

**LENGTH-WEIGHT RELATIONSHIP OF JUVENILE SARDINE
SARDINA PILCHARDUS (WALBAUM, 1792)
FROM BOKA KOTORSKA BAY**

**Ana Pešić*, Mirko Đurović*, Slobodan Regner*, Aleksandar Joksimović*,
Vladica Simić****

**Institute of Marine Biology, Dobrota b. b., 85330 Kotor, Serbia and Montenegro
e-mail: pi098ana@yahoo.com*

***Faculty of Science, Radoja Domanovića 12, 34000 Kragujevac,
Serbia and Montenegro*

(Received April 03, 2006)

ABSTRACT. The length - weight relationship of juvenile sardine *Sardina pilchardus* from Boka Kotorska Bay was analyzed. The better knowledge of juvenile growth needs more attention for the entire Adriatic sea, special for the Montenegrin coast were this investigation was made for the first time. The results obtained from these investigations were compared with the data obtained from the period 1986-87 from the area of Novigrad and Karin Bays of the eastern Adriatic coast [1].

INTRODUCTION

The huge problem in fishing biology is insufficient knowledge of growth and mortality of juvenile stadiums of fishes. That problem is mostly related to the fishing technique, because fishing tools are made for catching only the adult part of population. There is a specific situation on Montenegrin shelf, which enables detal researches of juvenile sardine, starting from analysing her growth and mortality to the anlyzes of frequences of new cohort apearing.

Namely, catch of small pelagic fishes on Montenegrin coast with industrial fishing techniques in the open sea is still undeveloped. Sardine and anchovy are only caught with beach seines with using of artificial lights (luring) in coastal waters, especially in Boka Kotorska Bay. Traditionally, this type of fishery is mostly developed in Kotor Bay.

This special type of fishery is carried out in Boka Kotorska Bay for centuries. First data of catching the juvenile sardine from the 1331 year could be found in the Kotor town

Archive. Furthermore, the fishery of juvenile sardine is spread all over Mediterranean, especially in Adriatic Sea [2, 3, 4, 5, 6, 7, 8, 9].

MATERIAL AND METHODS

Juvenile sardine were studied in Boka Kotorska Bay. It's a closed marine bay with a lot of freshwater springs emptying into it, and is liable to rather great temperature and salinity variations. Samples of juvenile sardine for this study were collected at least once a month from June 2004 to August 2005. The length and weight of 2489 individuals of *S. pilchardus* were measured. The total weight of analyzed individuals was 11.56 kg.

Total length (TL), from the peak of mandible to the stretched ends of the caudal fin was measured with the one millimetre precision.

Weight of the fishes was measured with precision of 0.01 gram.

RESULTS

Length - weight relationship was approximated with well known power function of the form:

$$W = aL^b \quad (1),$$

where W is the weight in grams, L is total length in centimeters, while a and b are constants.

The function (1) was linearized taking the logarithms W and L :

$$\log W = \log a + b \log L \quad (2).$$

Equation (2.) was fitted to the data, and constants a and b were estimated with method of linear regression, where $\log L$ was independent and $\log W$ dependent variable.

Linear regression was estimated from logarithms of average values of the length classes with the intervals of 0.5cm (Tab. 1).

The following results were obtained:

$$\begin{aligned} a &= -2.3304 \\ b &= 3.1671 \end{aligned}$$

Table 1 - Logarithmic averages of the length and weight trough length intervals in Boka Kotorska Bay

Interval midpoint (cm)	log LT	log W
4.745	0.6762	-0.1871
5.245	0.7197	-0.0469
5.745	0.7593	0.1249
6.245	0.7955	0.1962
6.745	0.8289	0.2969
7.245	0.86	0.3757
7.745	0.889	0.4646
8.245	0.9162	0.5804
8.745	0.9418	0.6606
9.245	0.9659	0.7193
9.745	0.9888	0.7848
10.245	1.0105	0.8437
10.745	1.0312	0.8864
11.245	1.0509	0.9487
11.745	1.0698	1.0476
12.245	1.0879	1.1372
12.745	1.1053	1.1639
13.245	1.1221	1.2576
13.745	1.1381	1.3041
14.245		
14.745	1.1686	1.3906
15.245	1.1831	1.4094
15.745		
16.245	1.2107	1.5278

Antilogarithm of the coefficient **a** is:

$$a = 0.0047$$

Standard error of the constant **b** is $S_b = 0.0256$, and the confidence limits for 95% probability levels are from 3.0925 to 3.2416. F_s value is 7845.9, and for $F_{1,22}$ of 14.4, $P < 0.001$ (99.9%). Coefficients of determination and correlation are $r^2 = 0.9975$ and $r = 0.9987$.

So, the length - weight relationship of *S. pilchardus* in Boka Kotorska Bay is:

$$W = 0.0047 L^{3.1671}$$

The logarithmic length - weight relationship, as well as 95% confidence limits to the slope of regression are shown in Figure (1).

