

Evaluation of Anchovy (*Engraulis encrasicolus*) Population by Age and Length

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Abstract:

Anchovy (*Engraulis encrasicolus*), is a member of small pelagic fish group in the waters of the Mediterranean and Adriatic Sea with important economic value for all regional countries, including Albania. The purpose of this study was to define the age of Anchovy, as one of the important indicators for the assessment of fishing reserves. Age evaluation was based on sagittal otoliths, found in the inner ear of the fish. The study was conducted at the Aquaculture and Fishery Laboratory in Durrës, during the period January 2008 - December 2009. At this time, 863 fish were analysed. For each individual was kept records for weight and height then, otoliths were removed, and finally watched in stereomicroscope (40 X) annual assessment circles around the otoliths opaque core. Age of fish is equal to the number of annual rings. The study showed that the average age was 2.22 year, and 70% were 2+ and 3+ years. The average length was 13.98 cm. About 58% of anchovy fish were with length 12.5 - 15 cm. This study will help determine the population dynamics of anchovy fish and more accurate predictions for the amount of fish to hunt in defined time periods.

Keywords: *Engraulis encrasicolus*, population, length, age, otolith.

1. Introduction

Anchovy (*Engraulis encrasicolus*) is a fish of a small pelagic group, measuring from 2-40 cm with a 3-5 year life span. It is a typical migratory fish, found in batches of the Black Sea, Mediterranean Sea and the Adriatic Sea depths of 30-200m. Anchovy occupies an important place in the canning industry of Albania. The age determination of sampled species is a fundamental parameter of study of biological aspects such as growth. Determination of the age is based on the modern method of the sagittal otoliths annual circles assessment. The otolith is approximately 2-5mm, oval with an outer concave face (Figure 1). The dorsal and ventral edges converge towards the front, formers and rostrum. The antirostrum, less marked than rostrum, is located on the dorsal edge, and is separated from the rostrum by a fissure or deep cutting. The dorsal edge is slightly curved, while the ventral one possesses quite regular saw-like teeth, which are more marked with increasing age of animal. In term of hyaline zone

counts no differences have been found between the right and left otoliths. Its major axis is oriented perpendicular to the growth ring. Generally, the interpretation of age of growth, through the reading of bony structures, such as rings of scales of otoliths, is based on the supposition that periodical morphological structures and created, which are proportional to fish growth [2, 10].

Due to the introduction, by Panella (1971) [7], of micro structural and chemical methodologies for the analysis of the structures used in age-determination of bony fish, many causes of error, so frequent in the past, in the interpretation of age have been eliminated now. Nevertheless, it is important to realize that although the instrumentation available is ever more sophisticated and complex, method estimating age by means of otoliths are always influenced by the subjective interpretation of the readers [1]. The otolith is formed by opaque and hyaline bands. The opaque bands are formed by crystalline structures whilst the

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hyaline bands by a protein matrix. Upon observation under transmitted light microscope, a crystalline structure with a long crystal axis oriented perpendicular to the growth rings can be seen. Each crystal is embedded within a protein matrix and a band indicates the direction of growth of the crystal. This is the discontinuous zone [4]. The term “discontinuous” is however, at times inadequate because there often is a continuity in the crystalline net [2]. The crystalline structure has been shown to be rich in calcium carbonate, disposed in an aragonite configuration [6]. Studies of anchovy otolith carried out by various authors have shown that opaque zones are associated to the summer period (May–November), whilst the hyaline ones, to the winter period (December–April) [3, 11]. The central part of the nucleus contains a diffuse zone that corresponds to the period of larval life and appears morphologically the same in all analysed otoliths [8].

The purpose of this study was to define the age of Anchovy, as one of the important indicators for the assessment of fishing reserves. Age evaluation was based on sagittal otoliths, found in the inner ear of the fish.

