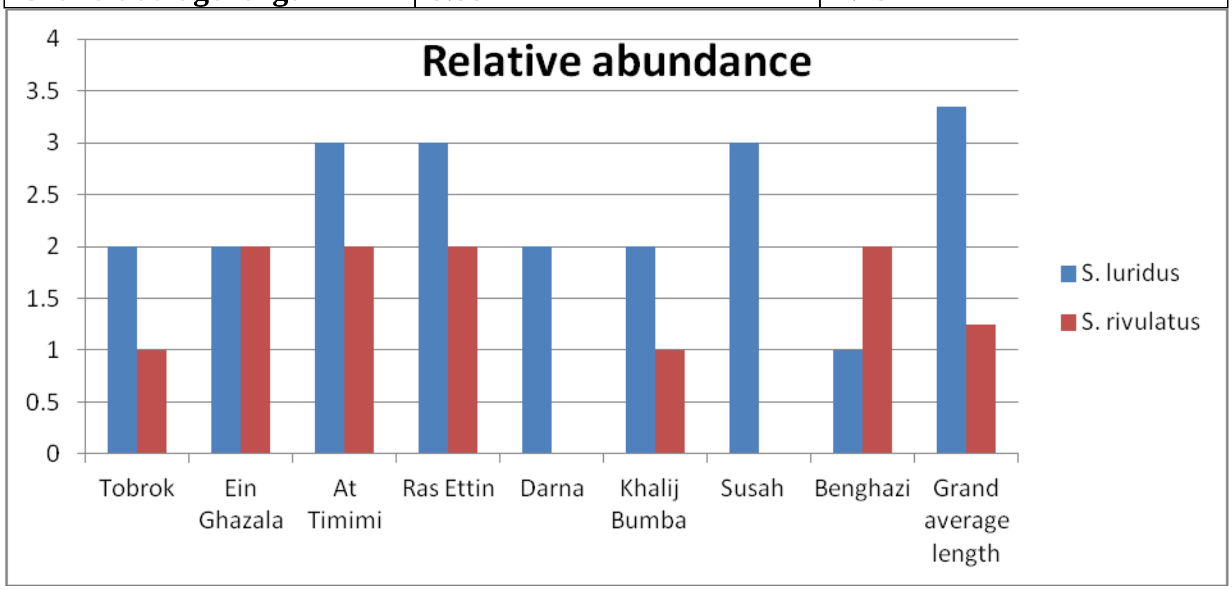


Figure 3. Relative abundance of *S. luridus* and *S. rivulatus* in the studied sites.

Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760

Vol.3, No.1, pp.1-20, February 2017

Published by European Centre for Research Training and Development UK (www.eajournals.org)

Table 4. Depth of occurrence of *S. luridus* and *S. rivulatus* in the studied sites.

Fishing/Landing site	**Depth of *S. luridus* and *S. rivulatus* in m**	
	Average	**Range**
Tobrok	**4**	**3 - 5**
Ein Ghazala	**4**	**1 - 7**
At Timimi	**4.5**	**1 - 8**
Ras Ettin	**6**	**4 - 8**
Darna	**2.5**	**2 - 3**
Khalij Bumba	**3**	**2 - 4**
Susah	**4.5**	**4 - 5**
Benghazi	**5.5**	**4 - 7**

