

VARIATIONS IN GROWTH AND LIFE HISTORY TRAITS OF SAND-SMELT, *ATHERINA BOYERI*, POPULATIONS FROM DIFFERENT WATER BODIES OF TURKEY: INFLUENCE OF ENVIRONMENTAL FACTORS

S. Tarkan¹*, G. Bilge², B. Sezen³, A. Tarkan², O. Gaygusuz¹, C. Gürsoy⁴, H. Filiz³, H. Acıpinar⁵

¹ İstanbul University, Faculty of Fisheries, Ordu Cad. No: 200, 34470 Laleli, İstanbul, Turkey. - serhan@istanbul.edu.tr

² Muğla University, Faculty of Fisheries, 48000, Kötekli, Muğla, Turkey

³ Faculty of Fisheries, Ege University, Bornova, İzmir, Turkey

⁴ Çanakkale Onsekiz Mart University, Natural and Applied Sciences Institute, 17100, Çanakkale, Turkey

⁵ İstanbul University, Natural and Applied Sciences Institute, 34850, Avcılar, İstanbul, Turkey

Abstract

The present study describes variations in biological and ecological features of sand smelt in three different ecosystems (fresh, brackish and saline-marine waters). Otolith analysis indicated that lifespan was three years in all study areas. Length-at-age data showed that sand smelt grew better in Ömerli Reservoir rather than in Homa Lagoon and İzmir Bay. Life history variables were relatively similar, although the spawning duration was more extended and GSI higher in Ömerli Reservoir. Differences in growth and life history traits of sand smelt from different water bodies could be attributed to variation in environmental factors.

Keywords : *Fishes, Reproduction, Growth, Lagoons.*

The sand smelt, *Atherina boyeri* (Risso 1810), is a small, short-lived, euryhaline teleost fish of faunistic importance in coastal, estuarine and lagoon habitats, salt marshes, and inland waters, forming large local populations. Sand smelt fisheries are among the most common and important in the Mediterranean countries and represent one of the main fishing resources. In Turkey, even though this species is not consumed by people, it is exported to some Mediterranean countries. However, there is no information about its environmental biology in Turkish waters. In this study, we provide basic information about some biological parameters of sand smelt for the fresh, brackish and marine waters from Turkey, which will be useful for its management.

Sand smelt were collected from Ömerli Reservoir (Anatolian part of İstanbul), Homa Lagoon (İzmir), and İzmir Bay using gill-nets, beach-seines and trawls between September 2003 and August 2004. In the laboratory, the fish were measured for total length (TL) to the nearest 1 mm and for wet body weight (TW) to the nearest 0.1 g. Sex was determined by visual examination of the gonad either by naked eye for larger fish or with the aid of a lens (x16) for smaller fish. Gonad weight (GW) was measured to the nearest 0.001 g. Age was determined from the otoliths. The gonadosomatic index (GSI) was calculated as: $GSI = (GW/TW) \times 100$. The overall ratio of males to females was examined with the chi-square (χ^2) test. Mean length-at-maturity was calculated using non-linear regression [1].

A total of 378 individuals from Ömerli Reservoir, 605 individuals from Homa lagoon, and 966 individuals from İzmir Bay were caught. Otolith analysis indicated that maximum age was three years old from all study areas. Minimum length was 2.4 cm in İzmir Bay and 12.9 cm in Ömerli Reservoir (Fig. 1). GSI of sand smelt peaked between April and July in Homa lagoon and İzmir Bay. However, this period was a bit longer in Ömerli Reservoir which extended to September. The length at first maturity was 4.1 cm, 4.6 cm and 5.1 cm for Ömerli Reservoir, Homa Lagoon and İzmir Bay, respectively. Corresponding ages were 1 year for the three areas. The male:female ratio was 1:12.5 for Ömerli Reservoir, 1:1.28 for Homa Lagoon and 1:1.96 for İzmir Bay which deviated statistically from 1:1 ($P < 0.0001$).

In the three studied areas, the life cycle of sand smelt was short, with only three age groups being evident. This is in agreement with the general pattern observed in most other sand smelt populations previously studied throughout their distribution range [2, 3]. [4] showed that sand smelt can adapt its life history and morphology to environmental conditions with a trend to reduced growth and length-at-age data along an oceanic-coastal-estuarine-freshwater habitat range. However, this trend has been conversely occurred in the present study. Length-at-age data showed that sand smelt grew better in Ömerli Reservoir rather than Homa Lagoon and İzmir Bay. A positive effect of temperature and food on growth of fish has been well documented. However, temperature regimes are quite similar in these locations and had probably no considerable impact on growth differences. We suggest that the presence of large sand smelt in Ömerli Reservoir is attributed to the lack of large predatory fishes in the reservoir and to the lack of fishing which is prohibited by local authorities throughout the year.

Life history variables were relatively similar, with some slight differences, namely extended spawning and higher GSI in Ömerli Reservoir. This may be ascribed to phenotypic adaptation to the environment with an increase in reproductive effort with increasing environmental variability. Since the Ömerli Reservoir is used as a source of drinking water for the İstanbul metropolitan area, an average of 872,000 m³ water per day is discharged from the reservoir which leads to very unstable water level. Furthermore, algicide (copper sulphate) treatments are applied to the reservoir to decrease cyanobacterial blooms, which influence water quality negatively and cause severe fish kills. High dominance of females to males in the reservoir supported this suggestion.

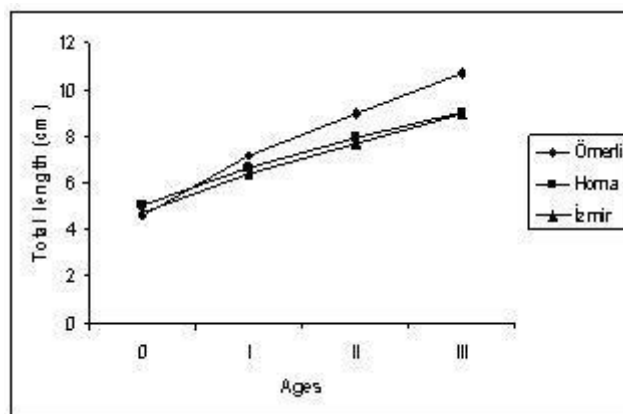


Fig. 1. Length-at-age data for *Atherina boyeri* from Ömerli Reservoir, Homa Lagoon and İzmir Bay.

References

- 1 - King, M.G. 1995. Fisheries Biology, Assessment and Management. Cornwall: Fishing News Books. pp. 158-160.
- 2 - Economou, A.N., Daoulas, C. H., Psarras, T. and Barbieri-Tseliik, R. 1994. Freshwater larval fish from Lake Trichonis (Greece). *J. Fish. Biol.*, 45: 17-35.
- 3 - Leonardos, I. D. and Sinis, A. 2000. Age, growth and mortality of *Atherina boyeri* Risso, 1810 (Pisces:Atherinidae) in the Mesolongi and Etolikon lagoons (W. Greece). *Fish. Res.*, 45: 81-91.
- 4 - Henderson, P. A. and Bamber, R. N. 1987. On the reproductive biology of the sand smelt *Atherina boyeri* Risso (Pisces: Atherinidae) and its evolutionary potential. *Biol. J. Linnean Soc.*, 32: 395-415.