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Abundance and Diversity of Early Stages of Shorefishes in Jeddah, Red Sea, Saudi Arabia

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Abstract. The composition of fish larval community was studied in Jeddah coast from January to December 2020. Larvae were collected from Obhur Creek and Shaara Bay on Jeddah coast twice a month using light traps that deployed for 2 hours after sunset at the new moon and the full moon. A total of 40 samples yielding 5717 larvae with an average of 1429 larvae/2h belonging to 32 fish families were collected from the two bays. The highest abundance was recorded in Shaara Bay (3413 larvae forming 59.7% of total larvae), whereas Obhur Creek recorded 2304 larvae (40.3% of total larvae). During the present work, the most abundant fish families were Clupeidae, Gobiidae, Scaridae, Pomacentridae, and Blennidae that collectively constituted about 86% of the total larvae. Family Clupeidae was the most dominant one constituted approximately 57% of total larvae followed by Gobiidae (1093 larvae) that formed 19.1% of the total larvae. Much more larvae and more families were collected during the new moon suggesting that settlement of reef fishes mostly takes place in the darker new moon than full moon periods.

Keywords: Fish larvae, light trap, settlement, Red Sea.

1. Introduction

The Red Sea is unique water, hosting some of the most productive and diverse coral reefs. Coral reefs are one of the world's most diverse ecosystems, with fish as an essential component (Maaty *et al*., 2021). Marine fish stocks are essential in the world food system and are particularly important for many of the poorest people in the globe (Hilborn *et al*., 2020; Maaty *et al*., 2021). The study of coral reef fish reproduction, as well as the ecology and biology of their early life stages, is critical for fish stock management (Fuiman 2002; Abu El-Regal 2013, 2017; Abu El-Regal *et al*., 2019). It is also important to understand population dynamics and ecological functioning (Sale 2004). However, the great biodiversity of coral reef fish and the large number of fish larvae recruited make it a difficult area of research. (Robitzsch and Berumen 2020). The Red Sea is a closed and relatively, isolated tropical sea, with little change in environmental conditions. The Red Sea system has very few atmospheric changes such as rainfall and cloudy days and lacks any significant tides 20 cm at its center (Pugh *et al.*, 2019). Fish eggs and larvae represent the meroplanktonic stages of fishes that are found mainly in the upper 200 meters of the water column and can be collected by planktonic gears. They can be utilized to determine the regional distribution of fishes since they have a wider range than their reef stationary adult stages (Leis 1986; Leis and McCormick 2002; Sale 1980, 2002). They are also used to estimate the commercial fishes' spawning stock, spawning seasons, and spawning sites. Because a simple plankton net may sample numerous species across large distances, determining the quantity of eggs and larvae in an area is generally less expensive

than collecting the adults. Furthermore, the plankton samples contain not only fish larvae but also a portion of their prospective zooplanktonic prey and predator (Smith and Richardson, 1977). Zooplankton is the first food item for virtually all fish larvae, as well as many plankton-eating adult fishes, when they transition from their yolk sacs to external feeding. Natural (e.g., current fluctuations, climate change, *etc*.) and human (e.g., growing pollution, river dams, *etc*.) influences can alter zooplankton, and hence fish larvae survival, and thus fisheries resources. The behavior of reef fish larvae may affect general trends in the dispersal and recruitment of reef fish. The orientation cues of the larvae, the swimming ability, and the vertical distribution of fish larvae in the water column may influence their ability to return to the natal reef. The horizontal distribution of fish larvae has been extensively investigated (Stobutzki and Bellwood 1994, 1997; Leis and Carson-Ewart 1997, 1998; Fisher *et al*., 2000; Fisher and Bellwood 2001). On the other hand, the vertical distribution and migration behavior of reef fish larvae has received less attention (Leis 1991). Assessing the early life cycle requires efficient sampling methods for fish larvae; different gears work for different habitats and often choose different sizes or life stages.

Despite a large number of various plankton nets and trawls, opening-closing mechanisms for discrete depth hauls, and environmental sensing systems, the open water ichthyoplankton methods are poorly suited over complex reef structures because rocks and corals are dangerous for research vessels and dragged sampling gear. Different methods are used for sampling fish larvae around complex reef environments. These methods include diver-steered plankton tows (Marliave 1986), diver-pushed nets (Smith *et al*., 1987), visual censuses (Kingsford and Choat 1989), free-fall nets (Kobayashi 1989), and night-lighting (Dennis *et al*., 1991; Victor 1991). Of these, towing nets and light traps have been used to describe the vertical distribution of reef fish larvae in the field. The study of the vertical distribution of larval fishes around Lizard Island (Leis 1986, 1991) found that reef fish exhibit taxon-specific vertical distribution patterns that can change during ontogenesis. In the Red Sea, towed plankton nets of different mesh size have been extensively used to study the abundance and distribution of fish larvae around reefs (Abu El-Regal *et al*., 2008; Abu El-Regal *et al*., 2019; Abu El-Regal 2013). However, the problem with towed net methods is that most larvae were small and preflexion while the late-stage larvae, most likely to return to reefs, are always under-estimated (Doherty 1987; Choat *et al*., 1993; Abu El-Regal, 2000, 2008; Leis *et al*., 2002). Information about the vertical distribution of postlarvae will lead to a better understanding of the settlement processes and consequently the recruitment success of reef fish.

