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Temporal Variability in Abundance of Demersal Fish Community from Izmir Bay, Turkey

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Abstract: Temporal variabilities of demersal fish species were analaysed in terms of their numerical abundance in the Izmir Bay. A total of 545559 specimen belonging to eight different families were caught in 2005, covering all the year using a R/V trawl. The contribution of each family was Sparidae (34.38%), Serranidae (22.25%), Bothidae (15.09%), Mullidae (14.22%), Gobidae (3.71%), Centracanthidae (1.01%) and Uranoscopidae (0.28%). Based on temporal variabilities of the families, cluster analysis identified three main groups, which were group-I: the Mullidae, group-II: the Centracanthidae, Uranoscopidae, Bothidae, Gobidae and Serranidae and finally group-III: the Sparidae and Triglidae. The family belonging to the first group was more abundant in cold months (picked in January) than others. The second group were more yielded in general from June-October (picked in October). The third group were more abundant in May and June.

Key words: Temporal variability, abundance, demersal fish, centracanthidae, Izmir Bay, Turkey

INTRODUCTION

To understand and to predict the effects of environmental variations and fishing on fish stocks, species structure of fish communities in space and time must be monitored in the context of ecosystem approach.

This is very important especially in the areas where, multi-species fishing is done (Mueter and Norcross, 2002). In those areas, as in Izmir Bay, trawl catches consisted of a large number of species (fish, cephalopod and crustaceans) resulting from the biological complexity of the environment (Ungaro *et al*., 1999; Kinacigil and Akyol, 2001; Collaca *et al*., 2003).

Izmir Bay is one of the most important fishing areas of the Aegean Sea. Approximately, 200 macroalgea, 5000 invertebrates and 388 finfish species inhabit in the Aegean Sea (Kocatas and Bilecik, 1992; Bilecenoglu *et al*., 2000). These species, however, have been subjected to urbanization, overpopulation and industrial development (Metin *et al*., 2000).

The purpose of this study is to identify temporal pattern of the demersal fish community from the Izmir Bay using more quantitative statistical approaches departing from the previous studies (Kinacigil *et al*., 1993; Togulga and Mater, 1992; Metin *et al*., 2000), which were conducted in the same area.

MATERIALS AND METHODS

This research was conducted in Izmir Bay situated on the western coast of the Anatolia peninsula and connected to the Aegean Sea. The data were collected in 2005 covering all year from the central part of the Bay around the Uzunada (Fig. 1).

A total of 36 hauls were carried out at three stations (3 hauls in each month). A traditional, 600 meshes around mouth, commercially used bottom trawl was operated onboard R/V Egesuf. The towing duration was 30 min for all hauls and the average towing speed was 2.4 knots (ranging between 2.0 and 2.8). A nominal 40 mm diamond mesh cod-end about 5 m in stretched length was used. Cover (24 mm mesh size) about 8 m in length attached over the cod-end was chosen both are considered to have low selectivity in terms of both species and size. Towing durations were 30 min in all hauls. Thus, numerical abundance of each demersal species were considered as 30 min for per haul. After each haul, catches in cod-end and cover were combined and than sorted, identified and weighted. All taxa and family were identified by Fischer *et al*. (1987) and systematic categories of fish species were given for Eschmeyer (1998).

Due to limited trawlable areas in the Bay and also reinforcement by Fishery Act No 1380, which regulates the fishing in Turkey, affect of depth on species

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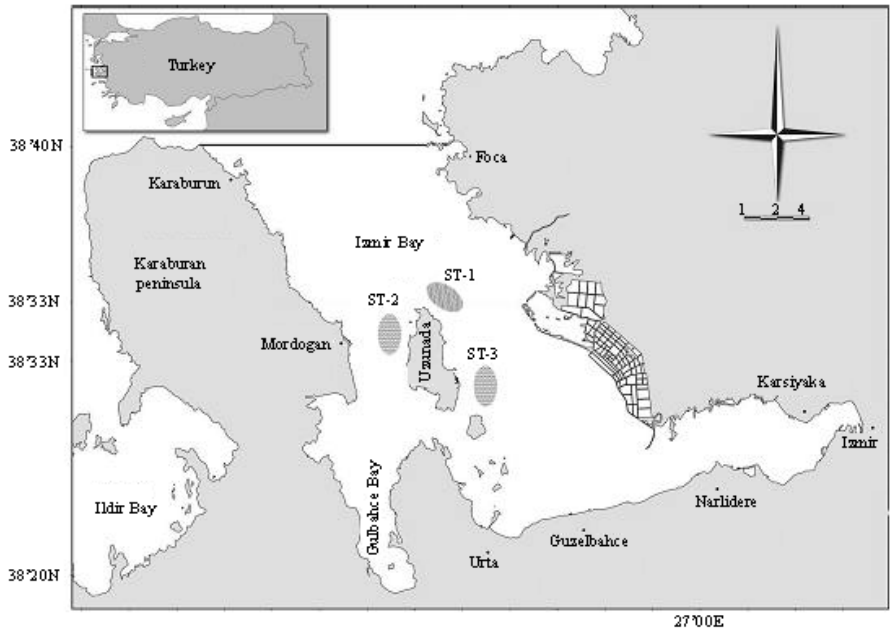

