Age and Growth of Caspian Roach, *Rutilus rutilus caspicus* (Jakowlew, 1870) in Southern Caspian Sea, Iran

Safoura Sedaghat and Seyed Abbas Hoseini

Department of Fisheries, Gorgan University of Agricultural Sciences and Natural Resources, Iran

Abstract: In the present study, age, growth and length-weight relationships were investigated in 208 specimens of Caspian Roach, *Rutilus rutilus Caspicus* (Jakowlew, 1870), collected from Southern Caspian Sea, Iran from October 2011 to March 2012. Age was determined using scale reading. The age, Fork length and weight of samples ranged from 1 to 6 years, 14.28 to 28 cm and 45.87 to 377g, respectively. The two year age group was the most frequent (39.42%) and the 6 year age groups were the least frequent classes (0.96%). The mean condition factor was 0.016 ± 0.001. Length-weight relationship showed positive allometric for average total species as: $W = 0.0065\ FL^{3.30}$ ($r2 = 0.95$).

Key words: *Rutilus rutilus caspicus* % Age % Growth % Caspian Sea

INTRODUCTION

The *Rutilus rutilus caspicus* (Jakowlew, 1870), species is a member of the *Cyprinus carpio* family, its maximum length is 46 cm and its maximum weight is 1840 g and the maximum reported age for it is 14 years. *Rutilus rutilus caspicus* is native to Caspian Sea [1]. It breeds 5 to 6 times during its life in temperatures 10 to 20°C. The maximum of its emigration and spawning have been observed in temperature 14 to 18°C and in the maximum depth of 50 m. however the reproduction emigration of this subspecies begins in 6°C [2].

This species is widely distributed in the Caspian Sea and supports important commercial fisheries recently [3-5], because of over fishing and deterioration of its spawning grounds; this species is considered for listing as a threatened species for the region [5].

The determination of fish age and growth is fundamental in fisheries biology and management; such age determined parameters as mortality and growth underlie the population dynamic models used in fishery analysis. Age studies can furnish other basic data such as stock age structure, age at first maturity, spawning frequency, individual and stock responses to changes in the habitat, recruitment success, etc [6].

The present study aims to determine the age, growth, relationship length- weight, growth pattern (t) and condition factor of *Rutilus rutilus Caspicus* in Southern Caspian Sea of Iran.

MATERIALS AND METHODS

208 specimens were collected from October 2011 to March 2012 in the southern parts of the Iranian waters of the Caspian Sea. *Rutilus rutilus Caspicus* were collected using seine nets (with a mesh size length between 40 and 70 mm.

Total length of captured fish was measured to the nearest 0.01 cm and weighted to the nearest 0.01 g [7].

Age was determined using scale reading [8]. Scales were taken from the middle of the body, behind the pectoral fins and above the lateral line. They were then placed in labeled envelopes and returned to the laboratories for reading and analysis. The scales were washed and placed in small covered Petri dishes with tap water. Then, the organic layers of scales were removed by rubbing and washing in tap water [9].

The relationship between length and weight was calculated using the exponential regression: $W = a \times Lb$ [10], where W is the total weight (g), L is the Total length (cm), a is the regression constant (intercept) and b is the regression coefficient (slope) that it is usually between 2 and 4. The Fulton condition factor (CF) was determined for each fish using the following equation: $CF = (W/L^3) \times 100$ [7], where W is the total fish weight (g), L is the total length (cm).

The growth pattern (t) was using the following equation [11]:

Corresponding Author: Safoura Sedaghat, Department of Fisheries, Gorgan University of Agricultural Sciences and Natural Resources, Iran.

$$t = \frac{sd1nL}{sd1n\Gamma\Gamma} * \frac{|b-3|}{\sqrt{1-r^2}} * \sqrt{n-2}$$

Where *Sd*Ln*L* is standard deviation of the length natural logarithm (cm), *Sd*Ln*W* is standard deviation of the natural logarithm weight (g), b is Curve slope of the relationship between length and weight, r^2 is regression coefficient between length and weight and n is the number of samples. Tables and graphs were drawn by Excel software.

