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AGE DETERMINATION ASPECTS IN ANCHOVY (*Engraulis encrasicolus*, LINNAEUS, 1758) AT THE ROMANIAN BLACK SEA COAST

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Abstract

Age is a factor providing significant information on species evolution at population level. Anchovy is a pelagic, gregarious, small-sized species and, until 20 years ago, it represented an important share of Black Sea fish catches. The Black Sea anchovy stock has suffered in the past decades from various causes, among which overexploitation, penetration of alien species, pollution etc.

Age determination of Romanian Black Sea anchovies was made by otolith reading using an inverted microscope. A decrease of the 2+ years share and an increase of the 1+ years age classes share were reported.

Key words*:* anchovy, Black Sea, otoliths, age

Introduction

In recent years, marine fisheries along the Romanian Black Sea coast have been limited to performing stationary fishing, in the coastal and shallow area (forage and spawning grounds for many fish species), using fixed fishing gears.

As a follow-up of analyzing the samples collected during 2010-2014, it was noticed that the biomass of commercial fish species recorded a continuous drop (Table 1). This decrease may be the result of several factors: eutrophication (sources from agriculture, municipal waste, industry etc.), harmful substances (sources from agriculture, industry, municipal waste etc.), commercial fisheries, alien species. The anchovy biomass and catches were largest during the 1980s. The first signs of overfishing appeared after 1984, when anchovy shoals were difficult to be found and the fishery enterprises incurred losses; it appears that the

dramatic reduction of the Black Sea anchovy stock in the late 1980s was due to the combined action of two factors: the excessive fishing and *Mnemiopsis leidyi* outburst [1].

Table 1. Biomass (tons) of the main commercial fish species of the Romanian Black Sea coasts (original, according to internal NIMRD Reports).

Species	**2010**	**2011**	**2012**	**2013**	**2014**
Engraulis encrasicolus (anchovy)	**50**	**41**	**57**	**44**	**30**
Sprattus sprattus (sprat)	59634	60000	68887	56429	60000
Gobiidae sp. (gobies)	500	500	450	300	300
Psetta maeotica (turbot)	1149	1147	628	554	298
Squalus achantias (dogfish)	13051	10000	1550	4483	1520
Merlangius merlangus euxinus (whiting)	20948	21000	5650	19797	15550

As it arises from the table above, anchovy, species with high commercial value and targeted by active fisheries before, has recorded massive biomass drops in the past years. Thorough population studies of the species are needed, in order to better understand the development of events such as biomass decrease. Consequently, the accurate determination of fish age is one of the most important aspects in population dynamics studies. Age is the background for calculation of growth, mortality, recruitment and other fundamental parameters for population studies [2].

Age determination in fish can me made by three methods: skeletochronology (the concentric growth rings identified in a bone cross-section are counted), scalimetry (estimation of the age of fish by examination of concentric peaks on their scales) and otolithometry (identifying the annual growth rings of otoliths in the internal ear**).** Otoliths, sometimes referred to as ear bones, are of unique value for age determination of teleost fishes because across taxa they are the only hard structures that continue growing even after somatic growth has ceased [3], but also because they are easily collected and stored.

The analysis of otoliths for age determination can be carried out in two different ways: at macrostructural level, considering annual bands, and at microstructural level, based on daily increments.

Materials and methods

Aiming at determining the age of anchovy, samples were collected from fixed fishery points located along the Romanian Black Sea coast, during May-September of the past years. Anchovy specimens were brought to the laboratory and analyzed on length classes or individually, with the purpose of assessing the general state of anchovy population at our coast (Fig. 1).

Fig. 1. Anchovy specimens analyzed in the laboratory (original).

A batch of approximately 200 individuals is analyzed for each sampling station; specimens are weighed, measured and, after separation on length or weight classes, sex, maturation degree and parasitization extent (where the case) are determined, and subsequently otoliths are extracted for age determination; growth rings are identified with an inverted microscope (Fig. 2).