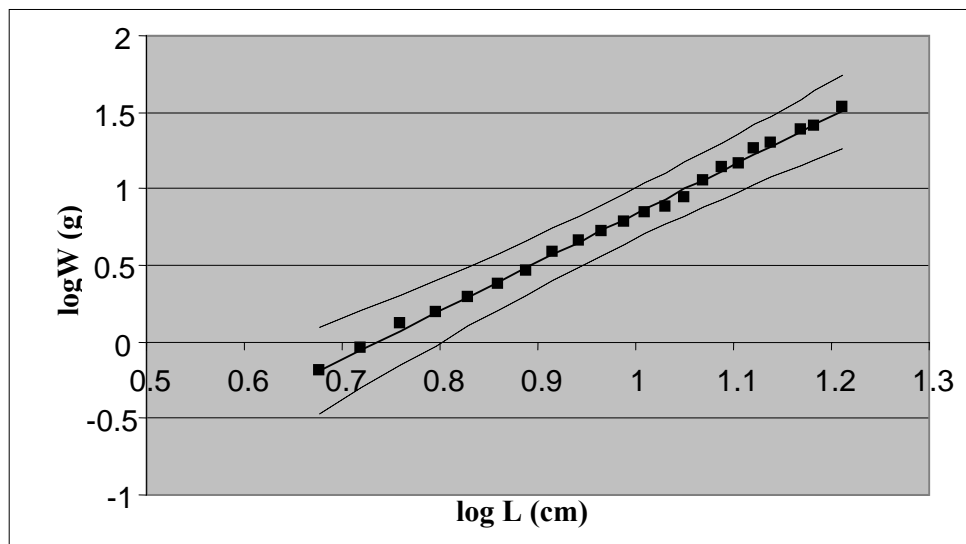


Figure 1 - Length - weight relationship of *Sardina pilchardus* in the Boka Kotorska Bay (full line), 95% confidence limits to the slope of regression (dashed lines). Dots = logL - logW averages

DISCUSSION

The length - weight relationship of *Sardina pilchardus*, from the samples collected with beach seines with using of artificial lights (luring) in the Boka Kotorska Bay from June 2004 to July 2005 was analyzed. The values of powers of the length - weight equations were $b = 3.1671$. The comparison of regression lines showed that the difference, although it obviously existed, was significant for the very low level of probability ($P < 0.25$).

Only data which can be compared with the results of our researches are the data from Kačić *et al.* (1987) from the area of Novigrad and Karin Bays (Croatian coast, east coast of Adriatic Sea). We found big similarity in data, especially in coefficient **b**, which was in Novigrad Bay $b = 3.122$ and in Karin Bay $b = 3.468$, and in our researches $b = 3.1671$.

This could be explained with similarity of those coastal areas in their levels of eutrophication, because there are more nutrients in closed marine bays, then in the open sea areas. The possible differences in data could be caused by dynamic of sampling (in our researches there is one year cycle of sampling, and in theirs there is only the spring aspect).

On the Western coast of Adriatic Sea there are only the data for adults and larvae of sardine, not for juveniles, so unfortunately it is impossible to compare the results.

References

- [1] Kačić, I., Sinovčić, G., Alegria-Hernandez, V. (1987): *Juvenile sardine along the eastern Adriatic coast – studies and protection*. FAO Rapp. Peches / FAO Fish. Rep. 394, 105-111.
- [2] Rizzoli, M., (1983): *Considératione sur la pêche du “Bianchetto” en Adriatique*. FAO Fish. Rep. No. 290: 233-234.
- [3] Romanelli, M., Giovanardi, O., Tarulli, E., Manzueto, L. (1994): Analisi quali-quantitativa del prodotto commerciale derivante dalla pesca del “bianchetto” nel compartimento marittimo di crotone (mar Ionio). *Biol. Mar. Medit.* **1** (1): 301-302.
- [4] Romanelli, M., Colloca, F., Manzueto, L., Manca, M., Gerano, R., Giovanardi, O. (1998): Analisi delle catture ottenute in campionamenti svolti con una sciabica da “bianchetto” nell-area di sestri Levante (Liguria orientale). *Biol. Mar. Medit.* **5** (1): 718-720.
- [5] Romanelli, M., (1998): Effetti della pesca di novellame di consumo (“bianchetto”) in Italia. *Biol. Mar. Medit.* Vol. **5** – Fasc. 3, -(Parte Prima).
- [6] Romanelli, M. & Giovanardi, O. (2000): A special fishery aimed at advanced larvae of *Sardina pilchardus* (Walbaum) along the Northwestern and Central Western coasts of Italy. A general report. *Biol. Mar. Medit.* **7** (3): 158-172.
- [7] Romanelli, M., Colloca, F., Giovanardi, O. (2002): Growth and mortality of exploited *Sardina pilchardus* (Walbaum) larvae along the western coast of Italy. *Fish. Res.* **55**: 205-218.
- [8] Ungaro, N., Casavola, N., Marano, G., Rizzi, E. (1994): “Bianchetto” and “rossetto” fry fisheries in the Manfredonia Gulf: effort exerted and catch composition. *Oebalia*, **20**: 99-106.
- [9] Ungaro, N., Marano, G., De Zio, V., Pastorelli, A. M., Rositani, L. (2003): *The traditional “bianchetto” and “rossetto” fishery in the Gulf of Manfredonia (Southern Adriatic Sea, GFCM Geographical sub-area N^o 18)*. Report of the AdriaMed Technical Consultation Adriatic Sea Small-scale Fisheries. Split, Croatia, 14th-15th October 2003.