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Araştırma Notu / Short Note

Comparisons of Various Bony Structures for the Age Determination of *Liza ramada* (Risso,1826) Population from the Mersin Bay

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Özet: ***Mersin Körfezi'ndeki*** Liza ramada ***(Risso,1826) populasyonunda farklı kemiksi yapılar kullanılarak yapılan yaş tayini sonuçlarının karşılaştırılması.*** Mersin Körfezinden Ekim 1997 ile Ocak 1998 tarihleri arasında yakalanan 120 adet *Liza ramada*'nın yaşı otolit, omur, operkül, pul, dorsal yüzgeç ışını kullanılarak belirlenmiş ve karşılaştırmaları yapılmıştır. *L. ramada*'da yaşın en iyi belirlendiği kemiksi yapının dorsal yüzgeç ışını olduğu bulunmuştur. Bunu sırasıyla pul, omur, otolit ve operkül izlemiştir. Populasyonda yaş dağılımı genellikle 2-8 arasında olup 6. yaş grubunda daha fazla birey bulunmuştur. Ancak 1, 9 ve 10. yaşlarda olan bireylere de rastlanılmıştır.

Anahtar Kelimeler: *Liza ramada*, yaş tayini, kemiksi yapılar.

Abstract: A total of 120 Mullet *Liza ramada* [Risso, 1826] were caught in the Mersin Bay of the Mediterranean Sea from October 1997 to January 1998. Age determinations were made by different methods using scales, otoliths, opercular bones, vertebrae and dorsal fin rays. It was understood that dorsal fin rays were the best bony structure for the age determination of *L. ramada* followed by scales, vertebrae, otoliths and opercular bones. The mullets sampled throughout the study were generally between 2 and 8 years-old. Six years-old fish were dominant in the population. Yet, individuals at 1, 9 or 10 years of age were also found in the samples.

Key Words: *Liza ramada*, age determination, bony structures.

Introduction

Determination of fish age is an important tool in fisheries biology and it is necessary for the assessment of life history, growth rate, maturity and spawning times, growth at different age groups and mortality rates of a given population.

Most reliable methods for estimating the age of fish are based on certain structures, which possess patterns related to the annual growth. The age of fish are generally estimated by examination of scales, fin rays, otoliths, opercular bones, vertebrae and some other bony parts (Casselman, 1987). All common ageing methods applied in fish can be found in Lagler (1952), Chugunova (1963), Rounsfell and Everheart (1953), Tesch (1968), Beamish (1979), and Beamish and Chilton (1982). It is well known, that a suitable age determination method differs from one species to another.

The purpose of this study was to determine the best ageing method by comparing scales, otoliths, vertebrae, operculum and dorsal fin rays of the mullet *L. ramada* inhabiting the Mersin Bay of the Mediterranean Sea.

Materials and Methods

An overall of 120 specimens of *Liza ramada* were collected from commercial trawlers fishing in the Mersin Bay of the Eastern Mediterranean between October 1997 and January 1998. Scales, otoliths, vertebrae, operculum and dorsal fin rays from each fish were removed for ageing.

Age readings expressed as 1+, 2+, 3+ in the text refer to 1, 2, 3 years of age. Scales were collected from the left side, between lateral line and pectoral fin of each fish and kept in 3% NaOH solution for 24 h and washed with distilled water. They were then immersed in 96% Ethyl Alcohol for 30 min for dehydration and hardening prior to age examination under the stereo microscope (Chugunova, 1963). The samples were examined under a stereo-microscope (4x10). Photographs of sections of fin rays were taken by using a Nikon F4S camera (Photograph 1). Otoliths removed from the fish were kept in an oven at 103°C for 15 min and cleaned in 96% alcohol and examined in xylol under the microscope (Chugunova, 1963). Opercular bones were taken by scalpel and dipped in boiling water for a few minutes for cleaning. They were dried at room temperature for 5-6 days after which they were placed in glycerine and examined under the microscope over a black background using reflected light (Astanin, 1974). Dissected vertebrae (from 4^{th} to 10^{th}) were placed in boiling distilled water for 2-3 minutes and cleaned off flesh and fat. They were kept in an oven at 103°C for 15 min and cleaned again and examined in xylol under the microscope (Chugunova, 1963). First dorsal fin rays were removed and immersed in 96% alcohol and dried in air. Sections of 0.35-0.60 mm were taken by a jewellery saw and dried at 103°C in the oven for 15 min (Burnet, 1969). They were placed in xylol prior to examining under the microscope. Three researchers of the same faculty read age rings at least twice at different times.

Standard deviations of various aging structures were compared by SPSS package program.

Results

Of all the structures examined in the current study, dorsal fin ray-method was the most reliable method for ageing *L. ramada*. Annual growth rings were clearer and sharper leading to lesser errors in the age estimation (Figure 1). The reliability was decreased in the order of scales, vertebrae, otoliths and opercular bones (Table 1).

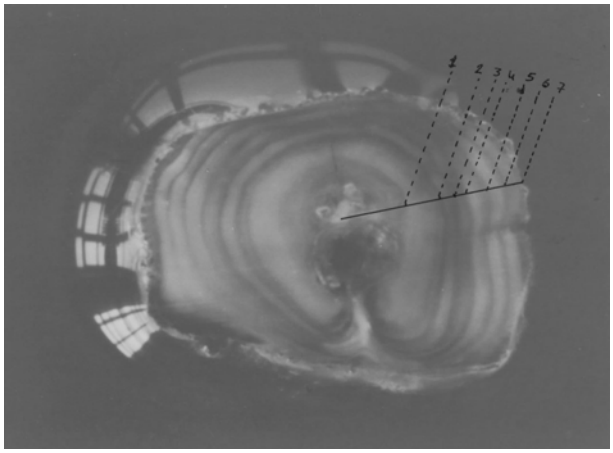

Figure 1. Section of dorsal fin ray of *L. ramada* at 7 years of age (original).

