GROWTH OF PANDORA, *PAGELLUS ERYTHRINUS*, FROM THE MONTENEGRIN SHELF

Aleksandar Joksimovich

Institute of Marine Biology, Kotor, Yugoslavia - ajoksim@biokotor.org

Abstract

The growth parameters of Pandora, *Pagellus erythrinus* (Linaeus, 1758) were estimated for the Montenegrin coastal area, as this is one of the most important species of trawling fishing. The estimates were made separately for Boka Kotorska Bay and the open sea of Southern Adriatic.

Keywords: Growth, Teleostei, Montenegrin shelf, South Adriatic

Pandora, *Pagellus erythrinus* (Sparidae, Percoidei) is only economically interesting species which biology and population dynamics has been studied in details in the Montenegrin coastal area. Among the others, growth parameters of this species have been studied too,(1) estimated growth parameters of Pandora in this area from the data obtained in the period from 1964 to 1965. These estimates apart, the only data on Pandora's growth for the Eastern Adriatic coast are those from the channel of the Middle Adriatic in the period 1957/58 (2). Therefore, the recent results given in this paper can be compared with these previous data.

Material and methods

Material was collected during the period from May 1997 to May 1999, with commercial trawlers in depth of 50-300 m. Thirty trawl hauls were analysed in total. In Boka Kotorska Bay 10 hauls were performed, and 20 at the open sea (Fig.1). The length and weight of 3201 individuals of *Pagellus erythrinus* were measured. The total weight of analysed individuals was 362.39 kg. Of that number, 2093 individuals (310.99 kg) were from Boka Kotorska Bay, while 1108 individuals (51.4 kg) have been taken at the open sea. Collected material was almost entirely processed on board Total length (TL), from the peak of mandible to the stretched ends of the caudal fin was measured with the one mm precision. The age of the fish was determined through rings on scales taken immediately above the lateral line. The age was read with the help of binocular lens "WILD" that enlarges 25 times. The estimate of growth parameters in the von Bertalanffy's function (3,4) is done with the method of smallest squares of non-linear functions.

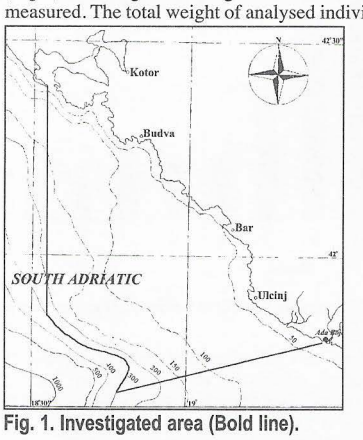

Fig. 1. Investigated area (Bold line).

In order to calculate this, programs FISAT (5) and TRAWLAN (6) were used. The parameters L_∞, K and t_0 are being estimated after the various transformations, in different ways, based on a long row of data about age (t) and length of fish (L). The ratio $\frac{L_{max}}{L\infty}$ was also calculated (7), as the mass growth in the function of time (3,4).

Results

The results of estimate of growth parameters are shown in Table 1 as well as graphically in Figure 2 and Figure 3. Table 2 shows the estimated values of length-weight ratio (8), growth and maximum weight of individuals, gathered both through this estimate and the earlier estimates for Boka Kotorska Bay, for year 1964/65 (1) and the channels of Midlle Adriatic from year 1957/58 (2).

Table 1. Growth parameters of von Bertalannfy's growth function, by method of estimation of sum smallest squares of non-linear function.

	L_∞	s.e.	c.v.	K	s.e.	c.v.	t_0	s.e.	c.v.	r
Bay	37.741	0.457	0.0121	0.162	0.0065	0.0399	-1.227	0.0979	-0.045	0.993
O. sea	32.755	2.592	0.0791	0.202	0.0494	0.2445	-0.568	0.4548	-0.801	0.990

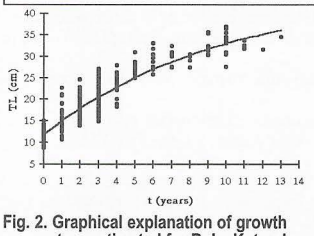

Fig. 2. Graphical explanation of growth parameters estimated for Boka Kotorska Bay.

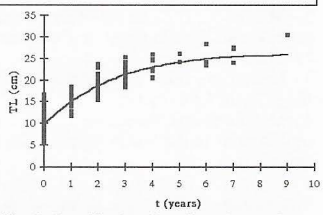

Fig. 3. Graphical explanation of growth parameters estimated for open sea.

Discussion

Estimation of growth parameters by the method of smallest squares of non-linear functions gave following results: for the Bay L_∞ = 37.741, K = 0.162 and t_0 = -1.227, for the open sea L_∞ = 32.752, K = 0.202 and t_0 = -0.568. Rijavec (1) got following values: for Boka Kotorska Bay L_∞ = 30.92 cm, K = 0.239 and t_0 = -1.639. The results of present estimate show larger values of the asymptote for Boka Kotorska Bay L_∞ = 37.741, but smaller growth rate K = 0.162, while t_0 =-1.227. The most probable explanation of this difference is the increase of trophic base in the bay as well as the increase in this species' biomass.

Table 2.- The estimatied values of length-wight ratio, growth and maximal weight of specimens in present and previous research.