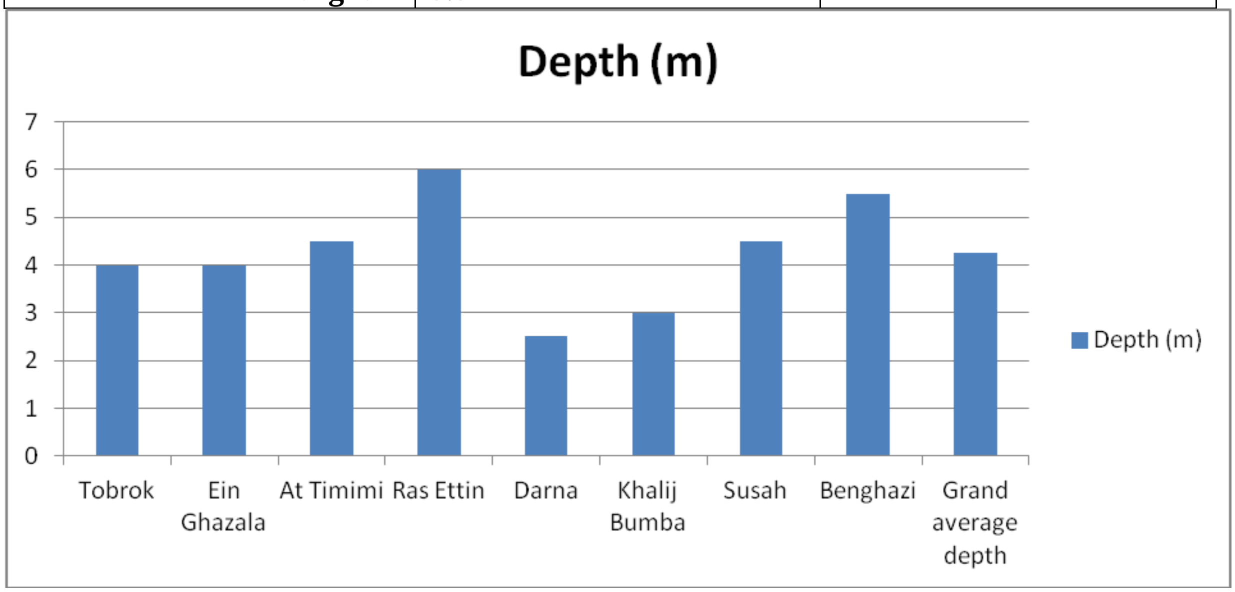


Figure 4. Depth of occurrence of *S. luridus* and *S. rivulatus* in the studied sites.

Fishers did not give separate fish lengths for *S. luridus* and *S. rivulatus* when first observed in the catch but gave a common average estimates for both fishes (Table 5 and Figure 5). Common lengths of *S. luridus* and *S. rivulatus* ranged between 10 to 40 cm with an average of 23.44 cm.

Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760

Table 5. Average total lengths of *S. luridus* and *S. rivulatus* in the studied sites. The fishers gave a common length estimate for both fishes. They were not able to give separate estimates for each fish.

Fishing/Landing site	**Total lengths of *S. luridus* and *S. rivulatus* in cm**	
	Average	**Range**
Tobrok	25	15 - 35
Ein Ghazala	20	10 - 30
At Timimi	25	15 - 35
Ras Ettin	25	20 - 30
Darna	22.5	15 - 30
Khalij Bumba	25	20 - 30
Susah	25	15 - 35
Benghazi	20	10 - 30
Grand average length	23.44	10 - 35

