Otolith features of some economic fish species in the Eastern Black Sea

Elvan Atılgan[1]**(MSc)**
Department of Fisheries Management

Murat Erbay[1]
Department of Fisheries Management

Ilhan Aydin[2]**(MSc)**
Department of Aquaculture

One of the osteoid organisms preferred for age determination of teleostei fish are otoliths. Otoliths are widely used in the field of fish biology. Besides of being used for age determination, the analysis of O_2 izotops in their body provides information on fish migration from freshwater to the sea. In addition, it is a factor which can be used for species and population determination.

A new conception in relation to otoliths having emerged recently is the identification of daily age rings. Otoliths which overtake the function of a balance organ of fish and, moreover, help to hear, can be found three pairs in the fish skull just below the rear of the brain. They are not attached to the skull, but rather "float" beneath the brain inside the soft transparent inner ear channels. Otoliths are white and made of $CaCo_3$. The one found in the sacculer channel is called "sagitta", in the lagena channel "lapillus" and in the utricular channel "asteriscus". The location, morphology, size and form of these three otoliths are different (Aydin, 2006). Generally, the size order is sagitta, lapillus, and asteriscus, respectively. Sagittus are mostly preferred for age determination.

Important factors for preferring otoliths are (1) their development during the embryonic phase and, thus, that they can reflect all processes within the life span of the fish, (2) that they are also found in scaleless fish, (3) that they give better results than scales and that their use on old fish is more practical than the use with scales, (4) that they do not make resorption or regeneration, (5) that the otoliths of individuals of one species all have the same features (Jearld, 1983). In contrast to this, the fish are being killed when otoliths are extracted out of them; in some cases, crystallization can be stated in the otoliths due to insufficient and irregular accumulation, so that age cannot be determined on the basis of otoliths, which is regarded as a disadvantage. For the age determination of otoliths, different techniques are used. For the emergence of these techniques, the difference in growth between different species or even between individuals of different age of one and the same species, the duration and simplicity of techniques for preparing otoliths for age determination, the difference between obtained results play an important role. Otoliths, as they can be analysed as a whole on the surface, can be analysed through breaking-burning or cutting techniques if thickness can be stated.

Age is an important factor with regard to fish population determination. If we consider that otoliths are also the most important organisms for age determination studies of teleosteis, it is important to know the morphology of otoliths of fish species and to consider these morphological differences while carrying out age determination studies in order to obtain correct information on their age. In this study, the otolith morphology of some fish species at the Black Sea which are of economic value was examined.

Features of Otoliths

Anchovy (*Engraulis encrasicolus*) :

As it is the case with other saltwater fish, anchovy otoliths are frequently used in age determination studies. Having a transparent disposition, otoliths are also used for daily age determination by using suitable techniques. As the otoliths of anchovy have a fragile structure, the otoliths have to be carefully removed and cleaned. Thornlike outgrowths can be found on the dorsal side of the otoliths (Figure 1).

Figure 1. Otoliths of Anchovy (*Engraulis encrasicolus*)

Sprat
(Sprattus sprattus phalericus)

Otolith of the sprat develop especially in winter and summer and, thus, two different situations can be observed in their central part (the centre of individuals hatching in spring is opaque while the one hatching in winter is hyaline). This situation has to be considered when doing the readings (Pisil, 2006).

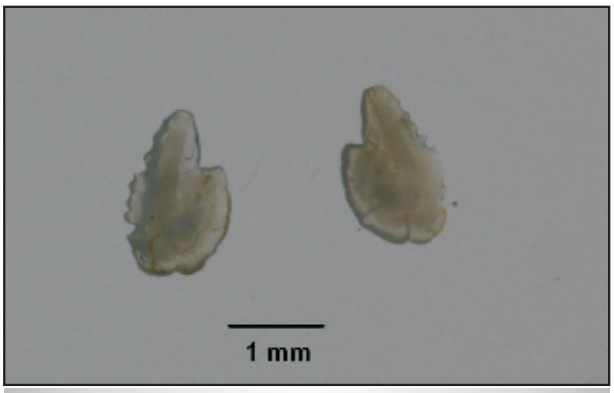

Figure 2. Otoliths of Sprat (*Sprattus sprattus phalericus*)

Horse mackerel
(Trachurus mediterraneus)

In comparison to other small pelagic species, it is less fragile and has a big otolith structure. In comparison to other species, the scoop part is deeper and has a more opaque colour. In an advanced age, it has a developed rostrum (Figure 3). It is stated that the most suitable organism for the age determination of this species are otoliths (Polat and Kukul, 1990). Otoliths are usually read as a whole but in an advanced age different methods such as breaking-destructing and sectioning together with thickening are used.

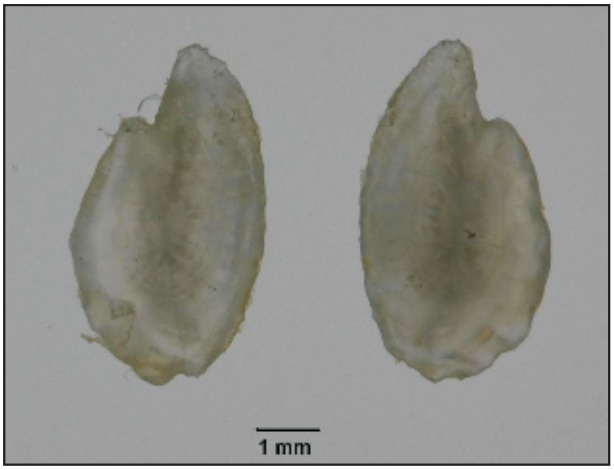

Figure 3. Otoliths of Horse mackerel (*Trachurus mediterraneus*)

Bonito
(Sarda sarda)

When bonito is estimated in body size, it has very small and fragile otoliths which are blob shaped (Figure 4). The otoliths of bonito are also used in daily age determination studies.

