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Morphological and taxonomic study of eggs of some fish families with a reference to their abundance in the North West of Arabian Gulf

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Abstract – Sampling of eggs of fish was conducted at two stations in the northwestern part of Arabian Gulf (Shatt Al-Arab estuary (A1) and Khor Amaya (A2)), during April 2012 to March 2013. A total of 2902 fish eggs were collected using conical plankton net (mesh size 330µm). Six families (Sciaenidae, Clupeidae, Soleidae, Polynemidae, Engraulidae and Ariidae) of fish eggs were identified. Sciaenid fish egg comprised 45.6 % of all eggs collected and peak of abundance (1680.3 egg/10m²) at station A2 was occurred in May. Water temperature was ranged from 13-34°C and salinity was 32-42 ‰. Water temperature seems to be the most vital factor in determining the onset of the spawning of fish in the Arabian Gulf. This study showed the importance of the northwestern part of the Arabian Gulf as a spawning and nursery site for the Sciaenidae, Clupeidae, Soleidae, Polynemidae, Engraulidae and the Ariidae.

Keywords: Morphology, taxonomy, fish families, eggs, NW Arabian Gulf.

Introduction

Eggs of most marine and estuarine teleost fall into two categories: planktonic or damersal, most marine and estuarine teleost species have planktonic egg. Most planktonic eggs are similar in appearance, usually, being spherical and transparent with smooth chorine. The diameter however, may range between 0.5-5.5 mm (Ahlstrom and Moser, 1980; Miller and Kendall, 2009).

Specific characteristic useful in recognition of eggs of different species, are egg diameter and shape, nature of the chorine (smooth or paternal) homogenous or segmented yolk, presence or absence of oil globules, the number position and size of oil globules in the yolk and the size of the perivitelline space (Kunz, 2004).

Studies of abundance and distribution of fish eggs and larvae in the North West part of the Arabian Gulf are limited to those of Ahmed and Hussain (1998); Ahmed and Hussain (2000a); Ahmed and Hussain (2001). Studies on the description of fish eggs are restricted to that of Ahmed and Hussain (2000b) for mugilid egg in the North West of Arabian Gulf. The aim of present study is to identify the eggs of six families (Sciaenidae, Clupeidae, Soleidae, Polynemidae, Engraulidae and Ariidae) occurred in the North West of the Arabian and their abundance in different times.

Materials and Methods

The present study is carried out in the North West Arabian Gulf. This part differs

physic-oceanographically from other Arabian Gulf regions due to the sediments transported by Shatt Al-Arab river. Al-Badran (1995) found that these sediments were composed of 48.2 % sand, 28.3 % clay and 23.5 % silt.

Ichthyoplankton samples were collected monthly from two stations during the period April 2012 till March 2013, during the daytimes and at low tide.
Station A1 (Shatt Al-Arab Estuary): depth 5m.
Station A2 (Khor Al-Amaya): depth 15 m (Fig. 1).

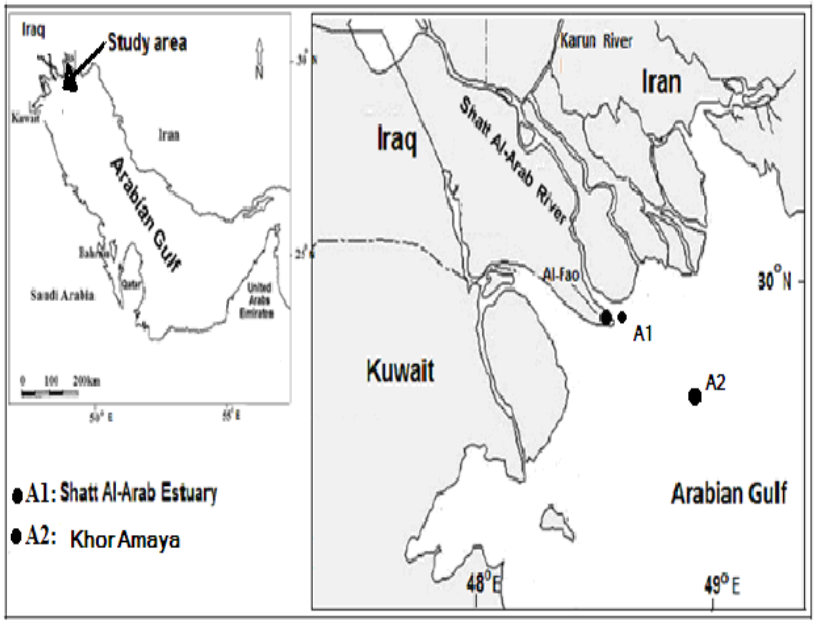

Figure 1. Map showing sampling stations in the NW Arabian Gulf.

