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Age Frequency Distribution of Four Mugilid Species of the Family Mugilidae from Karachi Coast of Pakistan

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Abstract: A study was conducted to determine age frequency data for the four selected mugilid species i.e., *Liza melinoptera, Liza macrolepis, Valamugil speigleri* and *Mugil cephalus* of the family Mugilidae collected from the Karachi coast of Pakistan. In the present study, age was calculated by counting the annuli on scales that obtained from the four different body regions such as, the head region, pectoral fin and near the base of dorsal fin. Because scales in these body regions face less friction during locomotion, therefore, each annulus was found to beclearer and easily recognizable for age determination. The minimum age recorded for four mullet species was 1+ year old, while the maximum agewas 6+ years.However, the age group 0+ was not observed in this study.

Key words: Mullet species · Age frequency data · Annuli on scales

INTRODUCTION

Aging is a composite biological progression that has impact on living organisms and it consist of consecutive cumulative destruction of bioenergetics function of cell followed by amplified oxidative pressure and an improved risk that are associated with age disorders disturbing numerous tissues [1]. The cell power house called as mitochondria has been well known as the main cell organelle that contributes to determine timing and sternness of decline linked to process of aging [2, 3]. During current years, there have been advancement towards quantitative analysis of fish age and growth, particularly, such analysis have been performed on the fishes that belongs to Class Chondrichthyes that are commonly known as cartilaginous fishes [4]. Different workers used different methods for age estimation in fishes including [5-9] have been utilized scales and otoliths for age determination in fishes. Drake *et al.*[10], Konides *et al.* [11]and Aleleye-Wokoma *et al.* [12] hadused length frequency data for estimating ages in mullet species, whereas Ergene [13] and Ilkyaz *et al.* [14] counts the scale annuli for determining the age in two *Liza* species i.e., *Liza ramada* and *Liza aurata*. But according to the Hotos [15], the age estimation and age validation of grey mullets based on the hypothesis that only single annulus will formed per year on their scales. Therefore, their scales should be considered for age estimation with some precautions, because it should be a great possibility that false annuli may have been counted as true annuli, especially during the first year of life. Therefore, for all these satisfaction, scales for the age determination were selected from the region below the first dorsal fin in this study, because this was a suitable area for this study and their scales were easily readable and reliable for age determination. Thus, our present study was conducted to observe distributionof the male, female and combined sexes of four mugilid species of the family Mugilidaeinto various age groups.

MATERIALS AND METHODS

Samples Collection: A total of 1006 specimens of the four species of family Mugilidae were collected monthly from the landings at Karachi fish harbour, during the period of

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April 2011 to December 2012. Total catch contains 307, 244, 293 and 162 samples of *Liza melinoptera*, *Liza macrolepis*, *Valamugil cephalus* and *Mugil cephalus*, respectively.

Age Frequency Data: Age frequency data was calculated individually for male, female and combined sexes of each mullet species of this study. For age determination, scales were removed from the second and third row just near the base of the first dorsal fin and pectoral fin using forceps. Method used for making the permanent slides of scales in order to study their complete structures follows Schneider *et al.* [8] and Hotos [15] with some modifications. These prepared slides then kept under 10 × magnifications with a stereo microscope and age examined by counting the annuli or annual rings on scale.

RESULTS

Age frequency data for each selected mullet species was calculated individually for combined, male and female sexes. The total specimens of combined, male and female sexes of each mullet species were classified into different age groups. Age estimated for four selected mullet species of this study was ranged from 1+ to 6+ years,butage group 0+ was not observed in the present study.

Age Frequency Data for Lizamelinoptera: Age frequency data for combined, male and female sexes of *L. melinoptera* was presented in the Figures 1.1, 1.1a &1.1b. The age estimated from the scale readings of the combined sexes of *L. melinoptera* revealed that the population of this species was comprises of four age groups ranged from 1+ to 4+ years. But age 2+ was dominated in the total catch and constituted 35.83%, followed by age 3+ (33.22%), age 1+ (22.80%) and age 4+ (8.14%), respectively, as shown in Figure 3.1. In the present study, the maximum age recorded for the males and females and sex combined of *L. melinoptera* was 4+ years old. There were no 0+ aged specimens in the total catch for combined, male and female sexes. However, females were predominated in the older age groups (Figure 1.1b), while males were abundant in smaller age groups, as shown in the Figure 1.1a.