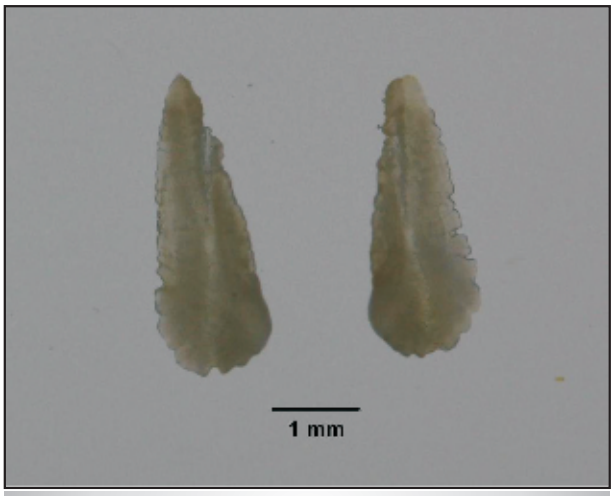

Figure 4. Otoliths of Bonito (*Sarda sarda*)

Red Mullet
(Mullus barbatus)

The otoliths of red mullet are small and notably rough (Figure 5). It is indicated that the best age determination technique for red mullet is to use the breaking-burning technique on otoliths. As a whole, it has been found that the otoliths read are showing the fish age at least one year lower (Polat et al., 2005).

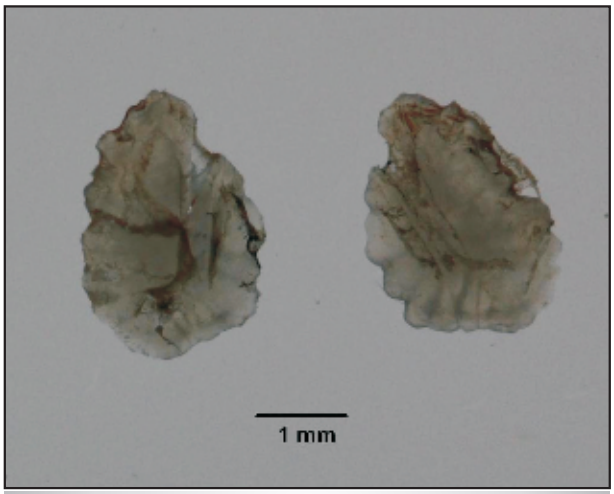

Figure 5. Otoliths of Red Mullet (*Mullus barbatus*).

Whiting
(Merlangius merlangus euxinus)

When the otoliths of whiting are of body size rate, they are notably big and thick (Figure 6).

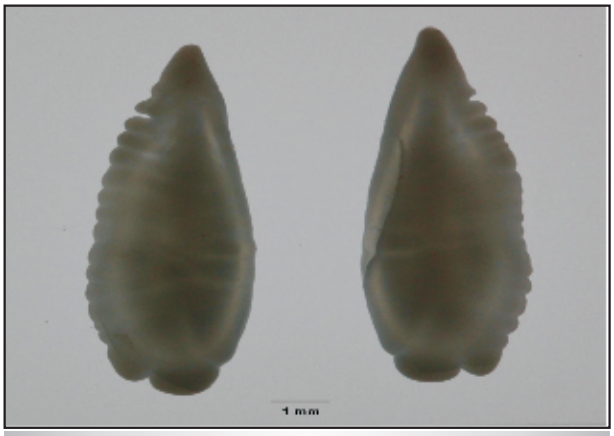

Figure 6. Otoliths of Whiting
(*Merlangius merlangus euxinus*)

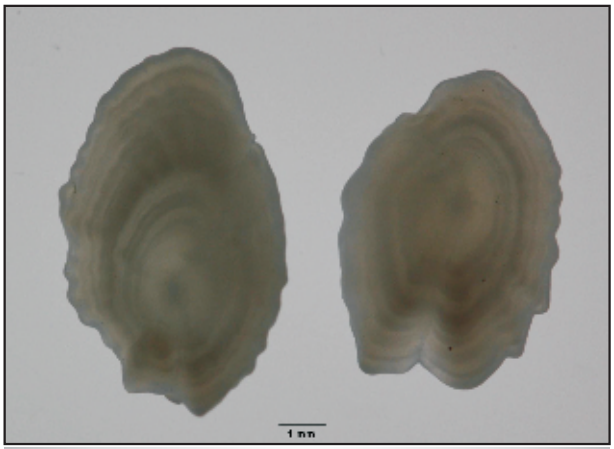

Figure 7. Otoliths of Turbot
(*Scophthalmus maeoticus*)

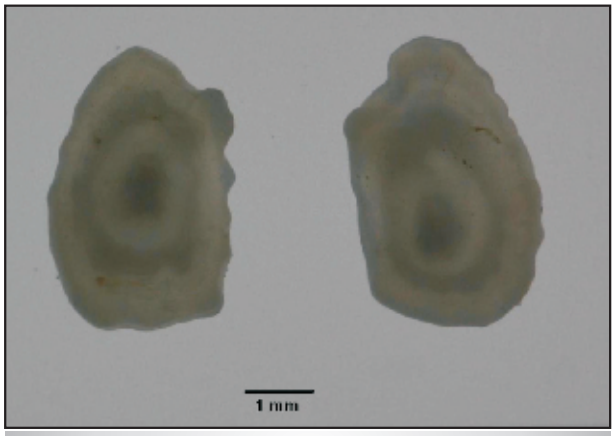

Figure 8. Otoliths of Flounder
(*Platichtys flesus luscus*)

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