Night lighting (catching fish larvae by light at night) is an unusual collecting technique that is particularly effective at capturing larvae over the reef right before settlement. Although no convincing explanation exists for this behavior, competent fish larvae are greatly attracted to lights at night, a trait they share with moths and squid (Victor, 1991). Light traps have been extensively used near reefs for sampling larvae reef fish while settling to the reef in the Red Sea (Froukh 2001; Fricke and Abu El-Regal 2017a&b; Abu El-Regal and Kon 2019; Robitzsch and Berumen 2020). They have been used to investigate the vertical distribution of reef fish larvae in the field (Doherty and Carleton 1997; Hendriks *et al*., 2001). These studies have shown that there are clear differences between taxa although many taxa are abundant in the surface. Little is known about the vertical distribution of tropical shore fish larvae (Leis 1978, 1986, 1991; Liew 1983; Robison 1985). These studies all agree that there are taxon-specific vertical distribution patterns that appear to have little spatial or temporal variations, except for day/night fluctuations. Since a few species were studied in more than one study, it is uncertain whether the trends are the same

for related taxa. The purpose of this study is to examine the settlement of larvae of shore fish (mainly reef fish) in the relatively shallow (30 m), sheltered waters of two lagoons during the new and full moons.

2. Material and Methods

2.1 Study Sites

Plankton samples were collected from two coastal bays (Obhur Creek and Shaara Bay) using a light trap on the Jeddah coast, Saudi Arabia, Red Sea. Obhur Creek (21° 42′ 30.8″ N, 39° 05′ 48.3″ E) is a 9.2 km long natural cut in the coralline limestone of the Tihama coastal plain that flows into the Red Sea through a narrow 264 m wide exit at the south-western end (Basaham and El-Sayed 2006). It has a depth of around 50 meters at the mouth, which rapidly diminishes towards the north-eastern tip until it is less than 6 meters deep at the terminus (Basaham and El-Shater 1994). It is a popular tourist destination that attracts a large number of tourists each year and offers mooring services for yachts as well as leisure activities (Fig. 1). The second sampling site is Shaara Bay, which is roughly 100 kilometers south of the first (21° 05′ 28.3″ N and 39° 05′ 48.1″E). This location is a coastal coral reef lagoon with a short fringing reef separating it from the beach (Fig. 2). The lagoon's depth ranges from one to five meters. The lagoon has a soft bottom with a few spots of seagrass and coral.

2.2 Fieldwork

This study was conducted for a year (12 months, 2020), where samples were collected twice a month at the new moon and the full moon from Obhur Creek Bay and Shaara Bay. The net was deployed in the water about two meters from the shoreline at night an hour after the sunset for two hours (6:00 pm) yielding two samples/night. The plankton samples were fixed in 90% ethanol immediately after collection for further examination in the laboratory. Due to the Covid-19 pandemic, it was difficult to take samples in April and May.

2.3 Laboratory Work

Fish larvae were sorted under a stereomicroscope then preserved in 90% ethanol. The sorted larvae were separated into their respective families and were identified to the lowest taxon and the larvae of each taxon were enumerated and then photographed under the microscope using AMOS camera. The identification of larvae was based on the literature and the expertise of other scientists, because the literature on the Red Sea fish larvae is very rare, we had to use the closest Indo-Pacific larval fish guides. The literature used for the identification of larvae in this study were Leis and Rennis (1983), Leis and Trnski (1989), Leis and Carson-Ewart (2002), Abu El-Regal (1999, 2017), Leis and Carson-Ewart (2004) and Froukh (2001).

3. Data Analysis

The monthly abundance of the larvae of each taxon was the mean of the standardized number of larvae at all positive stations for individual species. The univariate statistics were done in SPSS 22, using ANOVA to determine differences in number of individuals and number of species between months and sites. All data were tested for homogeneity of variance. Where the samples were not homogeneous, data were either transformed or the non-parametric Kruskal-Wallis test was used (Zar, 1999; Dytham, 2003). The multivariate technique cluster analysis, to determine similarities between sites and months, and diversity indices (species richness, the evenness and Shannon-Wiener), were calculated using PRIMER (Plymouth Routines in Multivariate Ecological Research) v 5.2. Similarity percentage analysis (SIMPER) was used to determine the dominant taxa in each seasonal grouping. All graphs were illustrated using GraphPad prism 8.

Fig. 1. Obhur Creek where the fish larval samples were taken by light trap.