Fig. 1: Sampling area and stations (ST-1-ST-3)

abundance was not considered. The mean depth±SD (range) of the hauls by stations were 40.50±9.66 m (21.85-49.4 m) for station-I, 58.82±0.78 m (58.1-60.85 m) for station-II and 39.03±9.32 m (16.0-46.25 m).

To identify the temporal variation of demersal fish species, Cluster analysis was used to classify the species based on their monthly abundance. Months were taken as temporal scale. The data were standardized before the analysis owing to large differences in species abundance using log (x) transformation. The data were also checked against the non-normality via Shapiro-Wilk's W test. All computations and statistical analysis were done by Microsoft Excel and Statistica for Windows (V.6.0).

RESULTS AND DISCUSSION

During the study, a total of 545559 specimen belonging eight families were caught. In terms of numerical abundance (N), the contribution (n%) of the families (highest to lowest) were; Sparidae (34.38%), Serranidae (22.25%), Bothidae (15.09%), Mullidae (14.22%), Gobidae (3.71%), Centracanthidae (1.01%) and Uranoscopidae (0.28%). Also, the mean abundance (mean±SD) of each the family was: the Sparidae (1563.5±1898.24), Serranidae (1011.91±802.15), Bothidae (686.08±451.34), Mullidae (646.75±271.44), Gobidae (169.08±133.23), Centracanthidae (46.25±67.15) and Uranoscopidae (13.08±3.98) (Fig. 2). In the same way, the percentages of fish caught by the mouth were (highest to lowest); May (16.70%), October (11.24%), July (10.82%),

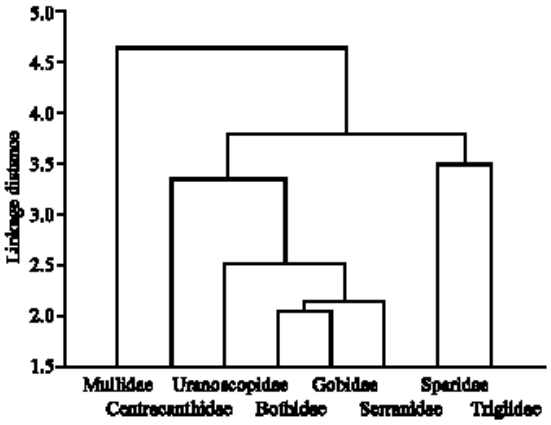

Fig. 2: Box-whisker plots of families based on their numerical abundance (N)

September (9.23%), June (8.90%), August (8.09%), December (7.58%), November (10.82%), January (5.47%), April (5.23%) and February (4.18%).

By using cluster analysis, three main groups were identified according to their abundance pattern based on temporal scale. The first group consisted of only the Mullidae. The second group consisted of the Centracanthidae, Uranoscopidae, Bothidae, Gobidae and the Serranidae families. The third group consisted of the Sparidae and the Triglidae (Fig. 3). Correlation between the abundance of the families based on temporal pattern also supports the results of the cluster analysis (Table 1).

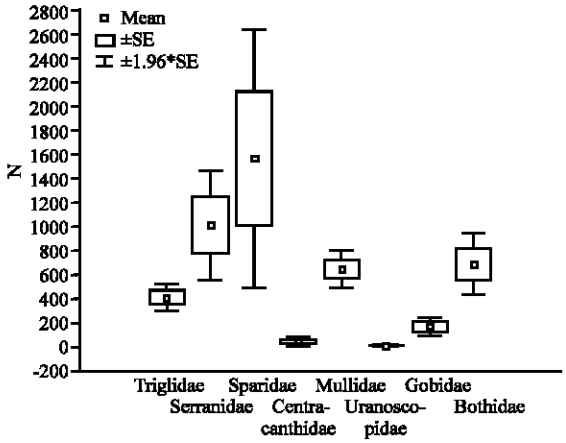

Fig. 3: Tree diagram for the families according to the their numerical abundance in temporal scale

Contrary to the other families, the lowest abundance value was observed for the Mullidae family in May. The abundances of the Gobidae, Bothidae, Serranidae, Uranoscopidae and Centracantidae increased gradually, generally, towards October (skewed to the right hand side from the Fig. 4). Triglidae and Sparidae familes had the highest abundance from May-Jun. It was remarkable that the abundance made a peak especially, in May and then decreased dramatically for Sparidae.