Age Frequency Data for Lizamacrolepis: Age frequency distribution for combined, male and female sexes of *L. macrolepis* was presented in the Figures 1.2, 1.2a &1.2b. Six age groups were determined for sex combined and males of *L. macrolepis,* 1+ to 6+ age groups (Figures 1.2, 1.2a). But the female population of this species was composed of five age groups, 1+, 2+, 3+, 4+ and 5+ years as shown in the Figure 1.2b. Therefore, the maximum age recorded for this species was 6+ years for sex combined and males, while 5+ years for females. Age frequency data of combined sexes of this species was showing the highest percentage (29.10%) for the age group1+, while minimum percentage (2.87%) was noted for the age group 6+. Both male and female individuals of this species were abundant in smaller age groups than in older age groups.

Age Frequency Data for *Valamugil speigleri*: Figures 1.3, 1.3a &1.3b revealed the age frequency distribution for combined, male and female sexes of *Valamugil speigleri*. Four age groups were identified for this species included 1+ to 4+ age groups. In this study, age frequency distribution pattern of sex combined revealed that highest percentage (44.03%) was noted for the age group 1+, while minimum percentage (15.70%) was observed for age group 3+ (Figure 1.3).In the present study, majority of males and females of this species were belongs to the age group 1+ constituting 48.24% and 39.02% of the total specimens for males and females, respectively, as shown in the Figures 1.3a& b. In general, the results of the age frequency distribution for males, females and combined sexes showed that they were more dominated in the young age groups (1+, 2+ years), while least in oldest age groups (3+, 4+ years).

Age Frequency Data for Mugilcephalus: Age frequency data for combined, male and female sexes of the *M. cephalus* was recorded in the Figures 1.4, 1.4a &1.4b. From 162 specimens of this speciesthe estimated ages ranged from 1+ to 6+ years. Age frequency distribution for the sex combined of the *M. cephalus* revealed that the most abundant age group in the total catch was 2+, represented by 59.88% of the total specimens, while the minimum percentage (4.32%) was recorded for the age group 6+ respectively, as shown in the Figure 1.4. Figures 1.4a &1.4b revealed that males of *M. cephalus* were totally absent in age group 1+, while females belonging to the age group 6+ were totally missing in the catches. Hence, the maximum ages recorded for the males were 6+ years, while females were 5+ years.

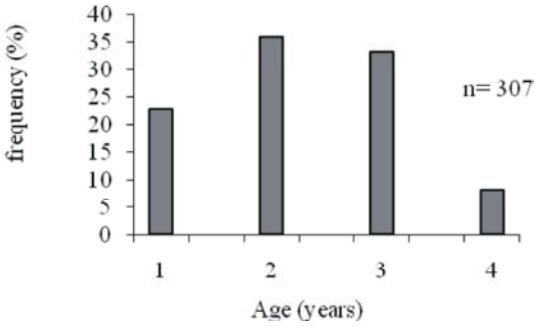

Fig. 1.1: Frequency distribution of *Liza melinoptera* (Combined Sexes)

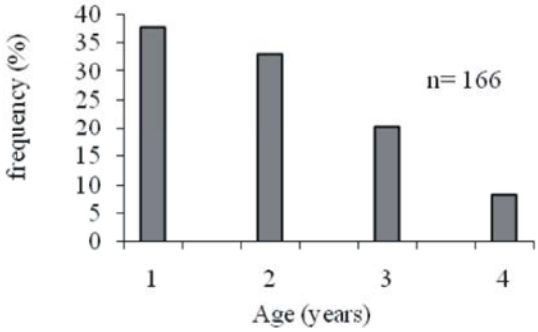

Fig. 1.1a: Age frequency distribution of *Liza melinoptera* (Males)