RESULTS

The ages, lengths and weights of the samples ranged between 1-6 years, 14.28 to 28 cm and 45.87 to 377g. The mean condition factor was calculated as 0.016±0.001. The mean lengths, weights, frequency and condition factors of different ages are given in Table 1.

Age Frequency: Age determination, based on scale readings, showed that the population was composed of 6 age-groups. The highest and lowest age groups were 2 (39.42%) and 6 age groups (0.96%) in population (Figure 1).

Length-Weight Relationship: The length-weight relationships were calculated for population. Body weight exponentially increased with FL (cm) by the following relationship:

W = 0.0065 FL$^{3.30}$ (r^2 = 0.95) (Figure 2)

Length-weight relationship showed positive allometric for average Total species.

DISCUSSION

Despite the importance of Caspian roach as a food fish in Iran, natural populations of this fish are endangered. In the present study, the FL for *Rutilus rutilus Caspicus* ranged from 14.28 to 28 cm. Naddafi *et al.* [12] Reported, the TL for *Rutilus rutilus Caspicus* ranged from 19.1 to 20.1 cm.

The most abundant age groups in commercial catch were 1, 2, 3, 4, 5 and 6 years, which are in agreement with the findings of Berg [2].

Length-weight relationship showed positive allometric for average Total species, with values b = 3.30, which are in agreement with the findings of Naddafi *et al.* [12]. The allometric growth might be due to the fact that all
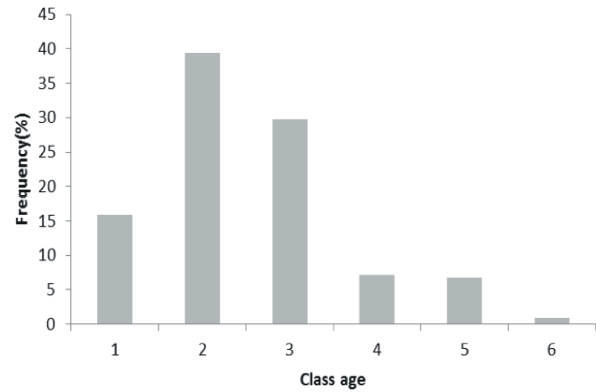

Fig. 1: Age class frequency in *Rutilus rutilus Caspicus* in Southern part of Caspian Sea
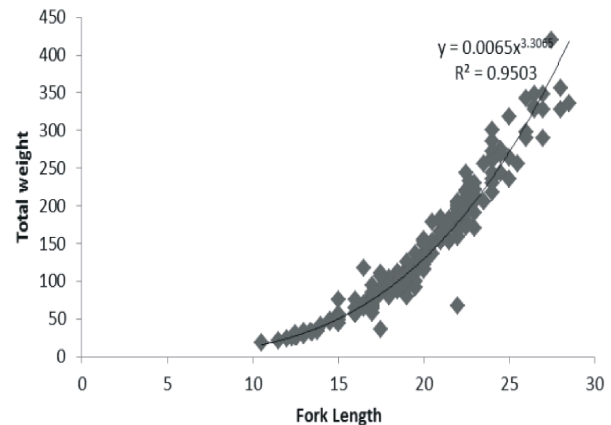

Fig. 2: Length-weight relationship in *Rutilus rutilus Caspicus* from Southern Caspian Sea, Iran

specimens were in prime condition during the onset of the spawning season, causing heavier body weight and therefore a higher b value.

In the present study, the mean of condition factor for average total species was 0.016±0.001. Kuliyev [13] gives 1.25-2.94, 1.46-2.27 and 2.12-2.27 for Azerbaijan, Daghestan and Turkman roach, respectively. Savenkova [14] for Turkman roach gives 1.7-1.83 and finally Belogolova [15] gives a mean condition factor of two for North Caspian roach in late summer.