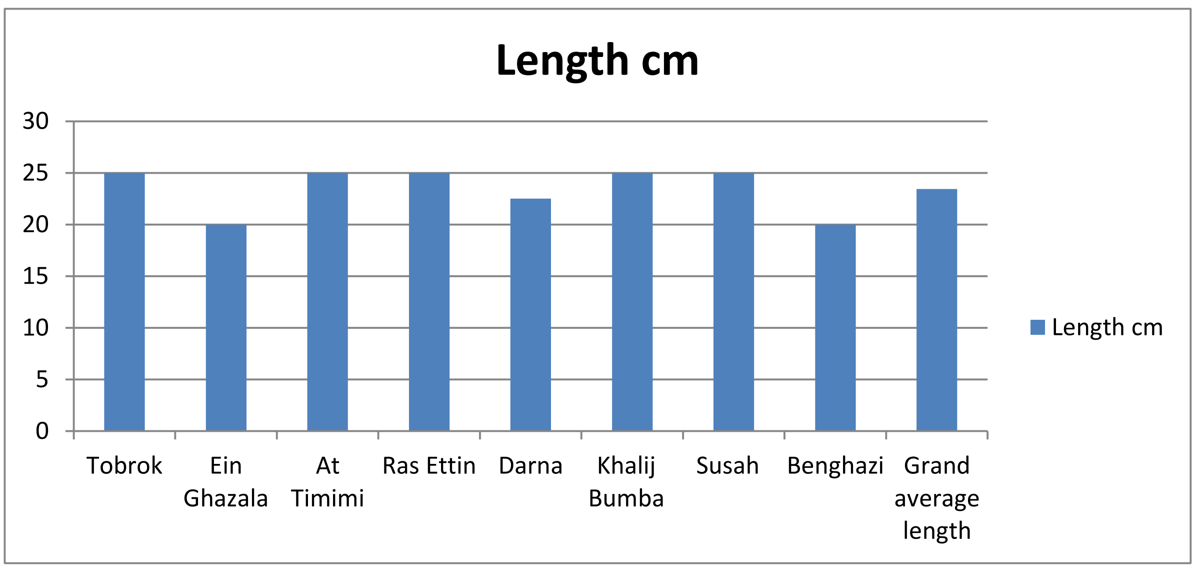


Figure 5. Average total lengths of *S. luridus* and *S. rivulatus* in the studied sites. The fishers gave a common length estimate for both fishes.

DISCUSSION

Establishing dates of first introduction of lessepsian migrants into different parts of Mediterranean Sea is important for studding biology, ecological relationships and acquired genetic variations of the organisms in their new habitat (Giacomo, 2014). Golani, 2010, stated

Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760

that frequently, invasive species are discovered after they have already been in the new habitat for extended period of time making it difficult to determine how the invasion started and when. According to Stirn, 1970; Lamboeuf, 2000; and Bazairi *et al*., 2013 *S. luridus* and *S. rivulatus* were recorded in in Libya for the first time in 1968 and 1970 in order. However, the present study shows that the two Siganids invaded Libya at a much earlier date: in Tobrok in 1950 and in Darna in 19954. Questionnaire is a powerful technique for establishing date of first entry. However, this technique is limited by the scarcity in elder fishermen who are inventory of information of the old times but are unfortunately eliminated through time. This may explain the much more recent dates of introduction into Ein Ghazala (1967), At Timimi (1970), Ras Ettin (1960), Khalij Bumba (1990), Susah (1970) and Benghazi (1960).

From the present study it appears that the two Siganids can grow into sizable populations and contribute to the catch shortly after they introduce themselves into a new site, with *S. luridus* becoming the more abundant one; more than twice abundant than *S. rivulatus*. This is in agreement with Shakman *et al*., 2008 who mentioned that the two species are abundant in the rocky shallow Libyan coasts and contribute significantly to the catch. One reason for the prosperity of these two herbivores is the richness of the Libyan coast in seaweeds and sea grass; another reason is their ability to compete with local herbivores.

Both Siganids inhabit shallow coastal waters: 1- 8 meters (average = 4.25 meters) where they are caught by nets and lines by fishers using boats or wadding.According to the questionnaired fishers the total length of the two species at the time they were practicing fishing ranged between 10 to 35 cm, with an average of 23.44 cm. Thirty five centimeters is more than the length recorded presently for the two Siganids in the international literature. Sommer *et al*., 1996; Bariche, 2002, 2005, reported that maximum lengths were 28 cm for *S. luridus* and 30 cm for *S. rivulatus* from the Mediterranean Sea and the Red Sea but a more common length for both is 20 cm.

Acknowledgements
Thanks are expressed
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Acknowledgements

Thanks are expressed to "Darna Fishers Trade Union", "Tobrok Fishers Trade Union" and "Office of Marine Resources in Darna" for helping in filling the questionnaires by fishers, availing to us relevant documents and records of their institutions and the productive discussions and suggestions they made.

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Print ISSN: ISSN 2397-7507, Online ISSN: ISSN 2397-7760