Sampling was conducted using conical nets, length 1.25m and has a mouth diameter of 50 cm with a mesh sizes 330µ, equipped with a flow-meter. Oblique tow was conducted at a speed of 0.5 m/s for approximately 10 minutes from near the bottom to the surface (Robinson *et al*., 1996). Samples were preserved in 10 % formalin.

Water temperatures and salinity, were measured immediately in the field by a digital multi meter Multi350i/SET Germany.

In the laboratory, fish eggs were sorted out and identification was done under a dissecting microscope (Wild M 38). The important morphological characters in the identification of eggs are see (Ahlstrom and Moser, 1980; Bunn *et al*., 2000):
1) Egg shape (spherical, elliptical).
2) Egg size.
3) Chorion (shell) thickness, filaments.
4) Egg membrane (color, thickness, sculpture, appendage).
5) Yolk (segmented or homogeneous, color, large or small).
6) Perivitelline space (width, narrow).
7) Oil globules (number, size and color).

Eggs were measured using an ocular micrometer and the drawing were made with a camera lucida. Fish eggs were identified to families according to Al-Nasiri and Shamsul Houda (1977); Moser *et al.* (1983); Moser *et al.* (1984); Houde *et al.* (1986); Manickasunderam and Ramaiyan (1990); Bensam (1990); Munk and Nielsen (2005) and Ditty *et al.* (2006).

Abundance of eggs was calculated according to the formula of Smith and Richardson (1977):

$$A = N \times D \times 10 / V$$

A = Abundance under 10 m^2 of sea surface.
N = Number of fish eggs.
D = Depth of tow (m).
V = Volume of water filtered (m^3).

Results:

Temperature and Salinity:

Monthly variations in average values of water temperature in the study regions are illustrated in Figure (2). Water temperature were ranging between 13°C in February and 34°C in July.

While the salinity ranged between 32 and 41 ‰. The lowest value was recorded during April at station A1 (Fig. 3).

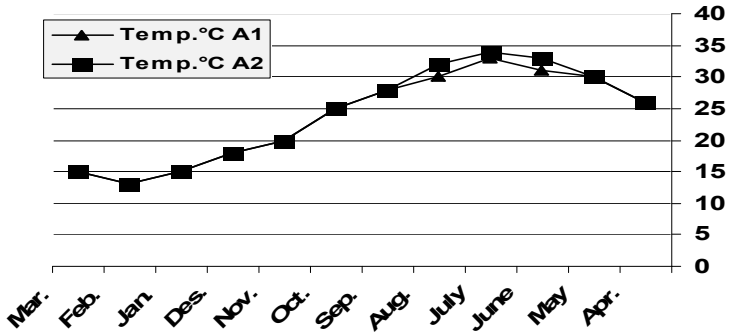

Figure 2. Monthly variations in the water temperature (°C) at the 2 sampling stations.

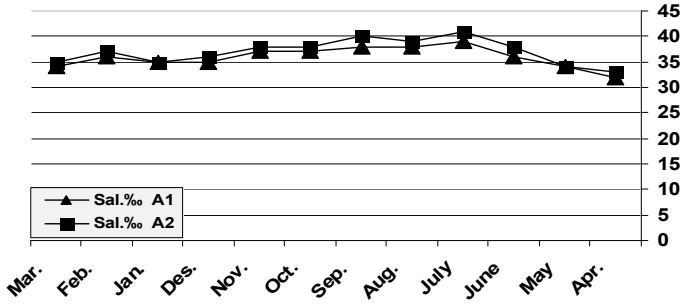

Figure 3. Monthly variations in salinity (‰) at the 2 sampling stations.

