MORPHOBIOLOGY AND AQUACULTURE OF THE KUTUM (RUTILUS FRISII) DISTRIBUTED IN THE SOUTHERN REGION OF THE AZERBAIJANI SECTOR OF THE CASPIAN SEA

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Abstract: The kutum (Rutilus frisii kutum) is one of the economically important semi-anadromous fish species widely distributed in the southern and partly the central regions of the Caspian Sea.[1,12] The article investigates the morphometric and meristic indices, biological characteristics, distribution area, spawning behavior in rivers, ecological adaptation, and aquaculture potential of the kutum under Azerbaijani conditions. The study shows that the biometric parameters of the kutum directly depend on environmental factors - abiotic and biotic factors such as temperature, salinity, and food availability -as well as anthropogenic impacts including overfishing, degradation of spawning grounds, and water pollution.[1,9,11] Although the population density of the kutum along the southern Caspian coast has decreased compared to historical periods, it has been determined that the species possesses favorable biological characteristics for aquaculture cultivation.[2,3,14]
Keywords: Rutilus frisii, kutum, Caspian Sea, morphobiology, biometric parameters, aquaculture.

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İntroduction:

The kutum (*Rutilus frisii*) is one of the most valuable semi-anadromous fish species of the Caspian Sea and has been widely distributed along the Azerbaijani coast.[11,15] It is mainly observed at depths of 9–24 m along the western shores of the Middle and Southern Caspian, and during the spawning season it migrates into rivers to reproduce.[1,12] (Fig.1) For many years, this species was of significant commercial importance in the Caspian Sea, and in some years the total catch reached up to 7,000 tons.[11] However, due to anthropogenic impacts, river flow alterations, and pollution, its stocks have begun to decline.[9,14] Studying the morphology, biological characteristics, and aquaculture potential of the kutum is of special importance both for biodiversity conservation and for the development of artificial fish farming in Azerbaijan.[2,3,15]

The Caspian Sea, being the largest enclosed water body in the region, is characterized by sharp fluctuations in salinity and hydrological conditions. Salinity in the Southern Caspian ranges between 13–14‰, while water temperatures vary between +10 and +25 °C throughout the year. These parameters are among the major ecological factors influencing the distribution, feeding, and biological activity of the kutum.[10,14] The inflow of rivers such as the Kura, Lankaran, Samur, and others into the sea supports the semi-anadromous life cycle of the species.[11] Changes in river regimes (dams, reservoirs, diversion canals) are among the key factors directly affecting the natural reproduction of the population over the long term.[9,12]