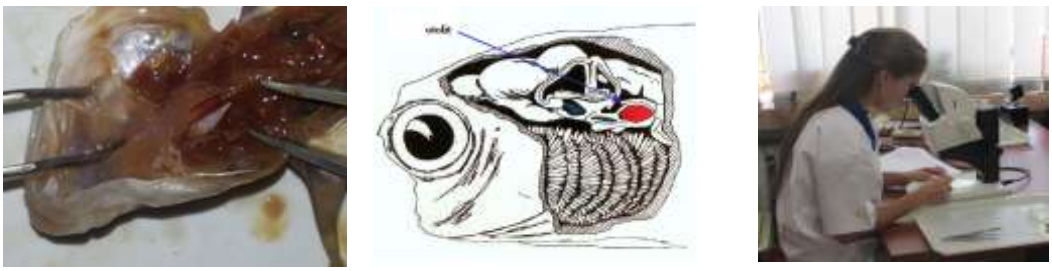

Fig. 2. Identification, extraction and analysis of otoliths (original)

Otoliths were collected by performing a section on the fish head, extracted and subsequently cleaned of the protection membranes with an alcohol-based solution. They were then stored in dry spaces until inverted microscope analysis was performed.

Age determination was made by identifying the growth rings on the surface of otoliths (Fig. 3).

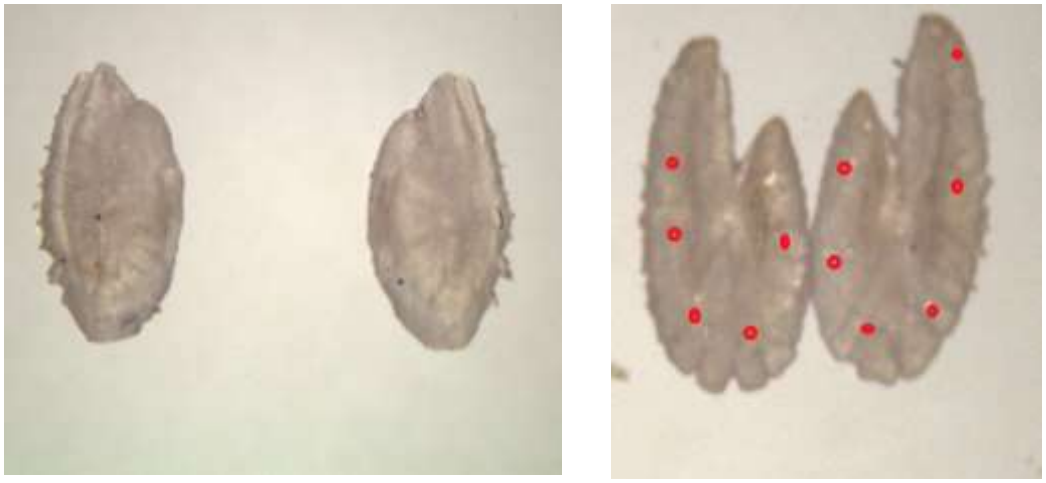

Fig. 3. Anchovy otoliths, age 1 : 1+ (original).

For an accurate age estimation, after identifying and counting annual growth rings, other aspects are also considered, such as likely hatching date, time of fishing etc. [4].

Results and discussions

During the analyzed period, the dominant age classes were between 1 : 1+ and 2 : 2+ years, while the 3 : 3+ age class had a smaller share; individuals belonging to the 4: 4+ years age class were identified only in an isolated manner (Fig. 4).

