SEASONAL STRUCTURE OF FISH LARVAE ASSEMBLAGES IN THE PAGASITIKOS GULF (GREECE)

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Abstract
Temporal abundance and species composition of fish larvae assemblages in the Pagasitikos gulf for the period January 1999-September 1999 are described. Seasonal differences in species composition and abundance in the study area appear to be associated with differences in the environmental conditions, particularly with temperature. Larvae of small pelagic fishes such as Engraulidae and Clupeidae, as well as larvae of shore-fishes, such as Gobiidae dominated the ichthyoplankton. Both larval diversity and abundance were higher by an order of magnitude in July and September 1999, corresponding to warmer waters.

Keywords: Ichthyoplankton, fishes, larvae, reproduction

Introduction
Information on species composition, distribution and abundance of eggs and larvae of marine fishes has great importance for the study of the population structure of exploited stocks, for understanding the reproduction rate of a population, and the fisheries exploitation of new areas.1,2,3 The objectives of the present work are to study the abundance and distribution of fish larvae in the Pagasitikos gulf in order to identify seasonal differences in larval compositions and by using the occurrence of fish larvae in the plankton to determine to limits of the spawning period of adults.

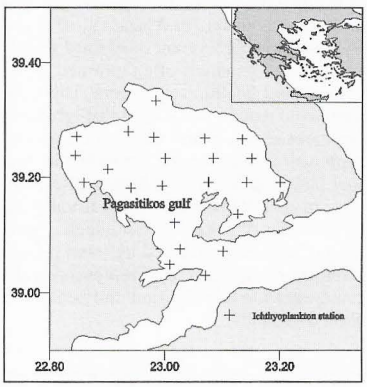
Material and methods


Figure 1. Map of the study area

A grid of 23 stations was designed in the study area (Fig 1), in which six ichthyoplankton surveys took place at January, April, May, June, July and September 1999. With the exception of a few stations that could not be resampled mainly due to the bad weather's conditions, the same stations were carried out repeatedly in each of the six ichthyoplankton surveys. Plankton hauls were made using a Bongo net with mesh sizes of 300 and 500 μm. Hauls were taken obliquely at a ship's speed of 2.5 knots, from just above the sea bottom to the surface. Continuous recording of temperature and salinity have been obtained using SEA CAT SBE 19 CTD.

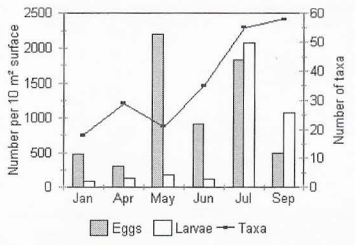
Results and discussion


Figure 2. Average abundances (number per 10 m² surface water) of the total eggs and larvae and number of larval taxa, collected during the six cruises in the Pagasitikos gulf.

A total of 90 taxa of fish larvae have been identified representing 38 families. A list of the families of fish larvae for each survey, including relative abundance per cruise, is given in Table 1. The maximum egg abundance in the plankton was observed in May with 2196.69 egg per 10 m^2 and the minimum in April with 304.2 eggs. The maximum larval abundance was observed in July with 2071.49 larvae per 10 m^2 and the minimum in January with 84.59 larvae. The maximum species richness value for the fish larvae was found in September with 58 taxa and the minimum in January with 18 taxa (Fig 2). The average surface temperature (±SD) during the surveys were recorded at 12.21 °C * 0.54 in January, 13.81 °C ± 0.79 in April, 17.65 °C ± 0.96 in May, 18.22 °C ± 1.06 in June, 21.73 °C ± 2.43 in July and 22.22 °C ± 1.28 in September.

Larvae of the small pelagic families Engraulidae and Clupeidae and larvae of the family Gobiidae dominated the ichthyoplankton making up the ~56,1% of the total catch. E. encrasicolus represented of the 32.65% of the total number of larvae recorded. Other taxa caught at high percentages were Gobiidae 1. (8.98%), *S. hepatus* (7.63%), *S. aurita* (7.61%), *T. mediterraneus* (6.59%), *C. macrophalma* (5.78%) and *C. chromis* (5,29%).

Taking into consideration the description of the ichthyoplankton assemblages during the six surveys, it is clear that the number of taxa and the egg and larval abundance exhibited fluctuation during the study period. Small and medium-size pelagic fishes like *E. encrasicolus, S. aurita, S. pilchardus* and *T. mediterraneus*, dominated the ichthyoplankton samples throughout the year. This indicates that the Pagasitikos gulf is an important spawning ground for small and medium pelagic fishes. Larvae of shore fishes (Gobiidae, Serranidae, Cepolidae, Blenniidae, Labridae, Pomacentridae e.t.c.) recorded at relatively high abundances, could be possible correlated with the wide continental zone of the study area.

Taking into account the temporal distribution of the larvae of the most abundant species/genus collected during the six surveys in the study area, it appears that the majority presents an extended occurrence in the plankton, lasting more than four months. The high values of the larval abundances and number of taxa recorded during the period between the end of summer and the beginning of autumn could be possibly correlated with the high water temperatures as well as the autumn peaks of phyto- and zooplankton in this area.

Table 1. Average abundances (number per 10 m^2 surface water) of identified larval families,collected during the six cruises in the Pagasitikos gulf.

Family	Jan	Apr	May	Jun	Jul	Sep
Apogonidae					2.3	3.5
Belonidae		0.1		0.2		
Blenniidae	0.2	3.2	6.4	9.2	1.0	0.9
Bothidae	5.6	8.5	0.1	1.6	41.2	49.0
Callionymidae	4.4	3.7	1.2	7.1	27.4	9.5
Caproidae					0.5	
Carangidae		0.3		1.1	199.1	44.4
Carapidae		0.1				0.8
Centrolophidae					0.5	
Cepolidae				2.0	76.4	135.9
Citharidae						20.8
Clupeidae	41.8	13.9	0.3	3.2	276.8	2.0
Cynoglossidae						23.0
Engraulidae		1.1	61.1	22.9	839.1	286.3
Gadidae	37.7	0.6				
Gobiesocidae	0.2					
Gobiidae	41.9	91.0	39.8	23.7	85.7	252.1
Labridae	0.0	1.5	7.4	2.4	12.3	7.3
Lophiidae		0.3		0.2		
Merlucciidae	0.2	0.3				0.1
Mugilidae		0.3	0.3		2.3	6.6
Mullidae	0.3				0.4	
Myctophidae	0.9	1.6	0.5	0.1	7.1	1.3
Ophichithidae					0.8	1.0
Ophidiidae					1.4	6.6
Pomacentridae				1.7	130.3	63.9
Scombridae				1.2	82.0	6.7
Scopthalmidae					0.7	0.1
Scorpaenidae					4.7	4.8
Serranidae			3.1	12.0	183.4	87.5
Soleidae	0.7				1.1	0.5
Sparidae	0.3	10.5	37.2	18.9	9.2	20.9
Sternoptychidae					0.1	
Syngnathidae				1.0		
Trachinidae					1.7	4.1
Trichiuridae	1.0				0.8	
Triglidae				0.6	25.4	10.1
Uranoscopidae					0.3	
Unknown-Destroyed	0.8	1.7	17.3	9.3	57.7	18.1

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