	W_∞ (gr)	L_∞ (cm)	a	b
B.K..Bay 98/99.	559.95	37.741	0.0146	2.907
Open sea 98/99.	326.28	32.755	0.0216	2.758
B.K.Bay 64/65.	313.84	30.92	0.0220	2.787
Midlle Adriatic 57/58.	679.74	37.88	0.0134	2.981

Therefore, it may be assumed that the intraspecific competition has increased too, so the individuals grow slower but attain larger final size. The parameters that indicate the levels of eutrophication (nutrients, oxygen saturation, BOD, etc.) were not systematically measured in the Boka Kotorska Bay. Therefore, it is difficult to estimate the time of the beginning of anthropogenic eutrophication, and to assess its level. The only reliable indicator of human induced eutrophication of the Bay is the regular appearance of the summer maximum instead of usual spring and autumn maxima of phyto and zooplankton (9). However, until the beginning of seventies, there were no summer maxima of both phytoplankton (10) and zooplankton (11) in the Adriatic. They appeared for the first time with the beginning of anthropogenic eutrophication of Adriatic.It is not possible to compare these data with data from Rijavec (1), as he does not present data of estimates of growth parameters for the open sea. The only existing data which may be compared with ours are given for the channel area of Midlle Adriatic, Zupanovic and Rijavec (2) have compared the material collected in season 1957/58 and find out that L_∞ = 37.88 and K = 0.20. The value of K in the channel zone of the Midlle Adriatic matches the value of K for the open sea of Montenegin sea coast, while L_∞ matches the value for Boka Kotorska Bay. These data point to the conclusion that the ecological conditions of channels in Midlle Adriatic in season 1957/58 were similar to the present ecological conditions of Boka Kotorska Bay. The discovered difference between the asymptotes and the temporary growth rates in Boka Kotorska Bay and the open sea, supports the theoretical hypothesis that, the quicker growth rate is, the smaller are the asymptotic lengths, means that, K and L_∞. are oppositely correlated. On the other hand, Zupanovic and Rijavec (2) have find out that at the relatively high values of temporary growth rate, the asymptote is large, too. This disagreement with the theory can be explained in two ways. As the channel area of Midlle Adriatic belongs to the naturally euthrophic zones (12), while the trawling fishing as well as the other ways of fishing were intensive even then, it is possible that Pandora grew faster due to suitable trophical conditions on one hand, and the decreased intraspecific competition on the other hand. The other explanation is, that perhaps those are two different populations of *Pagellus erythrinus*, one living in channel area of Midlle Adriatic and other from Montenegin shelf.The calculated Hohendorf's index shows that the specimens from the bay have a better growth potential (0.962) than those on the open sea (0.930). Considering the ecological conditions and the greater amount of suitable food, the difference in values of this index is clear. The calculated values of final growth W_∞ for the bay are now at 559.95 grams, similar to the values for channels of Midlle Adriatic 679.74 gr (2). This fitting of values supports the already explained similarity of ecological conditions in these two areas. On the other hand, the almost identical values for the open sea now 326.28 gr and Boka Kotorska Bay 313.84 gr in the period 1964/65 (1) speak in favor of the smaller trophical base, i. e., insignificant eutrophication of the Bay in previous period. Nowadays, the value of W_∞ for Boka Kotorska Bay is almost twice bigger than in the season of 1964/65, and this also points to the intensive anthropogenous eutrophication of Boka Kotorska Bay.

References

1-Rijavec L., 1975. Biology and Dinamics of *Pagellus erythrinus* (L.) in the Boka Kotorska Bay and of the Coast of Montenegro (South Adriatic). *Studia Marina*, 8: 3 - 110.
2-ZupanoviC S., Rijavec L., 1980. Biology and population dynamics of *Pagellus erythrinus* (L.) in the insular of the Middle Adriatic. *Acta Adriat.*, 21(2): 203-226.
3-Bertalanffy L. von, 1934. Untersuchungen über die Gesetzlichkeiten des Washstums. 1. Allgemeine Grundlagen der Theorie. *Roux' Arch. Entwicklungsmech. Org.*, 131: 613-653.
4-Bertalanffy L. von, 1938. A quantitave theory of organic growth (inquiries on growth laws. II). *Human Biology*, 10(2): 182-213.
5-Gayanilo F.C., Sparre P., Pauly D., 1995. The FAO-ICALRM Stock Assessment Tools (FISAT) User's Guide. *FAO Computerized Information Series (Fisheries)*. 8:126p.
6-Regner S., 1999. TRAWLAN - a BASIC package for trawl survey analysis.
7-Hohendorf K., 1966. Discussion der Bertalanffy - Funktionen und ihre Anwandung zur Characterisierung des Wachstums von Fischen. *Keiler Meeresforsch.*, 22: 70 -97.
8-Joksimovich A., 1999. Length-weight relationship of pandora, *Pagellus erythrinus* (Linnaeus, 1758), from the Montenegrin shelf. *Ichthyologia*, 31(1): 9-21.
9-Regner D., *et al.* 1999. Zastita i unaprelenje zivotne sredine morskog dobra. *Ekoloska studija*: 38p.
10-Pucher - Petkovic T., 1975. Fitoplankton Kastelanskog zaljeva u odnosu na organsku poluciju. *Pomorski zbornik*, 13: 247-256
11-Regner D., 1979. The influence of eutrophication on the copepods in the coastal area of Split (Central Adriatic). *Rapp. Comm. int. Mer Médit.*, 25/26(8): 101-102
12-Buljan M., 1964. Ocjena produktivnosti Jadrana dobijena na temelju njegovih hidrografskih svojstava. *Acta adriat.*, 11 (4): 35-45