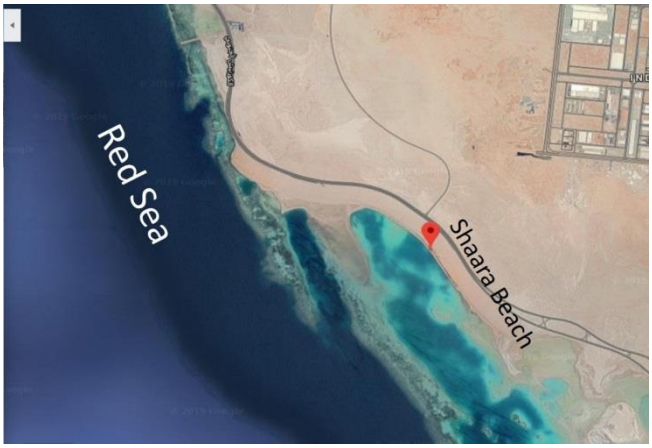

Fig. 2. Shaara Bay where fish larval samples were taken by light trap.

4. Results

4.1 Total Number of Fish Larvae

Throughout a year of sampling, a total of 5717 larvae with an annual average of 1429 larvae/2h belonging to 32 fish families were collected from the two bays. The highest number of fish larvae (3413, 59.7% of total larvae) was recorded from Shaara Bay, whereas Obhur Creek recorded 2304 larvae that constituted 40.3% of all larvae (Table 1). Regarding the monthly distribution in both sites, the highest number of larval fish was taken in July with 2486 larvae followed by September (631), whereas the lowest one was collected in December with 141 larvae (Fig. 3-4). Regardless to site, the highest number of fish larvae from both sites was found during the new moon with 3618 larvae (63.3% from the total fish larvae) compared to 2099 larvae (36.7%) during the full moon (Fig. 5-8). Furthermore, the maximum abundance in a single sample was observed in July at Shaara Bay at the new moon with 1647 larvae/2h (constituted 28.8% of total larvae), followed by Shaara Bay in the same month at the full moon (518 larvae/2h, 9% of all larvae). On the other hand, the minimum abundance of fish larvae was recorded in June at Obhur Creek at the new moon with only three larvae (0.05%). The analysis of variance (one-way ANOVA) showed that there is no significant difference between sites, months, or moon phases regarding the abundance and number of fish families. However, the two-way ANOVA showed that abundance and number of fish families varied significantly at phase moon in certain months. Moreover, abundance and number of fish larval families varied significantly in some sites ate certain months.

In general, the highest number of fish larvae families was collected from Shaara Bay at the new moon (24 families) followed by Obhur Creek Bay at the new moon (20 species). On the other hand, the lowest number of fish larval families was found in Shaara at a full moon and Obhur Creek full moon with only 15 and 16 families respectively (Table 2, Fig. 8). The highest number of fish families was recorded in March with 18 families, whereas the lowest number of families was found in January (six families). Shaara Bay harbored the highest number of families in March at the new moon (13 families) and in August at the full moon (10 species) (Table 2).

4.2 Diversity Indices

The highest richness of species fish larvae was observed in Shaara Bay (3.0) at the new moon, whereas the lowest richness of species fish larvae was recorded in Shaara Bay (2.0) at the full moon. The evenness reached its maximum in Shaara Bay (0.6) at the full moon, and its minimum value in Shaara Bay (0.3) at the new moon. The highest Shannon-Wiener diversity index was recorded in Shaara Bay (1.5) at the full moon, followed by Obhur Creek (1.4) at the new and full moon (Fig. 9). On the other hand, the Shannon index attained its lowest value in Shaara new moon (0.9). Richness values varied from 0.95 in January to 2.82 in March and the evenness varied between the minimum value in September (0.27) to the maximum value in December (0.75). The Shannon diversity index attained its maximum in August and December (1.81), and its lowest value in September (0.60) (Fig. 10).

4.3 Species Composition

The fish larval community collected during the present study was dominated by larvae of the family Clupeidae where they of constituted approximately 57% of all larvae. The most abundant five fish families, Clupeidae, Gobiidae, Scaridae, Pomacentridae, and Blennidae constituted about 86% of all larval fish collected during the present work. Gobiidae was the second most abundant family with 1093 constituting 19.1% of all larvae. With 249 larvae, family Scaridae was the third most abundant group (4.4%). On the other hand, larvae of the family Bythitidae showed the lowest abundance with two larvae (0.03%) (Tables 3 & 4; Fig. 11-13).

Table 1. Monthly variation in total number of fish larvae at different sites.

