PELAGIC MARINE FISH EGGS OF THE MEDITERRANEAN AND THE BLACK SEA: A TAXONOMIC GUIDE

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Abstract
In this paper we tried to classify the pelagic eggs of 157 marine teleost species, representing 61 families found on the Mediterranean and the Black Sea, using both descriptive and morphometric characters.

Keywords: Ichthyoplankton, Systematics, Black Sea, North-Eastern Mediterranean, Aegean Sea

Introduction: As the study of early life histories of fish is becoming increasingly important to a wide variety of research fields, many researchers, academics and students are attempting to identify ichthyoplankton samples. Knowing that ichthyoplankton systematics is particularly complex, we recognised the need for the development of an "easy-to-follow" taxonomic guide for the identification of the pelagic marine fish eggs of the Mediterranean and the Black Sea.

Materials and Methods: A total of 157 pelagic marine fish eggs belonging to 61 families, has been examined and classified using both descriptive (egg shape, presence or absence of oil globules, character of yolk, width of perivitelline space and character of chorion) and morphometric (egg size and oil globule diameter), independent of the embryo, characters [1]. These data were derived from an ichthyoplankton database, which includes drawings, photos and measurements of different developmental phases of eggs, larvae, postlarvae and juveniles of over 250 fish species inhabiting the Mediterranean and the Black Sea [2]. A search form was constructed in the above mentioned database, where the user can input the morphometric and descriptive characters of pelagic eggs he desires (Fig.1).

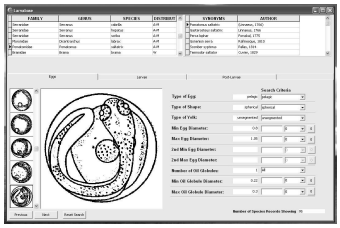

Fig. 1. Database search form with egg pictures

Results and Discussion: As seen in Table 1, most of the planktonic marine fish eggs examined were globular in shape (58 families, 150 species). The 7 species with an ellipsoidal shape are included in the families of Engraulidae, Carapidae, Scorpaenidae and Dactylopteridae. Taking into account the number of oil globules, the 150 spherical eggs were distributed in 3 main characteristic groups. The most common kind of pelagic fish eggs is that with a single oil globule. 95 species belonging to 38 families are included in that group. The second group included 33 species (16 families) who lacked oil globules, and finally the third group consisted of 22 species (11 families) containing multiple oil globules. The yolk is segmented in eggs of most "primitive" teleosts (12 families, 22 species) but is homogeneous (unsegmented) in the majority of eggs of "higher" teleosts (26 families, 71 species). The eggs of *Mullus barbatus barbatus* and *Mullus surmuletus* were characterized by the peripheral segmentation of yolk. In the vast majority of spherical pelagic fish eggs the perivitelline space is narrow; however, eggs with a wide perivitelline space are the basic type among eel-like fishes (Ophichthidae, Congridae, Muraenidae, Nettastomatidae). The Clupeidae family includes species with both wide (*Sardinella aurita* & *Sardina pilchardus*) and narrow (*Sprattus sprattus*) perivitelline space. As far as chorion is concerned, although most fish eggs have smooth, unornamented chorions, it can be variously and sometimes elaborately ornamented in some species. In our dataset we found 6 different chorion structures: Hexagonal honeycombed ornamentations (Macrouridae, Callionymidae, *Uranoscopus scaber* & *Synodus saurus*), striations (Scophthalmidae & *Seriola dumerili*), network of hexagonal and pentagonal polygons (*Maurolicus muelleri*), dome (*Centracanthus cirrus*), spinules (*Lophotus lacepede*) and chorionic filaments *(Scomberesox saurus saurus* & *Exocoetus volitans*). The 150 spherical pelagic fish eggs ranged from 0.56 mm in diameter to about 5.5 mm. The most abundant size category was eggs ranging from 0,71-1,00 mm (55 species, 36,67%), followed by eggs ranging from 1,01-1,50 mm (49 species, 32,67%), 1,51-2,50 mm (21 species, 14,00%), 2,51-5,50 mm (13 species, 8,67%) and finally 0,56-0,70 mm (12 species, 8,00%). The diameter of oil globule of 95 species with 1 oil globule, ranged from 0,10 mm to 0,53 mm. 36 species (37,89%) had a small oil globule (0,10-0,20 mm), 39 species (41,05%) had a medium size oil globule (0,21-0,30 mm) and finally 20 species (21,05%) had a large oil globule (0,31-0,53 mm).
The usefulness of the above identification characters is increased through the aid of a database. When putting specific search criteria for identification characters in the database we get one to ten pelagic species names as results. Apart from the species names we get in the results the eggs images which will be helpful for the identification. The same approach will be implemented in the future for the larvae and juvenile species.

Tab. 1. Taxonomic guide of 157 pelagic marine fish eggs of the Mediterranean and the Black Sea.

Pelagic Marine Fish Eggs of the Mediterranean and the Black Sea (61 Families, 157 Species)	Egg Shape	Number of Oil Globules	Yolk	Perivitelline Space & Chorion
	No Spherical (4 Families, 7 Species)	0 Oil Globules (2 Families, 4 Species)	Unsegmented (1 Family, 3 Species)	Narrow & Smooth (1 Family, 3 Species)
			~~Peripheral Segmented~~	———
			Segmented (1 Family, 1 Species)	Narrow & Smooth (1 Family, 1 Species)
		1 Oil Globule (2 Families, 3 Species)	Unsegmented (2 Families, 3 Species)	Narrow & Smooth (2 Families, 3 Species)
			~~Peripheral Segmented~~	———
			~~Segmented~~	———
		~~Many Oil Globules~~	———	———
	Spherical (58 Families, 150 Species)	0 Oil Globules (16 Families, 33 Species)	Unsegmented (9 Families, 20 Species)	Narrow & No Smooth (5 Families, 5 Species)
				Narrow & Smooth (4 Families, 15 Species)
				~~Wide & No Smooth~~
				~~Wide & Smooth~~
			Peripheral Segmented (1 Family, 3 Species)	Narrow & No Smooth (1 Family, 3 Species)
			Segmented (6 Families, 10 Species)	~~Narrow & No Smooth~~
				Narrow & Smooth (2 Families, 4 Species)
				~~Wide & No Smooth~~
				Wide & Smooth (4 Family, 6 Species)
		1 Oil Globule (38 Families, 95 Species)	Unsegmented (26 Families, 71 Species)	Narrow & No Smooth (3 Families, 9 Species)
				Narrow & Smooth (24 Families, 62 Species)
				~~Wide & No Smooth~~
				~~Wide & Smooth~~
			Peripheral Segmented (1 Family, 2 Species)	Narrow & Smooth (1 Family, 2 Species)
			Segmented (12 Families, 22 Species)	Narrow & No Smooth (2 Families, 2 Species)
				Narrow & Smooth (11 Families, 18 Species)
				~~Wide & No Smooth~~
				Wide & Smooth (1 Family, 2 Species)
		Many Oil Globules (11 Families, 22 Species)	Unsegmented (7 Families, 7 Species)	Narrow & Smooth (7 Families, 7 Species)
			Peripheral Segmented (1 Family, 7 Species)	Narrow & Smooth (1 Family, 7 Species)
			Segmented (4 Families, 8 Species)	~~Narrow & No Smooth~~
				Narrow & Smooth (2 Families, 2 Species)
				~~Wide & No Smooth~~
				Wide & Smooth (2 Family, 6 Species)

References
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