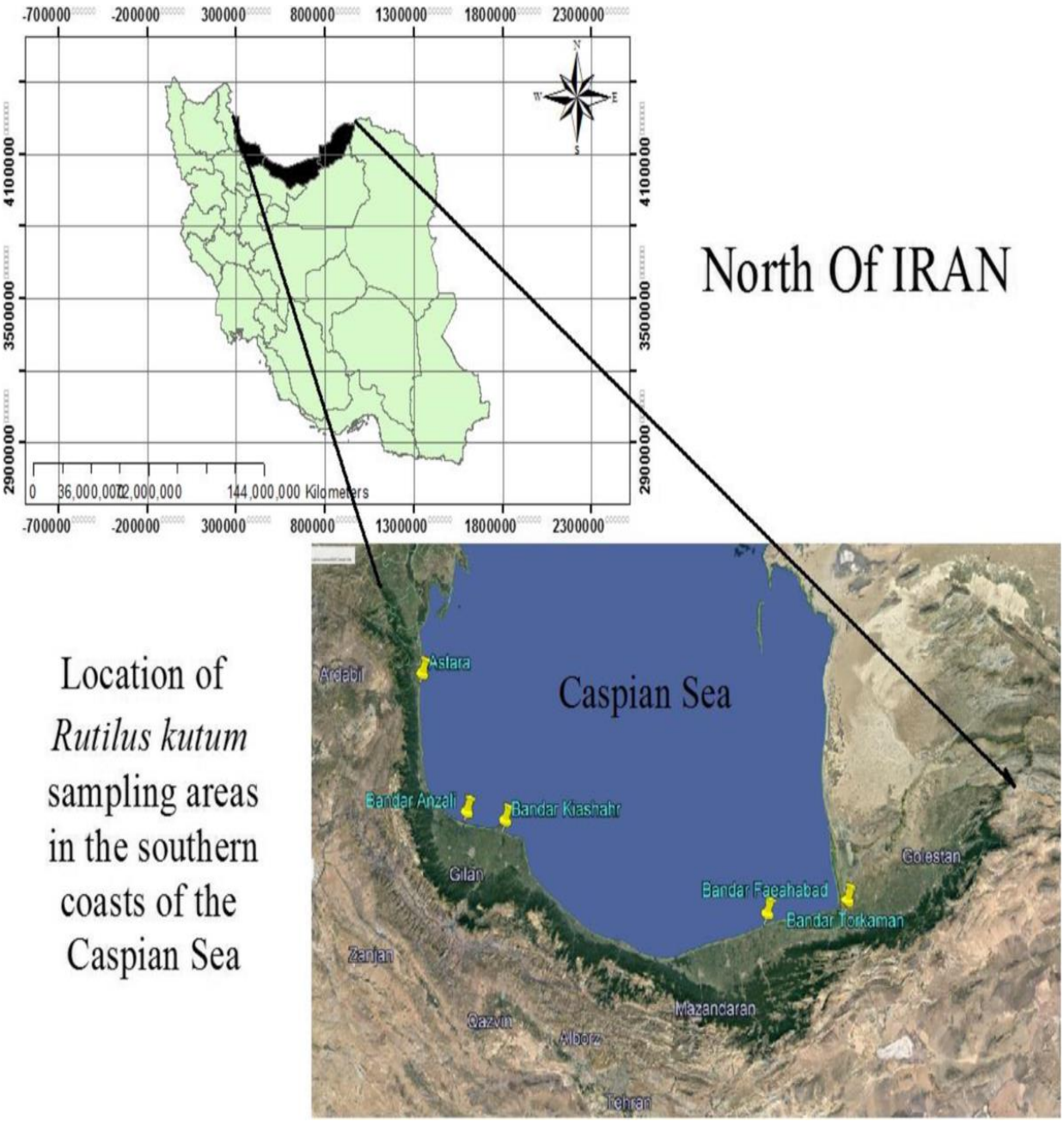

Fig.1 The distribution area of kutum

The general taxonomic position of species belonging to the family *Cyprinidae* is as follows:

Order: *Cypriniformes*
Family: *Cyprinidae*
Genus: *Rutilus*
Species: *Rutilus frisii* Nordmann, 1840
Subspecies: *Rutilus frisii kutum* (Caspian kutum)

The kutum is an endemic species distributed exclusively in the Caspian Sea. Its range stretches from the Terek River to the Gorgan Bay.[13] In Azerbaijan, it is most frequently found in the following areas:[15]

- Lankaran aquatory
- Gizilagaj Bay
- Kura–Araz delta
- Astara coastal zone

The taxonomic status of the kutum remains a subject of debate. Based on DNA markers, *Rutilus kutum* and *Rutilus frisii*

inhabiting the Azov–Black Sea basin exhibit strong phylogenetic similarity.[13] Kutum is a large fish, and its scales are relatively smaller than those of the bream (*Abramis brama*). The caudal fin is well developed. The back is dark with a greenish tint; the sides are silvery and the belly is white. The dorsal fin and the upper lobe of the caudal fin are dark gray, while the pectoral, pelvic, anal fins and the lower lobe of the caudal fin are grayish in color.

During the reproductive period, sexual dimorphism becomes clearly pronounced. Large epithelial tubercles appear on the head and body of males, whereas females become noticeably deeper-bodied. As one of the endemic species of the Caspian Sea, kutum exhibits transitional or semi-anadromous behavior depending on environmental factors. There is no typical freshwater population of kutum in Azerbaijani waters. It is widely distributed in the Caspian Sea, particularly along the western coasts of the Middle and Southern Caspian.

