# The use of eye lens diameter and weight in age determination in Indian oil sardine, *Sardinella longiceps* Valenciennes, 1847 collected from the Arabian Sea coasts of Oman.

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*SUMMARY: Specimens of Sardinella longiceps have been collected from the coasts of Salalah City at the coasts of the Arabian Sea. The ocular lens diameter and weight were tested as an additional age indicator to those already in use. The results showed that this technique could be adopted for determining the age of the species Sardinella longiceps when the specimens are over one year (I +) in case of eye lens diameter and weight. The method is especially useful for age determination when otolith or scale ring are not visible or when false rings give erroneous reading.*
***Key words**: Eye lens,* Sardinella longiceps*, Oman, Arabian Sea.*

RIASSUNTO: Esemplari di Sardinella longiceps sono stati rinvenuti a Salalah (Oman) sulle coste del Mare Arabico. Il diametro del cristallino e il peso sono stati testati come indicatori dell'età oltre a quelli già in uso. I risultati dimostrano che questi parametri possono essere utilizzati per determinare l'età di Sardinella longiceps quando gli esemplari superano l'anno di vita. Il metodo è particolarmente utile per determinare l'età quando gli otoliti o gli anelli delle squame non sono visibili o quando falsi anelli potrebbero portare a valutazioni erronee.
**Parole chiave**: Cristallino, *Sardinella longiceps*, Oman, Mare Arabico.

## Introduction

Eye lenses as an age indicator have been applied to a wide variety of animals since proposed by Lord (1959). Friend (1967) used this technique for birds and animals other than fish. Teska and Pinder (1986) used eye lens weight to determine the effect of nutrition on age determination in vertebrates.

The application of this technique is so limited in these animals, it being only possible to distinguish between juveniles and adults. Several authors concluded that both eye lens parameters (lens diameter and weight) can be used to estimate the age of fishes (Carlton, Jackson 1968; Burkett, Jackson, 1971; Crivilli, 1980; Saleem *et al*., 1990; Douglas, 1987; Al-Hassan *et al*., 1991; 1992; Al-Hassan, Al-Sayab, 1994; Conides, Al-Hassan, 2000; Jawad, 2001; 2003; 2004; Jawad *et al*., 2001).

Age determination is an important step in the process of studying growth in fish species. The method involves counting of scale or otolith annuli and usually requires the measurements of a large number of specimens (Fletcher, 1991). Otolith and scale readings require a variable and considerable effort to prepare each specimen and even then the readings are subject to both systematic and random errors in interpretation and require independent validation (Beamish, 1979). Thus, a considerable time is needed to acquire the skill necessary for consistent interpretation of the materials. In addition, extra readings are usually needed in order to verify the age assigned to a specimen (Sandermann, 1969).

The aim of this study is to determine the validity of the eye lens diameter and weight as

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age indicators in the Arabian Sea fish, *Sardinella longiceps* and to establish a faster method for ageing fishes beside the conventional methods of scale and otolith.

**Materials and methods**

Specimens of *Sardinella longiceps* (397) were collected from the coasts of Salalah City at the Arabian Sea during the period June 2010-August 2010. Fishes were taken to the laboratory and the diameter and weight of the eye lens were taken to the nearest mm and g respectively following the procedure of Jawad *et al*. (2004). The lenses were extracted, dried at room temperature (25°C). The measurement of the lens in each side of the animal was kept separate. The large bone such as operculum and preoperculum were used to determine the age following Al-Hassan and Al-Hassan (1994). The bones on both left and right sides were twice read independently, using an ordinary dissecting microscope for verification. One way analysis of variance followed by Duncan's multiple range test (Harraway, 1997) were applied to test the differences between the total length of the fish and its age.

**Results and Discussion**

The age of *Sardinella longiceps* samples ranging from less than one year (young of the year) to one year. The total length observed in different age classes of the species in question showed that body size is variable within an age class and considerable overlap exists between these age classes (P> 0.05). This is considered as one of the reasons for using eye lens diameter as an age indicator (Fig. 1).