Month	Shaara New Moon	Shaara Full Moon	Obhur New Moon	Obhur Full Moon	Total
Jan	58	10	81	43	192
Feb	16	173	8	19	216
Mar	253	20	116	19	408
Jun	45	0	305	3	353
Jul	1647	518	267	54	2486
Aug	19	116	185	97	417
Sep	14	7	61	549	631
Oct	97	94	63	51	305
Nov	174	37	92	265	568
Dec	101	14	16	10	141
Total	**2424**	**989**	**1194**	**1110**	**5717**

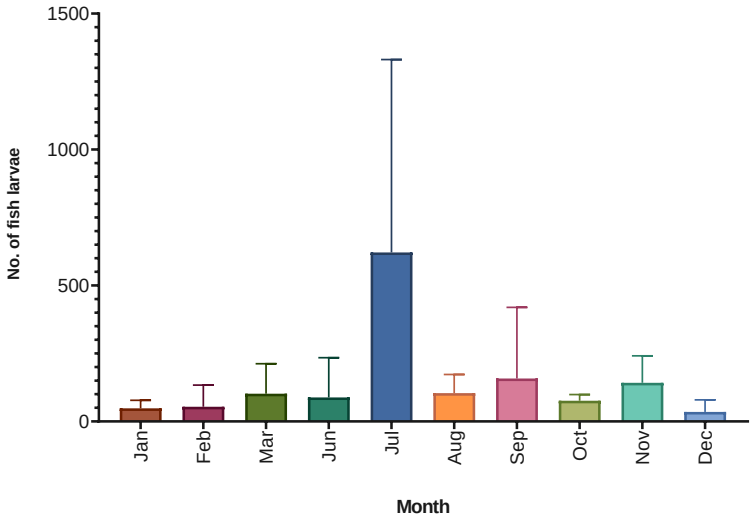

Fig. 3. Monthly average number of fish larvae collected by light trap from both studied sites.

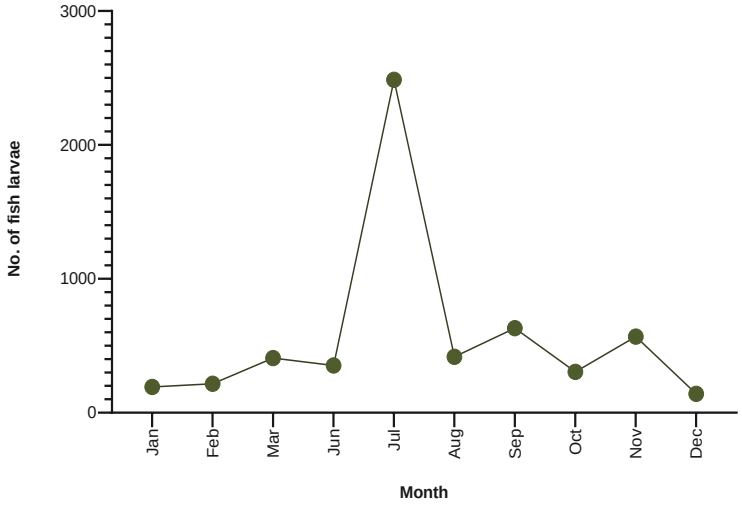

Fig. 4. Average of monthly number of fish larvae collected from both studied sites.

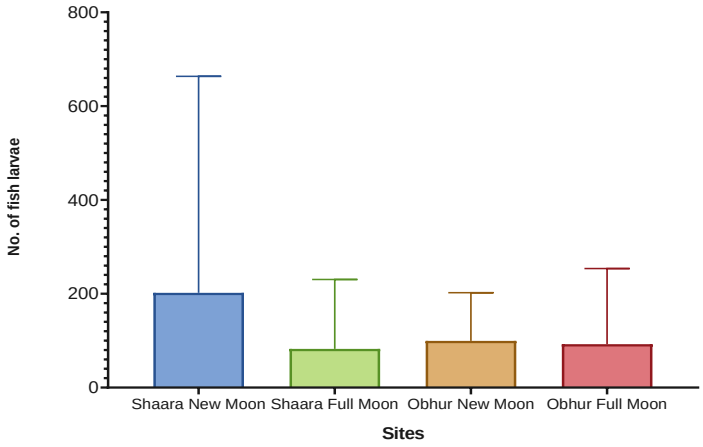

Fig. 5. Average number of fish larvae collected by light trap from both studied sites.

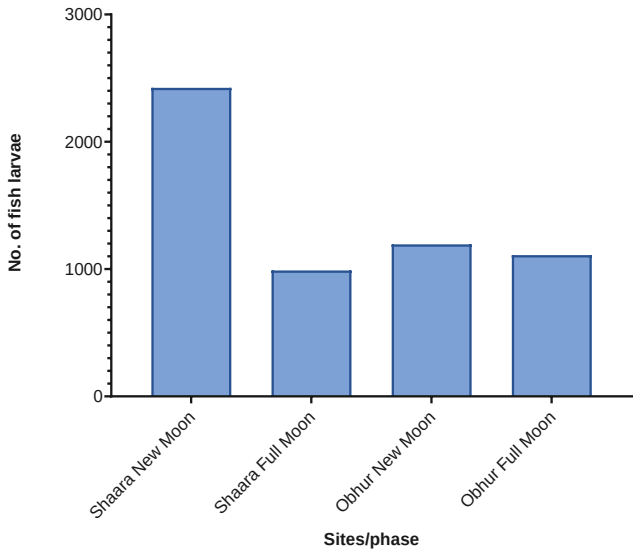

Fig. 6. Total number of fish larvae collected from different sampling sites.