Table 1. Distribution age groups in *Liza ramada.*

Bony Structures	Age Groups										Total Samples
	1	2	3	4	5	6	7	8	9	10	
Scales	3	8	15	24	32	24	9	4	1	-	120
Vertebrae	-	3	10	23	26	33	22	3	-	-	120
Dorsal Fin Rays	-	8	19	22	29	34	6	2	-	-	120
Opercular Bones	-	5	15	20	20	19	27	10	3	1	120
Otoliths	-	2	17	22	17	28	24	9	1	-	120

Table 2. Age difference between the compared bony structures (standart deviation).

Bony Structures	Age Groups							Means
	2	3	4	5	6	7	8	
Dorsal Fin Rays-Scales	0.00	2.83	1.41	2.12	7.07	2.12	1.41	2.23
Dorsal Fin Rays-Vetebrae	3.54	6.36	0.71	2.12	0.71	11.31	0.71	3.97
Dorsal Fin Rays-Otoliths	4.24	1.41	0.00	8.49	4.24	12.73	4.95	4.30
Dorsal Fin Rays-Opercular Bones	2.12	2.83	1.41	6.36	10.61	14.85	5.66	4.92

In this study, when various bony structures were compared, the least age difference was found between dorsal fin rays and scales followed by vertebrae, otolith and operculum (Table 2).

When age difference between dorsal fin rays and scale readings were compared, it was found that 40% of the specimens were at the same age whilst there were 1, 2, 3 and 5 years of age difference in 42.5%, 15%, 1.67% and 0.83%, respectively. Relationships between all of the methods are summarised in Table 3.

Table 3. Relationships among bony structures concerning age determination in *Liza ramada*.

Comparison of Traits	Percentage of Age Difference (%)						Total %
	0	1	2	3	4	5	
Scales-Otoliths	31.67	44.17	20.00	3.33	0.83	-	100
Scales-Dorsal Fin Rays	40.00	42.50	15.00	1.67	-	0.83	100
Scales-Opercular Bones	35.83	38.33	18.33	5.83	1.67	-	100
Scales-Vertebrae	30.00	46.67	19.17	3.33	0.83	-	100
Otoliths-Dorsal Fin Rays	33.33	42.50	17.50	6.67	-	-	100
Otoliths-Opercular Bones	39.17	43.33	15.00	1.67	0.83	-	100
Otoliths-Vertebrae	35.00	50.83	12.50	1.67	-	-	100
Dorsal Fin Rays-Opercular Bones	29.17	42.50	25.00	3.33	-	-	100
Dorsal Fin Rays-Vertebrae	29.17	55.83	13.33	1.67	-	-	100
OpercularBones-Vertebrae	35.00	49.17	11.67	3.33	0.83	-	100

Age composition of all the examined specimens throughout the study ranged between 2 and 8 years of age. Percentages of these age groups (2, 3, 4, 5, 6 and 8) were 5.83%, 12.50%, 19.17%, 20.83%, 29.17%, 8.33% and 4.17%, respectively (Figure 2).

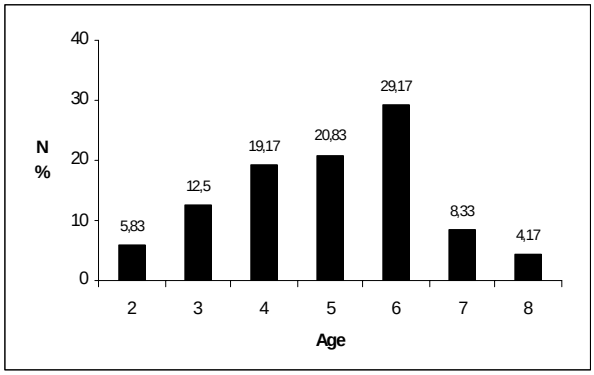

Figure 2. Age composition of *Liza ramada* determined by using dorsal fin rays.

Discussion

Dorsal fin rays were reported to be more suitable for ageing *Salmo trutta* than with otoliths (Burnet, 1969). There are many studies in which scales have been reported to be suitable means for age determination (Prather, 1967; Lux, 1971) as they are more practical and easier to prepare. However, in our work, the annual rings on scales of *L. ramada* could not be easily distinguished as also reported for Grey Mullets by Quignard and Farrugio, (1981). Similarly, ageing by using pectoral fin rays were better in Pasific Salmon in comparison to otoliths (Bilton and Jenkinson, 1969).

It is comparably more difficult to identify annual rings on otoliths as they are opaque (Erman, 1959). Therefore, otoliths are generally used together with scales in age determination in fish. Yet, otoliths were found as the most reliable ageing

structure in *Capoeta capoeta umbla* (Ekingen and Polat,1987) and *Trachurus trachurus* (Polat and Kukul, 1990), whereas scales and vertebrae were better as compared to otoliths in *Leuciscus cephalus* (Özdemir and Şen, 1986). Dorsal fin rays were reported to be more suitable for ageing *Barbus rajanorum mystaceus* and *Capoeta trutta* (Polat, 1987 a; Polat,1987 b).

Amongst all structures used in the age determination of *L. ramada*, dorsal fin rays were found to be the most reliable bony structure followed by scales, vertebrae, otoliths and operculum in the current study. Annual rings on the dorsal fin rays were better defined and easier to observe as compared to those on the other structures. As this ageing method resulted in less error, it is suggested to be the most reliable method in the age determination of *L. ramada*. The reliability was decreased in the order of scales, vertebrae, otoliths and opercular bones

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