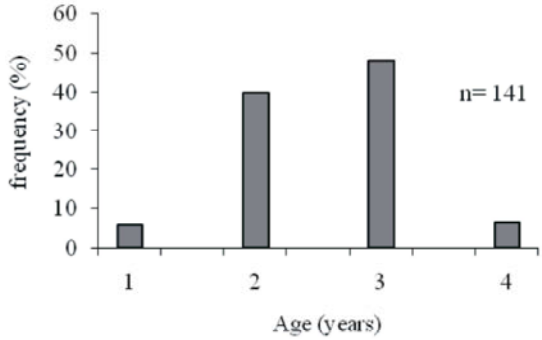

Fig. 1.1b: Age frequency distribution of *Liza melinoptera* (Females)

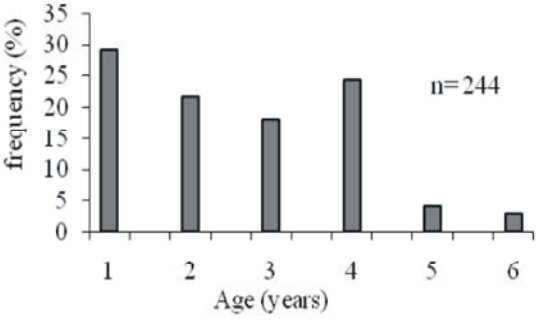

Fig. 1.2: Age frequency distribution of *Liza macrolepis* (Combined sexes)

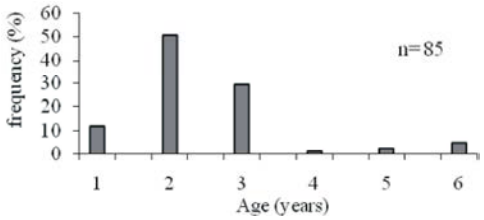

Fig. 1.2a: Age frequency distribution of *Liza macrolepis* (Males)

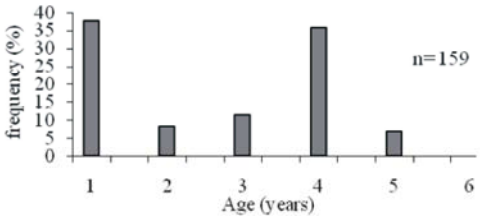

Fig. 1.2b: Age frequency distribution of *Liza macrolepis* (Females)

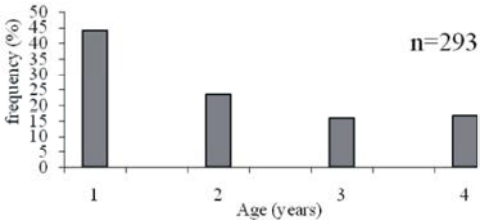

Fig. 1.3: Age frequency distribution of *Valamugil speigleri* (Combined sexes)

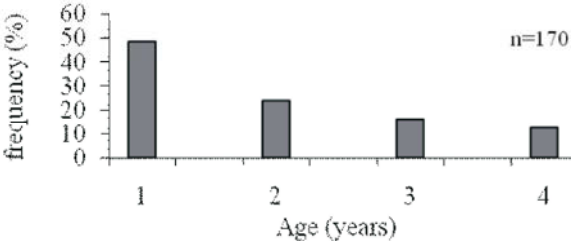

Fig. 1.3a: Age frequency distribution of the male of *Valamugil speigleri*

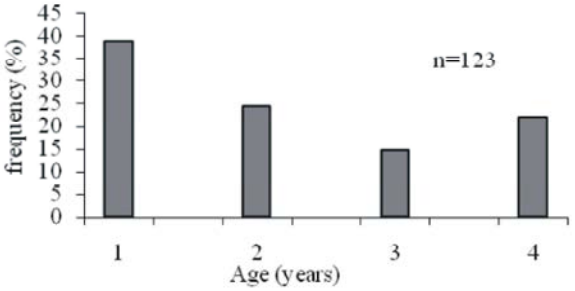

Fig. 1.3b: Age frequency distribution of *Valamugil speigleri* (Females)