Description and Abundance of Eggs:

Sciaenidae:

Sciaenidae eggs were collected during April-July and October. A total of 1324 eggs of Sciaenidae were collected at station A1 and A2 (Table 1). Eggs were most abundant during April (5232 egg/10 m² in A2) (Table 2). Eggs were collected when surface temperature ranged from 25-30 °C and surface salinity varied from 32-42 ‰.

Eggs are pelagic, spherical and transparent measures 0.81-1.02 mm in diameter, yolk is un-segment and perivitelline space narrow. A single oil globule measures 0.22 mm in diameter is found (Fig. 4).

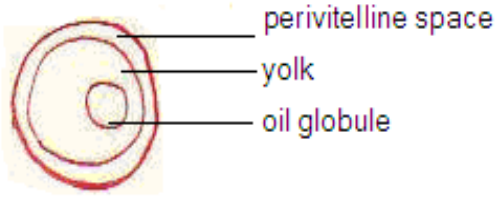

Figure 4. An egg of Sciaenidae (4X).

Table 1. Total number and abundance (egg/10 m²) of fish eggs collected from two stations in the N.W. of Arabian Gulf.

Families	Total number	%
Sciaenidae	1324	45.6
Clupidae	876	30.1
Solidae	538	18.5
Polynemidae	90	3.1
Engraulidae	65	2.2
Ariidae	9	0.3
Total	2902	

Table 2. Abundance (egg/10 m²) of fish eggs from two stations in the N.W. of Arabian Gulf.

Families	April		May		June		July		August		September		October	
	A1	A2	A1	A2	A1	A2	A1	A2	A1	A2	A1	A2	A1	A2
Sciaenidae	82.0	5232	822.7	1680.3	725.8	1610.2	-	0.9	-	-	-	-	3.9	2.8
Clupidae	260	-	53	52.7	4.9	53	2.1	98.2	1.5	17.3	-	-	19.3	126.3
Solidae	-	-	80	622	-	-	2.1	105.5	4.1	17.3	-	-	-	-
Polynemidae	-	-	-	-	-	-	-	-	0.85	52.7	-	-	-	-
Engraulidae	-	-	-	-	-	--	-	-	-	-	-	-	20.2	-
Ariidae	-	-	-	6.36	-	-	-	-	-	-	-	-	-	--

Clupeidae:

A total of 876 eggs of Clupeidae were collected from the two stations A1, A2 during April-August and October (Table 1). The eggs were more abundant in April (260 egg/10 m²) at A1 (Table 2).

Eggs are pelagic, spherical and transparent. Two type of Clupeidae eggs were recognized. Type (A), eggs range from 2.1-2.5 mm in diameter with one oil globule having a diameter of 0.09 mm. Yolk vacuolated, perivitelline space is wide. Type (B) Eggs range from 0.9-1.1 mm in diameter. Yolk segmented with 8-9 oil globule, perivitelline space is moderate (Fig. 5).

Clupeidae eggs were collected at temperature 25-30 ˚C and salinity 32-42 ‰.

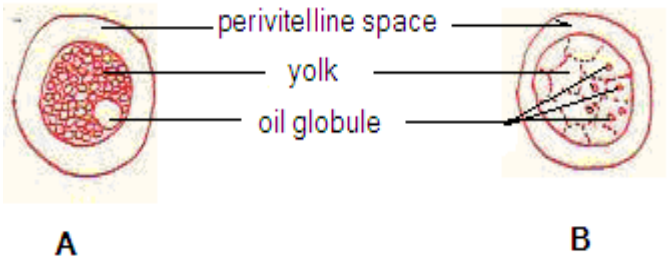

Figure 5. An egg of Clupeidae (4X).

Soleidae:

Table (1) shows the total number of Soleidae eggs (538) collected during May, July and August. The eggs were more common in May (622 egg/10 m²) at A2 (Table 2). The eggs were collected at temperature 25-30 ˚C and salinity 32-42 ‰.

Soleidae eggs are pelagic, spherical and transparent measuring 0.6-0.8 mm in diameter. perivitelline space is moderate. Yolk segmented with 25 oil globules (Fig. 6).