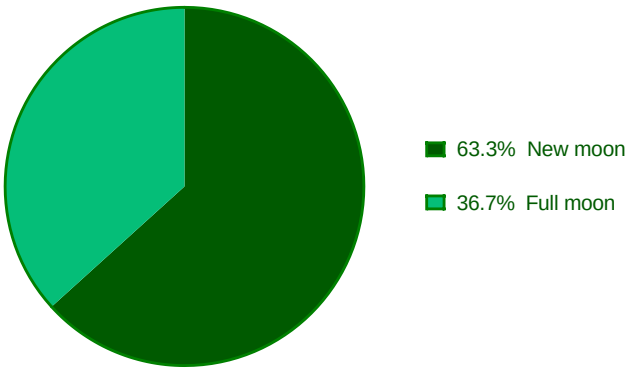

Fig. 7. Percentage contribution of fish larvae in both new and full moon.

Table 2. Total number of families of fish larvae at different sites and month.

Month	Shaara New Moon	Shaara Full Moon	Obhur Creek New Moon	Obhur Creek Full Moon
Jan	4	2	2	4
Feb	3	2	3	4
Mar	13	5	6	2
Jun	5	0	8	1
Jul	2	5	6	5
Aug	4	10	6	6
Sep	2	3	4	5
Oct	8	4	3	6
Nov	9	3	8	9
Dec	7	3	5	4

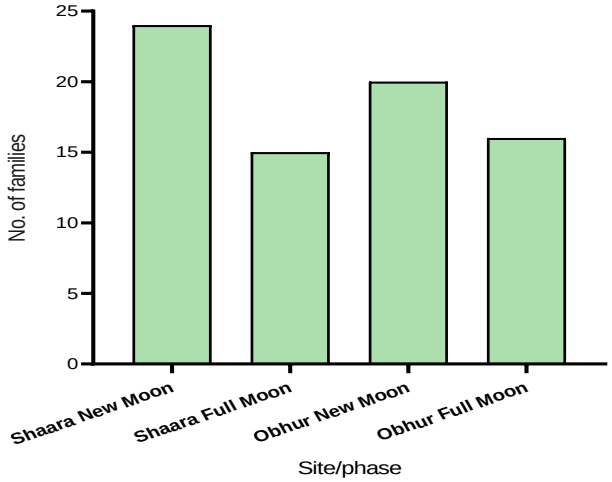

Fig. 8. Number of families in the different sites and moon phases.

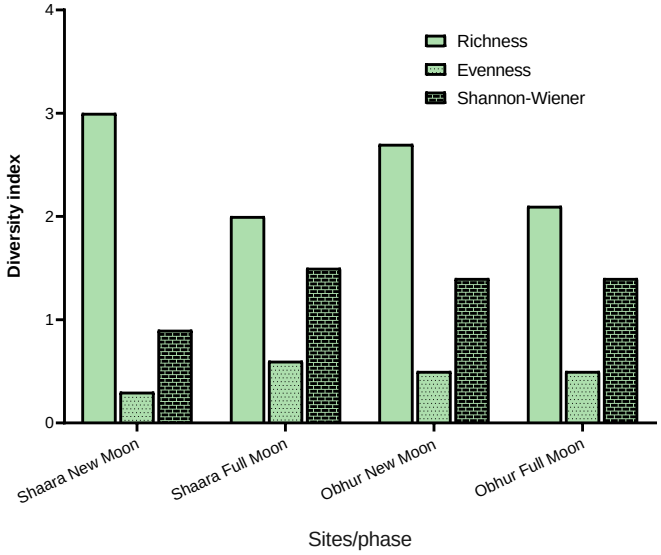

Fig. 9. Variations of diversity index; richness, evenness and Shannon-Wiener at different sites in Jeddah, Red Sea.

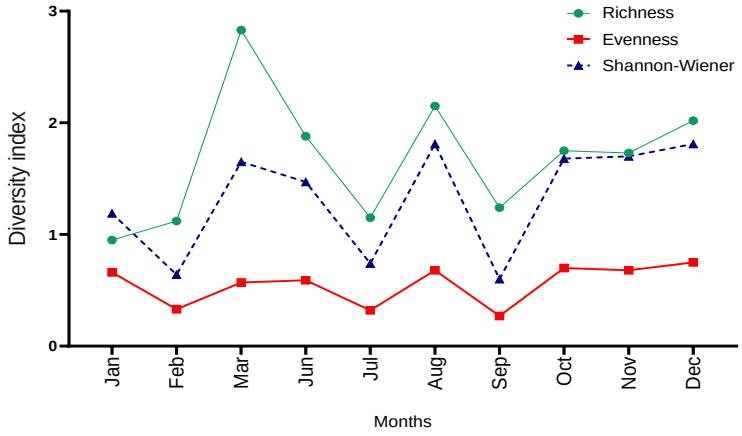

Fig. 10. Monthly variation of diversity index; richness, evenness and Shannon-Wiener of fish larvae.