Out of 18762 specimen belonging to Sparidae family, 15854 (84.50%) were Diplodus annularis and 10.01% (n = 1879) was *D. vulgaris*. *Serranus hepatus* (n = 10448) was the most abundant species (90.78%) among the Serranidae (*Serranus cabrilla*: 7.80%, n = 898 and *Serranus scriba*: 1.41%, n = 163). The Bothidae (n = 1475) family were presented with three species in the study. These species with their contributions were *Arnoglossus laterna* (97.62%), Bothus podas (1.28%) and *Arnoglossus thori* (1.08%). *Mullus barbatus* (n = 6755) and *Mullus surmuletus* (n = 111) were presented in the Mullidae family with 98.38 and 1.61%, respectively. The Gobidae (n = 1053) family were presented with four species which were *Lesueurigobius friesii* (57.64%), *Gobius niger* (40.26%), *Pomatoschistus* sp. (1.70%) and *Gobius cruentatus* (0.37%). The Centracanthidae were presented with *Spicara flexuosa* (87.29%), *Spicara smaris* (11.43%) and *Spicara maena* (1.27%). Only *Uranoscopus scaber* (n = 147) was presented in the Uranoscopidae family.

During the study, a total of 1504.97 kg fish were caught. The contribution of total biomass by families were the Sparidae (39.01%), Mullidae (17.04%), Bothidae (14.34%), Serranidae (13.59%), Triglidae (8.76%), Gobidae (4.50%), Uranoscopidae (1.96%) and Centracanthidae (0.76%).

Metin *et al*. (2000) investigated the seasonal change in the demersal fish compositions in bottom trawl on seasonal basis from the Gulbahce Bay (in Izmir Bay) and found that the species belonging to the Sparidae were dominant by 80.5% following the Mullidae by 6.2%. In a comparative study on the catch composition of trawl and beach-seining from the Izmir Bay, it was found that *D. annularis* (47.5%) and *M. barbatus* (29.9%) were the dominant species in the bottom trawl and *D. annularis*, *Pagellus erythrinus*, *M. barbatus* and *Spicara flexuso* were dominant in the beach-seining (Akyol and Kara, 2003). As in our findings and previous ones, species belong to the Sparidae (34.38%) were dominant and among the Sparids, *D. annularis* was the most occurred species in this region.

Although it is possible to attribute the lower density of the Mullidae family in the study to the fact that they occur more frequently in the shore line, the real cause is the increasing rate of gillnet fishing which is intensively carried out on.

The Serranidae family was surprisingly in the second order in terms of species abundance in this study. The same issue is valid for the Bothidae. Based on these results, a series of questions are raised. The first; the difference in sampling efficiency between the study and previous ones? the second; the changes in species composition by the time in the Izmir Bay? In sampling we used three main locations based on monthly scale (i.e., 12 hauls in each location) and we handled much more fish than previous study. This may be leaded to these differences. To answer the question of changes of species composition does not seem to possible based on the results. These results should be proved in different studies by time in future. If it will so, the mechanism/s leading to such changes should be investigated in different ways.

Annular sea bream (*D. annularis*) starts to spawn in April in the Izmir Bay (Kinacigil and Akyol, 2001). In the spring, the proportion of the younger size class in the population is higher than those in any season in the Izmir Bay (Ozbilgin *et al*., 2003). These references support our findings that the abundance make a peak in May.

Haidar (1970) showed that in the central and northern Adriatic, there are two migration types of *M. barbatus*: the migration of the young fish from the coast towards the open sea and the spring migration of adult spawning fish towards the channels region along the Croatian coast at depths between 50 and 85 m. Other authors found similar inshore-offshore behaviours (Scaccini, 1947; Zupanovic, 1963; Jardas, 1996). The lowest abundance value for the Mullidae was in May. Depending on GSI values,

Table 1: Correlations (Pearson-r) between the abundance of the families based on temporal pattern

Family	Triglidae	Serranidae	Sparidae	Centracanthidae	Mullidae	Uranoscopidae	Gobidae	Bothidae
Triglidae		0.35	0.44	0.25	-0.44	-0.02	0.29	0.11
Serranidae	0.35		-0.30	0.49	-0.10	0.34	0.79	0.49
Sparidae	0.44	-0.30		-0.06	-0.54	0.14	-0.14	-0.30
Centracanthidae	0.25	0.49	-0.06		-0.25	-0.25	0.13	-0.05
Mullidae	-0.44	-0.10	-0.54	-0.25		-0.07	-0.21	0.02
Uranoscopidae	-0.02	0.34	0.14	-0.25	-0.07		0.71	0.57
Gobidae	0.29	0.79	-0.14	0.13	-0.21	0.71		0.81
Bothidae	0.11	0.49	-0.30	-0.05	0.02	0.57	0.81	