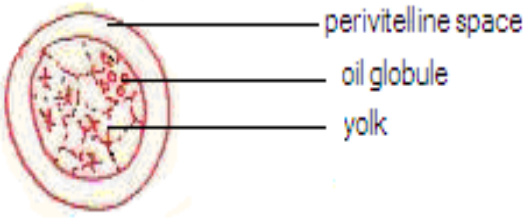

Figure 6. An egg of Soleidae (4X).

Polynemidae:

Polynemidae eggs were found in the study region during one month of the year, the number of eggs was 90 in August (Table 1). The abundance of Polynemidae eggs were 0.85 egg/10 m² at station A1 but 52.7 egg/10 m² at station A2 (Table 2).

Eggs were collected at temperature 31-34 °C and salinity 33-3 8‰ at A2. Eggs are pelagic, spherical and transparent measuring 0.6-0.8 mm in diameter, yolk is un-segmented and perivitelline space narrow. A single oil globule measures 0.27-0.37 mm is present (Fig. 7).

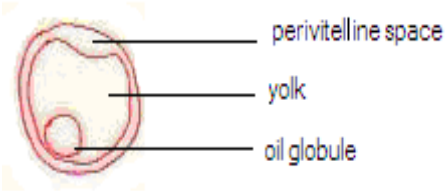

Figure 7. An egg of Polynemidae (4X).

Engraulidae:

A total of 65 eggs of Engraulidae were collected at station A1 during October only (Table1), no eggs was recorded at station A2, with abundance of 20.2 egg/10 m² (Table 2). Eggs were collected at temperature 31 °C and salinity 33 ‰.

The eggs were pelagic, transparent and oval, with narrow perivitelline space. Length of long axis 1.01-1.08 mm. Length of short axis 0.3-0.4 mm The yolk is segmented, without oil globules (Fig. 8).

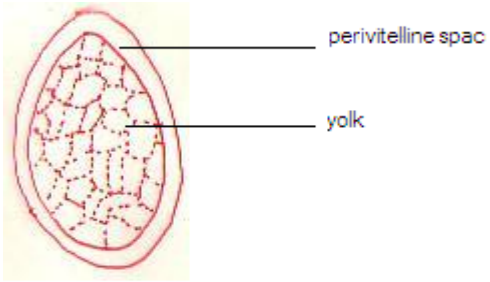

Figure 8. An egg of Engraulidae (4X).

Ariidae:

Very limited number of Ariidae eggs were collected during May (9 eggs) at station A2 (Table 1), with abundance of 6.36 egg/10 m² (Table 2), at temperature 30 °C and salinity 39‰.

Ariidae eggs are large, spherical, golden yellow in color, measuring nearly 5 mm in diameter. The perivitelline membrane was loosely attached to the yolk (Fig. 9).

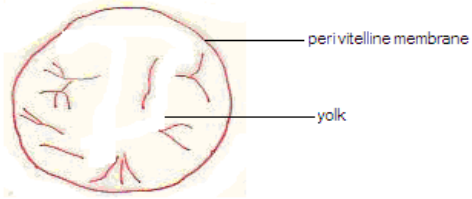

Figure 9. An egg of Ariidae (2X).

Discussion

Unfortunately, no data are available on the description and identification of the fish eggs of the North West Arabian Gulf for the purpose of comparison. The present survey showed that Sciaenidae, Clupeidae and Soleidae eggs are dominant in the region. These fish families are represented as very common in the Gulf (Ali, 1993; Hussain *et al*., 1999).

The highest abundance of fish eggs during spring and summer and their lower abundance during winter agree with the results of Houd *et al.* (1986); Ahmed and Hussain, (2001) and Al-Okailee (2001).

The seasonal distribution of fish eggs was coincided with the seasonal fluctuation in temperature due to its impact on the spawning, rather than salinity (Ahmed and Hussain, 2001).

The densities of the eggs of sciaenid were most abundant in the present study from April to October which is in accordance with high water temperature. According to the published data (Fischer and Biauci, 1984; Ali, 1993; Hussain *et al*., 1999; Mohemed *et al.*, 2002) many species of this family are very abundant and the occurrence of eggs coincides with the adult fish maturation cycle as determined by gonad examination of *Johienops sina*, *Johius belangerii* in the Shatt Al-Arab Estuary (Al-Mahidi, 1996).