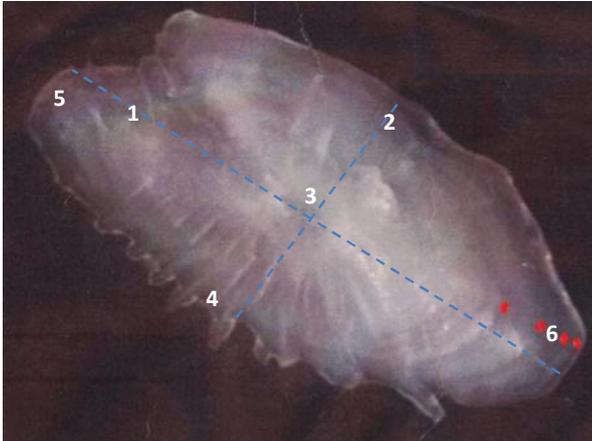


Figure 1. The otoliths of anchovy (*Engraulis encrasicolus*). (1. Major axis, 2. Minor axis, 3. Nucleus, 4. Ventral edge, 5. Rostrum, 6. Annual rings)

2. Material and Methods

The study was conducted at the Aquaculture and Fishery Laboratory, Durrës, in the period January 2008 - December 2009. During this time frame, 863 fish in total were analysed. For each fish the exact weight (g) and total length (mm) records were kept,

then otoliths were removed, and finally they were watched in a (40X) stereomicroscope in order to assess the annual circles around the otolith opaque core. The fish age is equal to the number of annual rings.

Protocol used for age determination of anchovy otoliths:

1. Cleaning of the otolith with water or alcohol
2. Conservation of the otolith in a dry environment in proper plastic tubes.
3. Numeration of the otolith, must be progressive and with one identifiable acronym of the species.
4. Reading of the annual rings. The otoliths, with the acoustic sulcus facing downwards, are placed in Petri-dish contain 70° alcohol on a dark or better, black base.

The reading is carried out with a stereomicroscope under reflected light. Counting of bands or rings is always carried out from the central zones to the marginal zones, the latter being situated in the posterior zone of the otolith (the dorsal edge). One hyaline band (slow growth) and one opaque band (fast growth) together constitute one unit of growth.

The magnification used for reading under reflected light is usually 40X. Both otoliths of an individual must be read and the readings must be carried out by least two readers in different places. If, on comparison, the readings result non-homogenous a third reader is required [5]. The readings, once confirmed, will be used to estimate the various growth parameters.

3. Results and Discussion

The study showed that anchovy is a fish species present throughout the year in the Albanian coast (Table 1).

That study showed that the average age was 2,22 years (sd = 0.932), (min. 0 years, max. 5 years) (Figure 2).

67% of the fish analysed were 2+ and 3+ years, indicating that the Anchovy population in the Albanian part of the Adriatic Sea is relatively not so young in age. This shows that Anchovy stock is not used, which leads to its aging and their flocks not being reproduced relatively normally and effectively.

The average length was 13.98 cm (sd= 0.764), (min. 8 cm whilst max. was 27 cm). The length of about 60% of Anchovy fish was between 12.5 - 15

cm. Anchovy average weight was 17.56 g. (2.9 g min. and max. 43.2 g).

Length / weight correlation resulted to be 0.91, while the age / length correlation resulted in 0.67 (Figure 3).

Age / weight correlation resulted weaker, only 0.6 and this is explained by the fact that anchovy is a fish that grows up very fast in the first year, and then its growth pace decreases significantly.

Table 1. Assessment of Anchovy samples for the period 2008 – 2009

Anchovy 2008 - 2009										
Month	No. of samples	Length (cm)	Min	Max	Weight (gr.)	Min	Max	Age (years)	Min	Max
Januar	85	14.66	9	17	17.29	3.9	32.8	2.31	0	4
February	82	12.935	10	17	13.175	5.6	28.3	1.735	0	4
March	50	13.29	11	16	14.86	5.8	26.3	1.84	1	3
April	92	15.07	11.5	27	23.515	11.4	40.5	2.23	0	4
May	105	14.715	12	17.5	23.63	9.2	42.8	2.18	0	5
June	101	13.73	8	17.5	17.835	2.9	35	2.11	0	4
July	66	14.34	10.5	18	21.9	7.1	43.2	2.03	1	4
August	33	13.06	10.5	16	13.57	6.4	22.6	2	1	3
Septembre.	77	13.03	9.5	16	14.14	5	25	2.25	1	3
Octobre.	73	14.88	12.5	17.5	21.13	10.8	36.5	2.67	2	4
Novembre.	48	13.64	10.5	16.5	15.58	6.9	26.1	1.75	1	3
Decembre.	51	13.35	10.5	16	14.13	7.2	25.3	2.37	1	4
	863	13.98	8	27	17.56	2.9	43.2	2.22	0	5