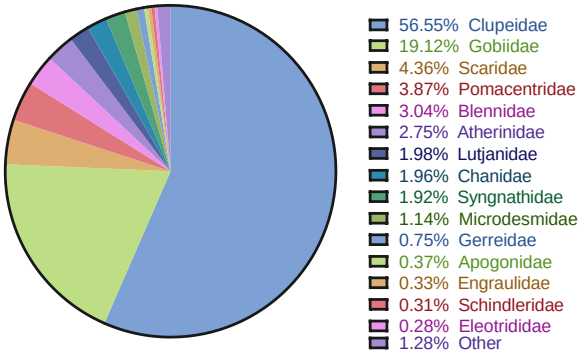

Fig. 11. Percentage contribution of fish families to the larval fish community in Jeddah.

Table 3. Monthly number of fish larvae recorded at different sites in the area of study.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Clupeidae	83	178	158	-	-	61	1984	111	512	44	62	40	3233
Gobiidae	80	27	142	-	-	134	260	98	104	90	130	28	1093
Scaridae	3	2	1	-	-	11	0	7	0	8	217	0	249
Pomacentridae	4	5	5	-	-	120	4	0	2	3	78	0	221
Blennidae	6	1	7	-	-	1	135	12	4	0	6	2	174
Atherinidae	0	0	12	-	-	0	2	53	1	84	5	0	157
Lutjanidae	0	0	2	-	-	0	3	0	5	61	42	0	113
Chanidae	0	0	0	-	-	0	0	105	0	3	4	0	112
Syngnathidae	0	2	2	-	-	10	91	4	0	0	1	0	110
Microdesmidae	0	0	0	-	-	1	0	3	0	2	19	40	65
Gerreidae	0	0	43	-	-	0	0	0	0	0	0	0	43
Apogonidae	0	1	7	-	-	1	2	2	0	3	0	5	21
Engraulidae	0	0	9	-	-	0	1	6	0	3	0	0	19
Schindleriidae	16	0	2	-	-	0	0	0	0	0	0	0	18
Eleotrididae	0	0	7	-	-	0	0	0	0	4	0	5	16
Mugilidae	0	0	0	-	-	0	0	0	0	0	0	10	10
Haemulidae	0	0	1	-	-	0	0	8	0	0	0	0	9
Soleidae	0	0	0	-	-	8	0	0	0	0	0	0	8
Albulidae	0	0	2	-	-	1	4	0	0	0	0	0	7
Pempheridae	0	0	5	-	-	0	0	0	0	0	0	1	6
Belonidae	0	0	0	-	-	0	0	0	0	0	0	6	6
Mullidae	0	0	0	-	-	0	0	0	0	0	3	0	3
Labridae	0	0	1	-	-	0	0	1	1	0	0	0	3
Carangidae	0	0	2	-	-	0	0	0	0	0	0	0	2
Acanthuridae	0	0	0	-	-	0	0	0	1	0	0	0	1
Synodontidae	0	0	0	-	-	0	0	0	0	0	1	0	1
Gobiesocidae	0	0	0	-	-	0	0	0	0	0	0	1	1
Hemiramphidae	0	0	0	-	-	0	0	1	0	0	0	0	1
Scorpaenidae	0	0	0	-	-	0	0	0	1	0	0	0	1
Sphyraenidae	0	0	0	-	-	0	0	6	0	0	0	0	6
Tripterygiidae	0	0	0	-	-	3	0	0	0	0	0	3	6
Bythitidae	0	0	0	-	-	2	0	0	0	0	0	0	2
Total	**192**	**216**	**408**	**-**	**-**	**353**	**2486**	**417**	**631**	**305**	**568**	**141**	**5717**

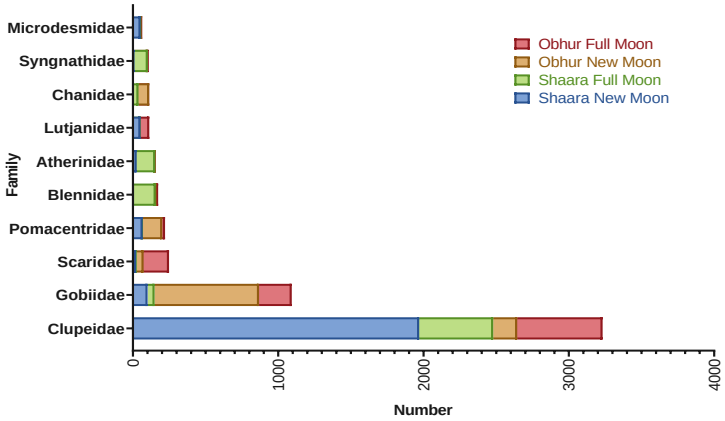

Fig. 12. Abundance and distribution of the most abundant fish families at sites and moon phase.

Table 4. Total number of different families of fish larvae at studied sites.