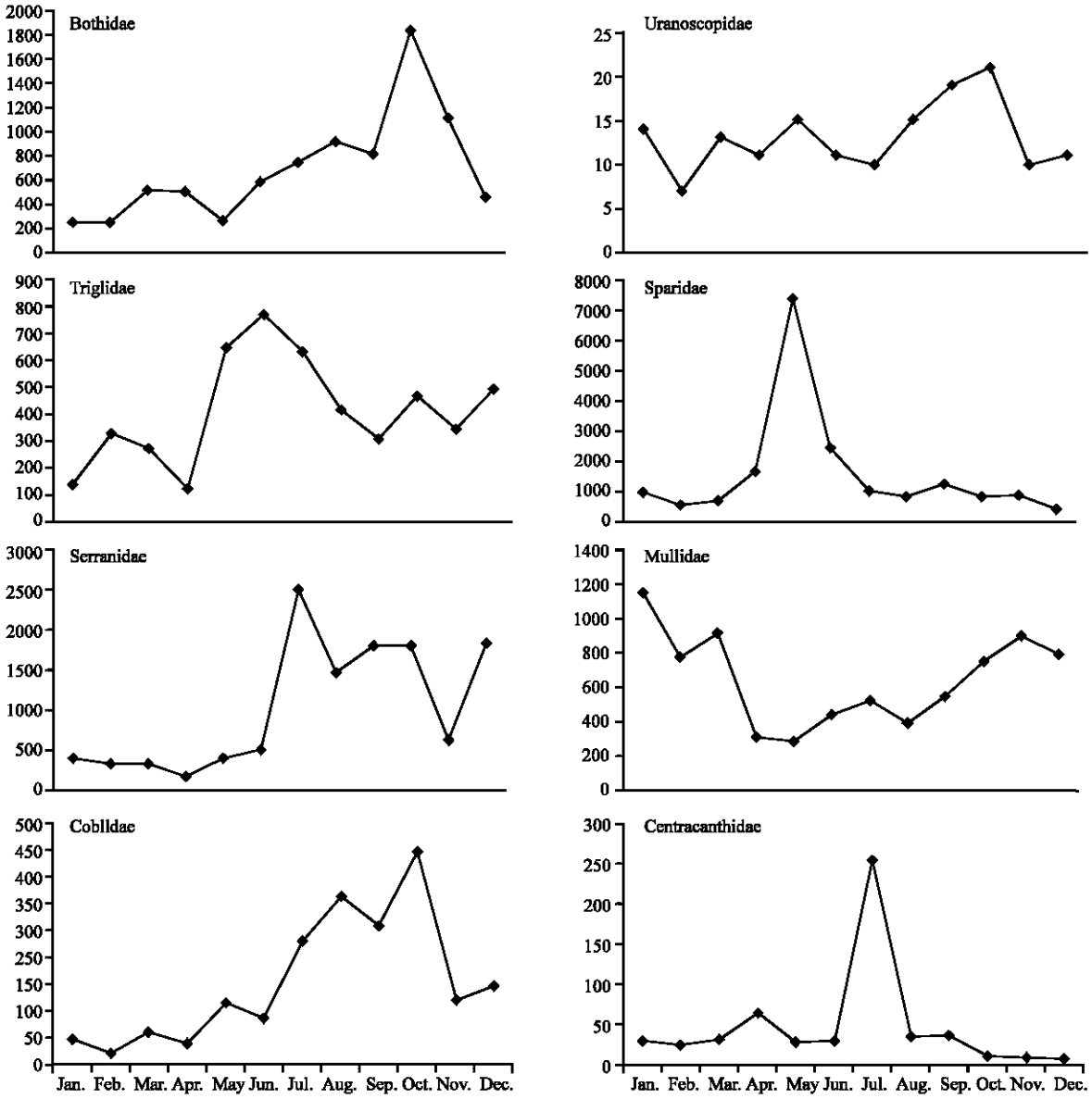

Fig. 4: Monthly abundance of the families

reproduction for *M. barbatus* takes from April-August, but the most in May (Metin, 2005). In the same area, distribution and abundance of pelagic eggs and larvae of teleost fishes were investigated considering five sampling place (Ak and Hossucu, 2001). In that study, eggs of *M. barbatus* were observed in all station, while fish larvae were observed. In reproduction season, therefore, the adults of this species migrate from trawable area (more

depth) to shallow areas, where trawling is banned. In this period (spring to summer), the yield of this species from gillnet fishing, which is operated in all seasons and much more close to the coastline than trawling, is remarkable.

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