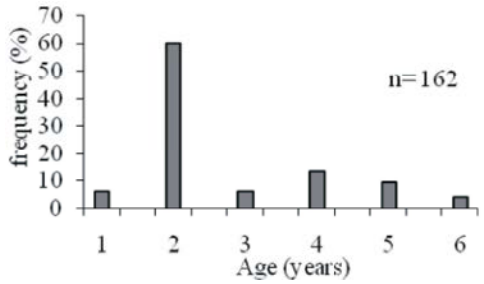

Fig. 1.4: Age frequency distribution of *Mugil cephalues* (Combined sexes)

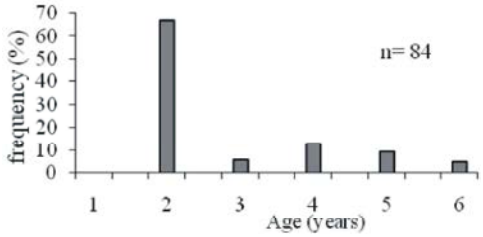

Fig. 1.4a: Age frequency distribution of *Mugil cephalues* (Males)

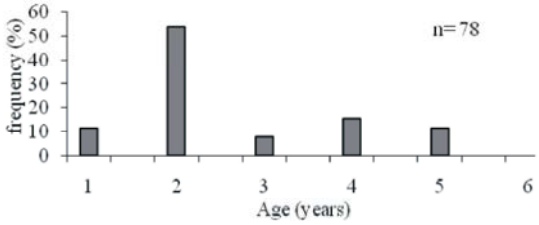

Fig. 1.4b: Age frequency distribution of *Mugil cephalues* (Females)

DISCUSSION

In the present study, the total populations of males, females and combined sexes of each mullet species were classified into different age groups. Similar pattern had been previously used by Gallardo-Cabello *et al.* [16] who alsoobserved the age-frequency data for *Anisotremus interruptus* of family Haemulidae by using their scale readings. The results of the present study revealed that age frequency distribution for four selected mullet species was found to be varies from species to species and alsobetween the male and female populations even within the same species. The total catch of *Mugil cephalus* was classified into 6 age groups which revealed that males were totally absent in the age group 1+, while none of the females was included in the age group 6+, as shown in Figures 1.4, 1.4a& 1.4b respectively. The age observed for the combined sexes and males of *Liza macrolepis* ranged from 1+ to 6+ years, while females of this species were found to be 1+ to 5+ years old. In *L. melinoptera*, females were dominated in the older age groups, while males were more numerous in smaller age groups (Figures 1.1a & 1.1b). This result was in agreement with the results of most researchers such as, Koutrakis and Sinis [5] and Patimar [17], which also worked on mullet fishes. This may be due to gear selectivity [18] or males were sexually mature at the age of one year earlier than females [14-15,19-20]. Whilst in *V. speigleri*and *M. cephalus*, both males and females were more frequently observed in smaller age groups (Tables 1.3 a & b, 1.4 a & b). Aleleye-Wokoma *et al.* [12] also observed that the sex combined of *M. cephalus* was dominated in age group 1+. However, the *L. macrolepis* showed different picture in which males were abundantly found in smaller age groups, while females were almost equally dominated in small and large age groups (Figures 1.2a & 1.2b).