Family	Shaara New Moon	Shaara Full Moon	Obhur New Moon	Obhur Full Moon	Total
Clupeidae	1970	510	165	588	3233
Gobiidae	101	49	718	225	1093
Scaridae	22	5	47	175	249
Pomacentridae	67	3	132	19	221
Blennidae	8	149	6	11	174
Atherinidae	26	128	2	1	157
Lutjanidae	52	0	3	58	113
Chanidae	5	34	73	0	112
Syngnathidae	11	92	0	7	110
Microdesmidae	53	4	3	5	65
Gerreidae	43	0	0	0	43
Apogonidae	9	0	9	3	21
Engraulidae	12	6	1	0	19
Schindleridae	1	0	17	0	18
Eleotrididae	5	0	7	4	16
Mugilidae	10	0	0	0	10
Haemulidae	0	2	2	5	9
Soliedae	8	0	0	0	8
Albulidae	2	2	2	1	7
Pempheridae	3	3	0	0	6
Belonidae	6	0	0	0	6
Mullidae	2	0	1	0	3
Labridae	0	0	2	1	3
Carangidae	2	0	0	0	2
Acanthuridae	0	0	1	0	1
Synodontidae	1	0	0	0	1
Gobiesocidae	0	0	1	0	1
Hemirhamphidae	0	1	0	0	1
Scorpaenidae	0	0	0	1	1
Sphyraenidae	5	1	0	0	6
Tripterygiidae	0	0	0	6	6
Bythitidae	0	0	2	0	2
Total	**2424**	**989**	**1194**	**1110**	**5717**

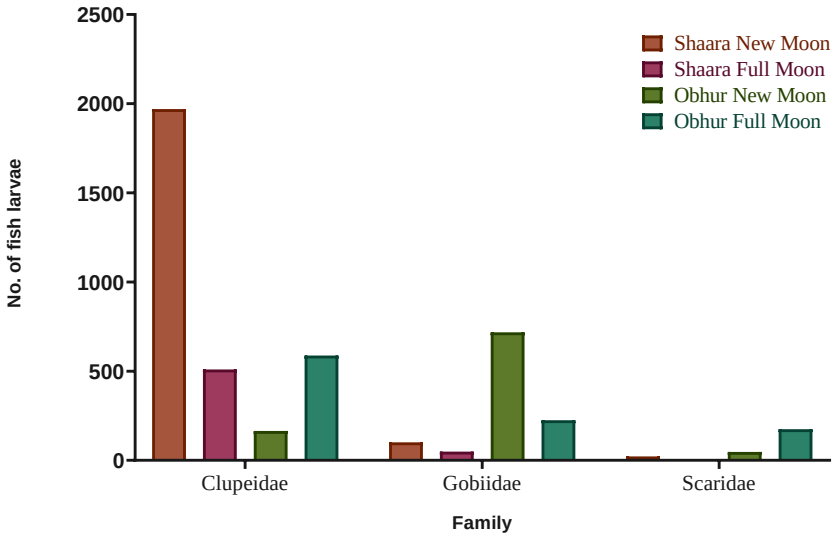

Fig. 13. Distribution of the most abundant fish families in different sites and moon phases.

5. Discussion

Most marine fishes have a planktonic larval stage (Llopiz and Cowen 2009), which is commonly referred to as ichthyoplankton and can be sampled quantitatively with plankton gear. While there is a variety of active and passive sampling equipment available (Neal *et al*., 2012), the applicability of each is debatable. Ichthyoplankton of reef fishes in the Red Sea is poorly studied compared to that in other Indo-Pacific areas such as Great Barrier Reef (Abu El-Regal *et al.*, 2014 a, b).

The identification of the mechanisms that determine patterns of distribution and abundance of early stages of fish is an essential goal of ecology and conservation biology. In species that experience ontogenetic changes in habitat utilization, patterns of early life-stage dispersal, return (i.e. settlement), and persistence in adult habitats (i.e. recruitment) can have an impact on population dynamics and connectivity (Besson *et al.*, 2017). To maximize output that ensure sustainability and fishery management requires an understanding of diversity and distribution of ichthyoplankton. The larval source, supply, and recruitment patterns of reef-dependent fish can considerably influence the adult population dynamics of reef-dependent fish on both natural (Sponaugle and Shaw 2003) and artificial reefs (Hernandez and Shaw 2003).

The vertical distribution of late stages of reef fish larvae may potentially influence their dispersal, recruitment success, and energetic expenditure during the recruitment process. To date, methods of examining the vertical distribution of reef fish larvae either under-sample late-stage individuals or are incapable of discretely sampling the water column (Fisher and Bellwood 2002). The majority of fish species' pelagic phase is poorly understood. Many species' larvae have been taken close to shore, while others have been recovered from large distances offshore (Abu El-Regal *et al*., 2014a, b; Maaty 2015). Some studies have been carried out on the species composition of larval fish inshore and offshore (Clark 1991; Leis 1986, 1991; Maaty 2015; Abu El-Regal 2017). Despite their relevance in fisheries management, there are very few research on Red Sea reef fish larvae (Abu El-Regal *et al.*, 2014b; Maaty 2015).Because of its intimate ties to fisheries, ichthyoplankton research has been more relevant since the turn of the century. Studies on fish population dynamics and the reasons of big variations in

fish stock production have aided in establishing a better knowledge of fish population dynamics and pinpointing the causes of major fluctuations in fish stock production (Fuiman 2002).

