EVALUATION OF THE PERFORMANCE OF FISHERY INDICATORS IN THE AEGEAN SEA

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Abstract
Fishery indicators were calculated from data derived through a monitoring program of trawl catches from 1995 till 2005 in the Aegean Sea. Size-based indicators were highly correlated with each other and with the mean trophic level of the demersal assemblages of the study area. Mean trophic level seemed to constitute a useful indicator since it offered powerful detection of existing trends with sampling sizes of a relatively smaller time interval.
Keywords : Bio-indicators, Fisheries, Demersal, Eastern Mediterranean.

Trawlers have dramatic effects on the ecosystem including physical damage to the seabed and the degradation of associated communities, the overfishing of demersal resources, and the changes in the structure and functioning of marine ecosystems derived from the depletion of populations and the huge amount of by-catches and associated discards. In the Mediterranean, bottom-trawling fisheries are essentially multi-species, carried out in a wide range of depths and affecting different bottoms and communities. Moreover, the large number of landing harbours makes it difficult to gather long and reliable series of trawl fisheries data, which are necessary for the development of appropriate indicators contributing to track the impact of trawling on the ecosystem. In this study we discuss the performance of fishery indicators calculated from data derived through a monitoring program of observers recording catches on-board commercial trawlers during an eleven years period in the Aegean Sea. The aim is to evaluate which are more powerful in detecting trends on the state of demersal fish assemblages in eastern Mediterranean waters, being thus more useful for monitoring community/ecosystem changes.

From 1995 to 2005, on a seasonal basis, observers on-board commercial trawlers followed fishing operations and recorded data from hauls in the central Aegean Sea, considered to be among the most important fishing grounds for trawl fisheries in Greece. In a representative sample from each haul, the various species were sorted out, the number of individuals per species and their total weight were noted, while total length of each individual was also recorded. Based on these data three of the so-called size-based indicators, i.e. the mean length, the mean weight, as well as the mean maximum length of the Aegean demersal assemblages, were calculated in each haul. Then, the mean trophic levels were estimated by assigning trophic levels to individuals of the various species on the basis of their length, using relationships between length and trophic level as determined by [1]. Finally, Hill's first and second diversity numbers (i.e. N_1 and N_2: [2]) were used as overall measures of species diversity, as they are less sensitive to the dominant species and to the sampling effort. The overall performance of the indicators was evaluated through correlation analysis and power analysis [3].

Tab. 1. Pearson correlation coefficients between all indices' time series in the Aegean Sea.

	Mean Length	Mean Weight	Mean max Length	Mean Troph	Hill's N1	Hill's N2
Mean Length						
Mean Weight	.989**					
Mean max Length	.912**	.928**				
Mean Troph	.742**	.773**	.918**			
Hill's N1	.486	.528	.469	.518		
Hill's N2	.652*	.693*	.633*	.613*	.947**	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

From Table 1 it is obvious that most indicators are positively correlated to each other. Highly significant positive correlations existed between the various pairs of size-based indicators, as well as between the mean trophic level and each of the size indicators. For powerful detection of a relatively small ecosystem change (<5% of the mean value of the series) a sample exceeding 20 years is needed for all indicators calculated in the present study except for the mean trophic level; the latter appeared to offer powerful detection of possible trends with sampling sizes covering smaller time intervals (Fig. 1). It should be noted, however, that no single tropho-dynamic indicator can track the complexity of the possible changes in fisheries and ecosystems and any change must be interpreted in the light of other complementary indicators. In fact, the present study based on data of a rather limited spatio-temporal coverage could be considered as indicative and has a preliminary role, while the clarification of the observed patterns will be derived only through long-term retrospective analyses, which would also allow correct interpretation of possible trends.

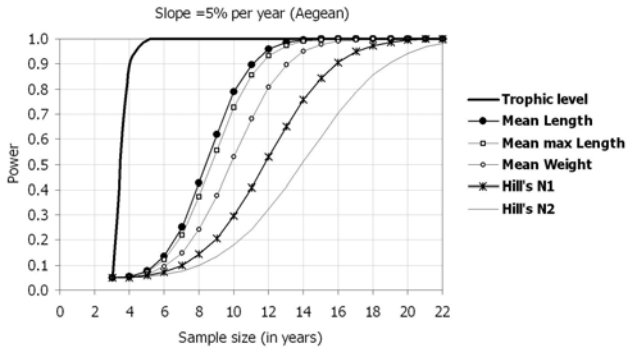

Fig. 1. Power versus sample size (in years) of all indicators' time series in the Aegean Sea. The hypotheses tested a detection of a linear trend (in terms of absolute value of slope) $\leq 5\%$ of the mean value of the series.

References

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