As important as the present biological findings might be some influencing non-biological factors in the life history of the Caspian roach in Iran such as water pollution, illegal fishing, overfishing and other human impacts may equally affect the migratory population of the roach.

The finding on age and growth of *Rutilus rutilus Caspicus* from this research will help to elucidate the distribution with age of fish and their sustainable management.

Table 1: Mean length (L), weight (W), frequency (%) and condition factor (CF) of *Rutilus rutilus Caspicus* samples by age groups [± Standard Error (Min-Max)]

Age	Age groups					
	1	2	3	4	5	6
FL (cm)	14.28±1.89	18.3±1.15	21.74±1.19	23.96±1.23	26±1.68	28±0.70
W (g)	45.87±23.25	96.77±21.85	179.05±40.34	245.12±40.67	304.85±48.64	377.5±60.10
F (%)	15.86	39.42	29.80	7.21	6.73	0.96
CF	0.015	0.015	0.017	0.017	0.017	0.017

ACKNOWLEDGEMENTS

REFERENCES

1. Gholamhosein V. and B. Mostajir, 2003. Freshwater fishes. Tehran University of Agricultural Sciences and Natural Resources.

2. Pinder, A.C., 2001. Keys to larval and juvenile stages of coarse fishes from freshwaters in the British Isles. Freshwater Biological Association. The Ferry House Far sawrey, Ambleside, Cumbria, UK. Scientific Publication, 60: 136.

3. Berg, L.S., 1949. Freshwater fishes of the USSR and adjacent countries. Israeli program for scientific translations, Jerusalem, pp: 2.

4. Coad, B.W., 1980. Environmental change and its impact on the freshwater fishes of Iran. Biol. Conserv., 10: 51-80.

5. Abdoli, A., 2000. The inland water fishes of Iran. Iranian Museum of Nature and Wildlife, Tehran, pp: 378.

6. Morales-Nin, B., 1985. Daily growth increments in the otoliths of *Dicentrarchus labrax*. Rapports Commion International Mer Mediterrania, pp: 29-97.

7. Bagenal, T.B. and F.W. Tesch, 1978. Age and growth. In: T. Bagenal, (Ed), methods for assessment of fish in freshwaters, 3rd Edition. IBP Handbook No. 3. Blackwell Scientific Publication, Oxford, pp: 75-101.

8. Ghadirnejad, H., 1996. Population dynamics of grey mullet species (*Liza aurata* and *L. saliens*) in the southern Caspian Sea. PhD thesis, University of Wales Swansea, pp: 207.

9. Fazli, H., D. Ghaninejad, A.A. Janbaz and R. Daryanabard, 2008. Population ecology parameters and biomass of golden grey mullet (*Liza aurata*) in Iranian Waters of the Caspian Sea. J. Fish Res., 10: 1-7.

10. Ricker, W.E., 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Board Can., pp: 382.

11. Pauly, D. and J.I. Munro, 1984. Once more on the comparison of growth in fish and invertebrates, ICLARM. Fish Byte, 2(1): 106.

12. Naddafi, B.R.A. Abdoli, B. Hassanzadeh Kiabi, B. Mojazi Amiri and M. Karami, 2005. Age, growth and reproduction of the Caspian roach (*Rutilus rutilus caspicus*) in the Anzali and Gomishan Wetlands, North Iran. J. Appl. Ichthyol., 21: 492-497.

13. Kuliyev, Z.M. and S.H.M. Bagirova, 1979. Peculiarities of the dwarf population of the Caspian roach, *Rutilus rutilus caspicus*. J. Ichthyol., 19: 51-55.

14. Savenkova, T.P., 1994. Distribution and characteristics of the biology of young-of-the-year vobla, *Rutilus rutilus caspicus*, in the southeastern Caspian Sea. J. Ichthyol., 34: 28-38.

15. Belogolova, L.A., 1988. Population dynamics and distribution of juvenile vobla (roach), *Rutilus rutilus*, bream, *Abramis brama* and zander, *Stizostedion lucioperca*. J. Vop. Ikhtiol., 2: 253-258.