Studies on ichthyoplankton have become important since the beginning of last century in view of its close relationship with fisheries. Studies on the early life history of fish have been useful in developing a better understanding of fish population dynamics and determining the causes of major fluctuations in fish stock production (Fuiman 2002). Data about where and when larvae of these commercial fish could be very helpful in the determination of their spawning seasons and grounds and hence management of their fisheries of the Red Sea (Abu El-Regal *et al.*, 2014 a, b). Larvae of many commercial fishes were collected during the present study. Families such as Mullidae, Lutjanidae, Scaridae, Carangidae, Sphyraenidae, Gerridae and Serranidae are represented in the current samples by larvae indicating nearby spawning grounds. This study presents important information on the spawning seasons and spawning grounds of these fishes that form baseline data concerning the larvae of commercial fishes as an essential part in fisheries management. However, the larvae of some fishes whose adults are important constituents of Jeddah fisheries were rare or even absent in the collection. This may be due to the adult or the larvae behavior (Leis 1991; Montgomery *et al*., 2001). Larvae of lethrinid fishes were absent in the ichthyoplankton samples during the period of study and other studies in the Red Sea (Abu El-Regal 1999, 2008, 2017; Maaty 2015; Abu El-Regal *et al.*, 2014 a, b; 2019). Lunar periodicities were investigated because there are many hypotheses on lunar reproductive patterns pertaining to propagule dispersal and predation rates that occur both at the beginning (spawning) and end (settlement) of the planktonic phase (Robertson, 1991). Many reef fish appear to time their spawning events with different lunar cycles (Thresher, 1984). Higher rates of fish settlement often occur during darker, new moon periods than full moon periods (Victor 1986; Rooker *et al*., 1996), presumably a response to mortality associated with visual predators. These patterns of spawning, transport, recruitment, and settlement in association with the local physical oceanographic regime, often result in variable larval supply and settlement patterns with distinct lunar periodicities.

In the current study, most of the larvae were collected during the new moon nights in comparison to the full nights. Approximately, two-thirds (63%) of all larvae were collected in the new moon nights. Furthermore, most of the larvae were recorded in Shaara Bay (about 75%). Species composition varied significantly among Shaara, Obhur in the new and full moon nights. The number of clupeid larvae in the full moon nights is almost half that of the clupeid collected in the new moon nights. Hemirhamphidae, Tripterygiidae, and Scorpaenidae are absent in the new moon and occurred in the full moon. On the other hand, larvae of 11 fish families occurred only dark in the new moon nights. These include Acanthuridae, Synodontidae, Gobiesocidae, Carangidae, Bythitidae, Mullidae, Belonidae, Soliedae, Mugilidae, Schindleridae and Gerreidae. Settlement of reef fishes mostly takes place in the darker new moon than full moon periods.

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كثافة وتنوع الأطوار المبكرة للأسماك الشاطئية في جدة، البحر الأحمر، المملكة العربية السعودية

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المستخلص. تمت دراسة تكوين مجتمع يرقات الأسماك في ساحل جدة من يناير إلى ديسمبر ٢٠٢٠. حيث جمعت اليرقات من خور أبحر وخليج شعارة على امتداد ساحل جدة مرتان شهريًا باستخدام المصيدة الضوئية لمدة ساعتين بعد غروب الشمس عند القمر الجديد والقمر المكتمل (البدر). تم جمع ٤٠ عينة تضم ٥٧١٧ يرقة بمتوسط ١٤٢٩ يرقة / ساعتين تنتمي لـ ٣٢ عائلة من الأسماك. سجلت أعلى وفرة في خليج شعارة (٣٤١٣ يرقة تشكل ٥٩,٧٪ من مجموع اليرقات)، بينما سجل خور أبحر ٢٣٠٤ يرقة (٤٠,٣٪ من مجموع اليرقات). خلال العمل الحالي، كانت أكثر عوائل الأسماك وفرة، هي: السردين (Clupeidae)، الجوبى (Gobiidae) والحريد (Scaridae)، أبو دفدف (Pomacentridae)، والبلينى (Blennidae) والتي شكلت مجتمعة حوالي ٨٦٪ من إجمالي اليرقات. كانت عائلة السردين (Clupeidae) هي الأكثر تواجدًا بين جميع العوائل حيث شكلت حوالي ٥٧٪ من إجمالي اليرقات تليها عائلة الجوبى (Gobiidae) (1093 يرقة)، والتي شكلت ١٩,١٪ من مجموع اليرقات. تم جمع أكثر اليرقات وأكثر الأنواع خلال القمر الجديد، مما يشير إلى أن استقرار أسماك الشعاب المرجانية يحدث في الغالب في القمر الجديد الأكثر عتمة من فترات اكتمال القمر.

الكلمات المفتاحية: يرقات الأسماك، المصيدة الضوئية، مستوطنة، البحر الأحمر.