Furthermore, in the present investigation, the maximum age recorded for the sex combined, males and females of *L. melinoptera* and *V. speigleri* was 4+ years. The maximum age recorded for combined sexes of *M. cephalus* and *L. macrolepis* was 6+ years. However, the maximum recorded for both male and female individuals of these two mullet species was found to be different. In *M. cephalus* and *L. macrolepis*, the maximum age recorded for the males was 6+ years and females was 5+ years. Hence, our results revealed that age frequency data was also found to be varied by sex as observed by Patimar [17]. Irani [21] also reported the maximum age of mullets in Gomishan wetland was 6+ years for males and 8+ years for females. This may be because of significant variation between the growth rates of male and female sexes [22], or as male grow more rapidly than females during initial ages (1+ to 2+ years) of its life to reach at its adult stage. Such high growth rate of male fish during the first year of life can reduced it average life span [17]. In addition, the minimum age estimated for the both male and female sexes of *M. cephalus* also found to be varied in the present study, as smallest males were found to be 2+ year old, while smallest females were 1+ year old (Figures 1.4a & b), hence, there was no 1+ year old male sample was observed in this study, which might be due to differential fishing. The maximum age attained by these mullet species was also found to be different in different habitats [17]. In the present study, maximum age (6+ years) recorded for combined sexes in *M. cephalus* was found to be more than that of observed by

Aleleye-Wokoma *et al.* [12] and Chang *et al.* [23] for the combined sexes of *M. cephalus* in Bonny estuary of India andseawater of Taiwan. Furthermore, the minimum age of *M. cephalus* in this study was also found to be different from the observations of Aleleye-Wokoma *et al.* [12] who reported some 0+ aged specimens of this species. Such variations might be because different methods such as scales, otoliths, vertebrae and length frequency distribution and different materials e.g., different length ranges, sex and different number of specimens were used for age estimation in fishes [15]. The time of first annulus formation on scales was found to be varies from species to species. According to the Hotos [15], maximum ages recorded for the individuals collected from seawater was found to be more that those obtained from inland waters.

According to the Abowei and Davies [24], the aging of tropical fish species was found to be difficult because of the ecological condition of their environment, as they found in 'steady-state environment' in which very slightly variation was observed in water temperature throughout the year. Like some other fish species, the scales of mullet fish also records the annuli on them very clearly, which was in agreement with Koutrakis and Sinis [5] who recorded the formation of annuli on scales of mullets during the winter season. Hence, it had been proved that the scales ofmullets could also be utilized for the determination of their ages and growth. Although, the age estimated in this study may not be free from error due to the differential fishing, because fishermen mostly prefer the large-sized specimen during commercial catch [25], as a result, fry or juveniles stage (>10.0 cm in TL) with 0+ age group was not catch in this study and only medium (Mature) and adult stages were observed in this study. Therefore, In general, all specimens of the 1+ and 2+ age groups were classified as young ones (First maturation phase), which were mostly present in a large percentage in the catch of these mullet species, but disappeared from other older age groups while mature individuals (Second maturation phase) were present in the 3+ and 4+ age groups, which mostly shows the second largest percentages. While the adults individuals may found in 5+ and 6+ age groups mostly in minimum percentages, which was in agreement with Hotos [15] and Kendall *et al.* [26], which also classified the populations of *Mugil cephalus* and *Myxus elongatus* and observed the similar results.

Wassef [27] reported that the growth rates in fish could be extremely variable, even when they obtained from the same location. The growth in fish was found to be varied among the male and female sexes, from species to species and from stock to stock within the same species. This may be due to the different ecological conditions of their habitat in which they lived as observed by Patimar [17] and Spare and Venema [28] or due to overfishing or pollution [12]. Hence, the presence of annulus in the immature individuals belongs to the age group 1+ suggested that the process of annulus formation was related to the seasonal growth patterns that might be affected by the certain environmental factors such as, water, temperature, rather than to reproductive or spawning activity as observed by Hotos *et al.* [29] and Newman *et al.* [30]. According to the Taylor [31], the organism found in high temperature will represent lower ages (6+ to 7+ years), while those found in cold environment will shows higher ages (Above 10+ years old).As the length frequency method is not suitable for the specimens collected from the commercial landings due to the high selectivity of fishing gears [32], therefore, in the present study, scale is use for estimating the ages of fish by counting the number of annuli on them. The scale readings for selected commercially important mullet species were proved to be reliable and furthermore, each annulus on these mullet scales was clear and easily recognizable. Thence, the age frequency data of this study revealed that scales were more suitable for aging the mullet species.

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