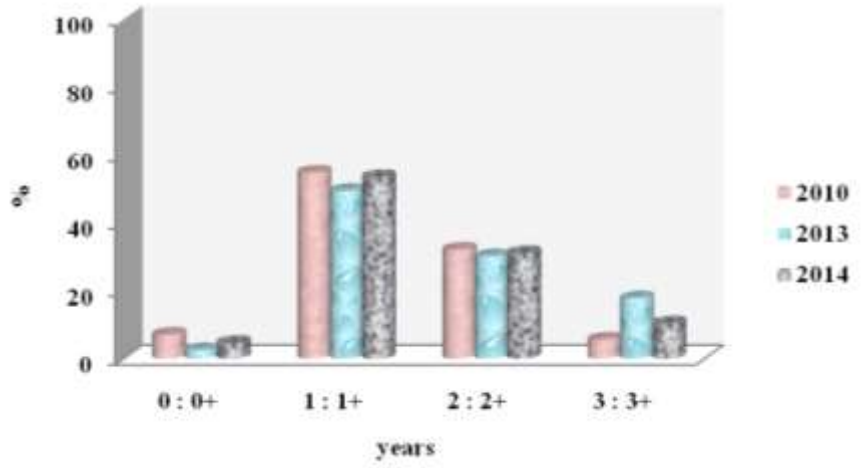

Fig. 4. Percentage of age classes in anchovy 2010-2014 (original)

Compared to previous years, it was noted that the share of individuals aged 1 : 1+ and 2 : 2+ years is dominant, with a slight increase of 3 : 3 + years individuals [5]. As such, it can be concluded that a slight rejuvenation of anchovy population of the Romanian Black Sea coast is documented.

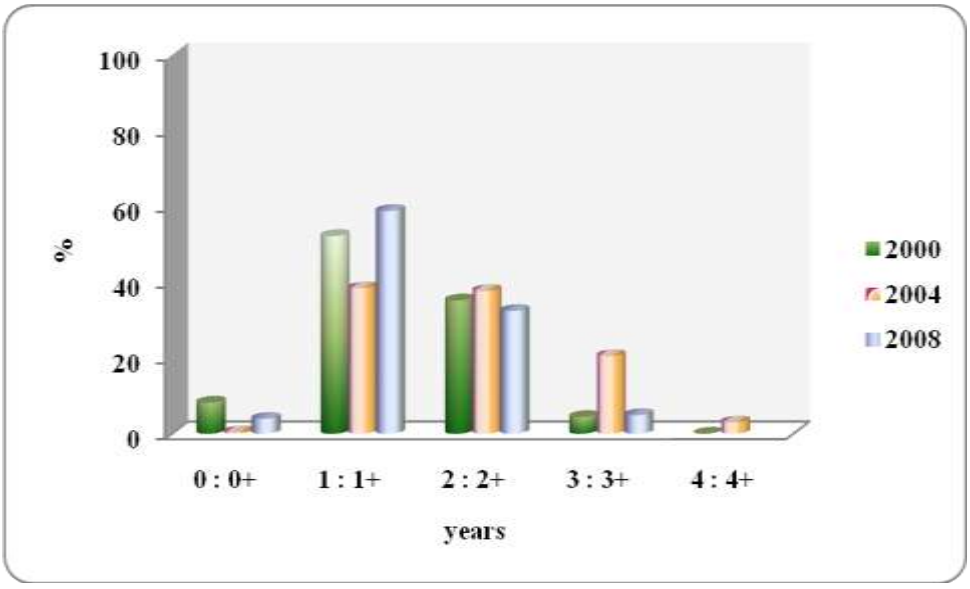

Fig. 5. Percentage of age classes in anchovy 2000-2008

(modified after Maximov et al., 2010).

Representation of several age classes in the population of one species in an ecosystem is an indicator of a good general state.

Conclusions

Age determination in fish can me made by three methods: skeletochronology (the concentric growth rings identified in a bone cross-section are counted), scalimetry (estimation of the age of fish by examination of concentric peaks on their scales) and otolithometry (identifying the annual growth rings of otoliths in the internal ear). In this case, age determination of anchovy of the Romanian Black Sea coast was made by otolith analysis.

The results pointed out that, during the analyzed period, the dominant age classes were between 1 : 1+ and 2 : 2+ years, while the 3 : 3+ age class had a smaller share, while anchovy individuals belonging to the 4: 4+ years age class were identified only as isolated specimens.

Compared to previous years, it was noted that the share of individuals aged 1 : 1+ and 2 : 2+ years is dominant, with a slight increase of 3 : 3 + years individuals [5], thus indicating a rejuvenation of anchovy population of the Romanian Black Sea coast.

Identification of several age classes in the anchovy sampled from the Romanian coastal waters show a reproductive success of the species, as well as a good state of the environment it lives in.

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