The spawning season of Clupeidae fish in North West Arabian Gulf was extended from April to October. Clupeidae egg abundance were also high in April to October. Similar results were also reported by Ahmed and Hussain (2000 b). Younis (2000) noticed that *Ilisha megaloptera* spawning period was occurred during May and July in the Shatt Al-Arab Estuary.

Soleid eggs appeared during May, July and August and this is in agreement with the results of Al-Okailee (2001), also Kopoula and Lacroix (1992) found that the spawning period of *Solea solea* was during April, May and June in Biscay Gulf in France.

Polynemid eggs occurred in August. Hussain and Ahmed (1995) suggested that polynemid larvae occurred in the Shatt Al-Arab Estuary during summer, while Jabir (1999) indicated that *Polydactylas sextarius* (polynemidae) in Iraqi marine water have two spawning seasons in the year, one start in May and the other in October. Few eggs of Engraulidae occurred here in October.

This family is known to be estuarine residents, estuarine dependents (Castro *et al*., 2005). Similar results were also reported by Al-Okailee (2001) who found that Engraulidae larvae occurred in the Shatt Al-Arab Estuary during March to October.

Very limited number of eggs of Ariidae were collected in May due to parental care of eggs and larvae. Eggs were found rolling down from the buccopharyngeal cavity (Bagarino and Chua, 1986; Al-Nasiri and Shamsul Hoda, 1977).

Previous studies have shown that Ariidae generally spawn in warm season or associate with increasing temperatures, and this is coincide what the results of the present study. Marine catfishes generally exhibit a single annual spawning period corresponding to the warm season or associated with high water temperature (Dmitrenko, 1970; Rimmer and Merrick, 1983; Gomes and Araujo, 2004).

In general, the occurrence of eggs of Sciaenidae, Clupeidae, Soleidae, Polynemidae, Engraulidae and Ariidae in the region indicate that this area is the spawning ground for the members of these families. Ali (1993) collected the spawners from the same area.

Hussain *et al.* (1999) considered Shatt Al-Arab estuary and coastal waters as nursery ground for many marine species. This region considered as the highest productivity area in the Arabian Gulf (Al-Shaban, 1996), due to the nutrient input into the Shatt Al-Arab River (Abaychi *et al.*, 1988).

Al-Zubaidi (1998) pointed out that the primary productivity in the Iraqi marine water was of bi-modal pattern, the first peak was in early spring and the second in late summer. The highest abundance and occurrence of fish eggs were synchronized with these two period. The primary and secondary productivity and topography of study area provided ideal condition for the distribution of fish eggs (Hussian and Ahmed, 1995).

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دراسة مظهرية وتصنيفية لبيوض بعض عوائل الأسماك مع الإشارة إلى وفرتها في شمال غرب الخليج العربي

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المستخلص – جرى مسح لبيوض الأسماك في الجزء الشمالي الغربي من الخليج العربي (محطة مصب شط العرب A1 ومحطة خور العمية A2) للفترة من نيسان 2012 إلى آذار 2013. جمعت 2902 بيضة أسماك باستعمال شبكة هائمات مخروطية (حجم فتحة الشباك 330 ماكرون). صنفت بيوض ستة عوائل سمكية (النعاب Sciaenidae والصابوغيات Clupidae واللسان الأيمن Solidae والداكوك Polynemidae والبلم Engraulidae والجري البحري Ariidae). سجلت أعلى نسبة لبيوض عائلة النعاب وبلغت 45.6 % وأعلى وفرة 1680.3 بيضة/10م^3 عند محطة A2 في أيار. تراوحت درجات حرارة الماء بين 13-34 ^{o}م والملوحة بين 32-42 جزء بآلاف. كانت درجة حرارة الماء العامل الحيوي المهم في تحديد مواسم طرح البيوض في الخليج العربي. أظهرت الدراسة الحالية أهمية الجزء الشمالي الغربي من الخليج العربي كمناطق تكاثر لعوائل أسماك النعاب والصابوغيات واللسان الأيمن والداكوك والبلم والجري البحري.