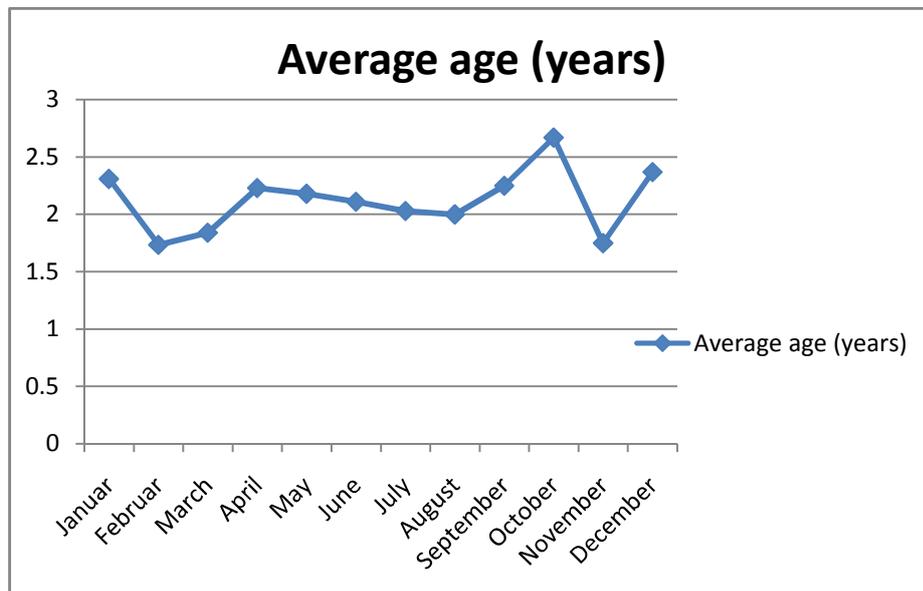


Figure 2. Average age of Anchovy about months

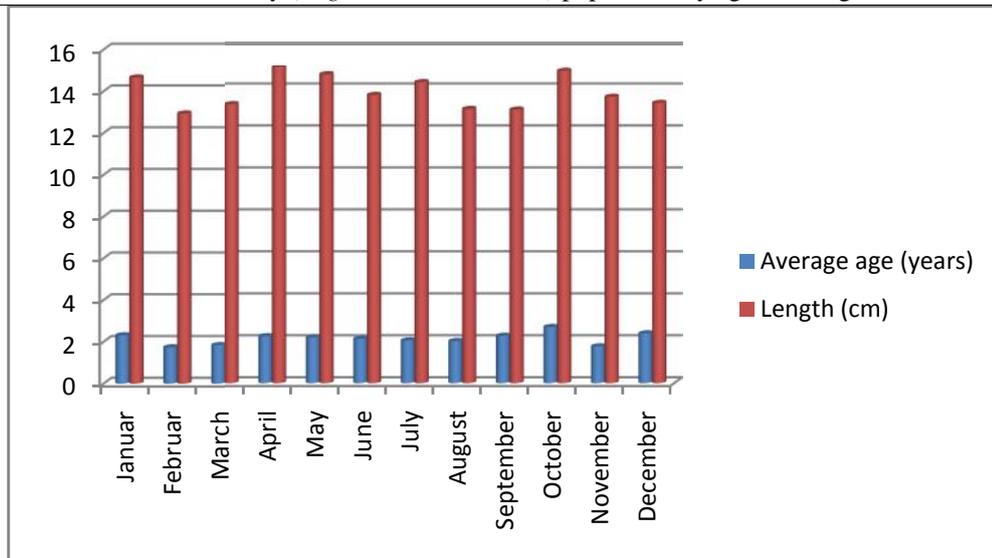


Figure 3. The relationship between age and length

4. Conclusions

According to the primary objectives of the research is focused to used stock assessment with modern and dynamic tools for data collection and biological sampling.

This study serves to raise awareness of pelagic fishery sector in Albania. By exploiting Albanian anchovy resources and not the imported stock. Our processing factories will make use of a specific anchovy already known for its economic value and unique taste. This study will help determine the anchovy fish population dynamics in order to accurately predict the amount of fish catches in defined time - periods.

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