The average lens diameter showed a considerable increase with age for the species under consideration (Fig. 2). This increment is obvious in fishes belonging to age class I & $I^+$ (P>0.05). The overlap in lens diameter between young of the year class and Classes 0 & I invalidates any accurate age determination for fish samples younger than age group $I^+$. Carlton and Jackson (1968) and Jawad (2001) reached the same conclusion with carp and tilapia respectively when working on a small sample size and with fish not older than five years. Thus, only specimens of age group $I^+$ year old can be effectively separated

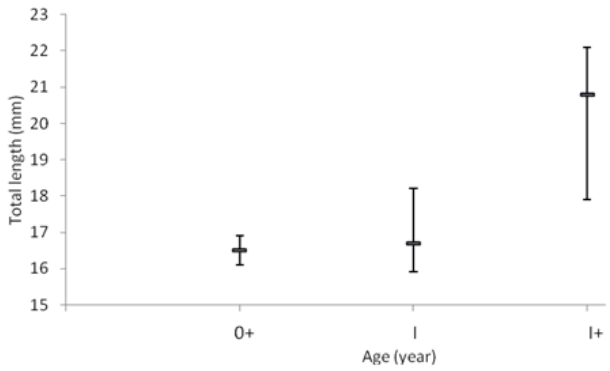


Fig. 1. Total lengtht vs age (determined from opercular bone) of *Pentaprion longimanus*. Vertical bars represent range of fish total length and horizontal lines represent mean fish length. *Fig. 1. Lunghezza totale vs. età (determinata dall'osso opercolare) di* Pentaprion longimanus. *Le barre verticali rappresentano la variazione della lunghezza totale del pescee le linee orizzontali la lunghezza media.*

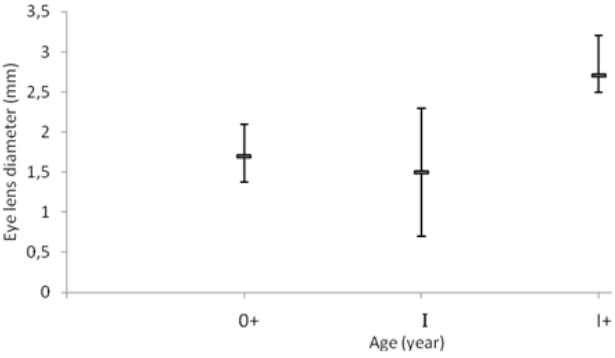


Fig. 2. Lens diameter vs. age (determined from opercular bone) of *Pentaprion longimanus*. Vertical bars represent total range of lens diameter and horizontal lines represent mean diameter. *Fig. 2. Diametro del cristallino vs. età (determinata dall'osso opercolare) di* Pentaprion longimanus. *Le barre verticali rappresentano la variazione del diamtero del cristallino e le linee orizzontali il diametro medio.*

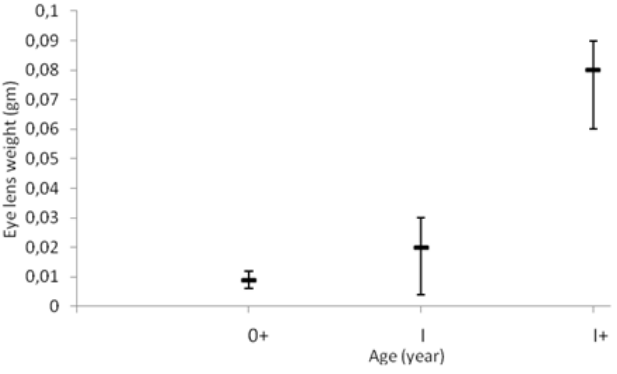


Fig. 3. Lens weight vs age (determined from opercular bone) of *Pentaprion longimanus*. Vertical bars represent range of lens weight and horizontal lines represent mean lens weight. *Fig. 3. Peso del cristallino vs. età (determinata dall'osso opercolare) di* Pentaprion longimanus. *Le barre verticali rappresentano la variazione del peso del cristallino e le linee orizzontali il peso medio.*

from the remaining age groups on the basis of lens diameter and weight ($P<0.05$).

Gerking (1966) showed how different environmental factors could alter the growth rate in the bluegill; *Lepomis macrochirus* Rafinesque, 1819 and Swedberg (1965) summarized the various growth rates of drum, *Aplodinotus grunniens* Rafinesque, 1820 from different areas in the United States. Environmental conditions must be considered in applying the lens technique (Burkett, Jackson, 1971). Crivilli (1980), working on carp, stated that in the reproductive period energy is transformed from somatic to gonadal growth. Since the increment in lens diameter and weight is closely correlated with somatic growth, the variation in individual reproductive development could result in an increased variation in lens weight within an annual group. In other words, the growth rate during the reproductive period drops down due to the concentration of body on the reproductive metabolism. This drop in growth rate will affect the different parts of the fish body including the eye lens. This will end up giving variable results not in accordance with the general growth rate of the individual.

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