During the spawning period, kutum migrates into rivers flowing into the Caspian Sea, large canals, and the Small Gizilagaj Bay. In males, nuptial tubercles (spawning rash) develop on the body during this period. Females are larger and fuller-bodied. Differences in the structure of the pelvic fins can also be observed. They reach sexual maturity at 3–4 years of age and can live up to 11 years. Fecundity ranges from approximately 26,000 to 270,000 eggs.[1] Spawning occurs from March to May. Kutum is a lithophilic species, meaning that it deposits its eggs at once on gravel–pebble substrates of rivers.[5,3] The eggs are adhesive and attach to stony-sandy riverbeds. After spawning, the broodstock returns to the sea. Many juveniles do not remain in rivers for long and drift back to the sea with the water flow.

Average biometric indicators of the Southern Caspian population:

- Total length: 32–45 cm (maximum 70 cm)
- Weight: 450–1100 g
- Body index: 3.5–4.2
- Lateral line scales: 48–54
- Gill rakers: 18–23 [12]

In some individuals, the elongated shape of the head and the laterally compressed body structure are clearly visible, which is associated with hydrodynamic adaptation.(Fig.3)

Fig. 2 The biological analysis of kutum

Biological characteristics:

Adult individuals mainly feed on mollusks and gastropods; however, small crustaceans also play a significant role in their diet. Juveniles primarily feed on cladocerans, cyclops, and diatom algae. Kutum meat is considered a high-quality commercial product, with individuals inhabiting the southern range exhibiting superior market characteristics. It has always been one of the commercially valuable species. Due to the degradation of some spawning habitats, artificial propagation has already been introduced, and the current stock level is satisfactory. Since the 1980s, larvae have been obtained and raised at the Gizilagaj fish reproduction plant in Liman settlement of Lankaran. Kutum was also introduced into the Mingachevir reservoir, where its maturation period accelerated. However, there is still insufficient evidence to conclude that its natural stock has significantly recovered. Kutum is considered one of the most promising species for aquaculture in Azerbaijan.[2,4]

Kutum has high adaptive capacity and can tolerate a wide range of salinity and temperature conditions. Positive traits for aquaculture include:

- High growth rate – reaching 250–350 g at 2 years of age
- High market value – fatty and high-quality flesh
- High fecundity

However, the species also presents several challenges for aquaculture.[9,11] Natural spawning depends heavily on river flow regimes. Reduced river discharge and dams hinder migration routes. Decreased genetic diversity poses risks in artificial breeding. Research shows that kutum in the southern Caspian region is of significant importance for biodiversity, fisheries, and aquaculture. Its morphobiological features confirm its high ecological adaptation potential.

Considering the decline in natural population size, propagation and cultivation of this species in aquaculture is an important measure for biodiversity conservation and food security.

During aquaculture cultivation, growth rate is moderate but can improve under proper feeding and optimal conditions. Kutum mainly feeds on zooplankton, phytoplankton, aquatic plants, and small aquatic organisms. Balanced diets and natural food availability are essential for healthy growth. This species releases a large number of eggs during artificial spawning, demonstrating excellent reproductive capacity—an important advantage for aquaculture.

Optimal aquaculture conditions require clean water, stable temperature, proper oxygenation, and balanced chemical composition. The species can grow in both freshwater and slightly brackish water, but the best growth is achieved in clean, well-oxygenated environments. Water temperature should range between 10–22°C, with an optimal level of 15–18°C, ensuring rapid growth. Dissolved oxygen must remain consistently high, as the species is highly sensitive to oxygen deficiency. Water pH should be 7.0–8.5.[8,4] Ammonia and nitrite levels must be zero because these compounds adversely affect fish health and growth performance. In the wild, kutum feeds on zooplankton and aquatic vegetation, whereas in aquaculture, a balanced feeding regimen is required.[2,4] High-protein fish feeds, small crustaceans, formulated pellets, and live foods (zooplankton, insects) are commonly used. Juveniles require light, high-protein feeds, while adults require more balanced diets.

For aquaculture reproduction, special conditions must be created. *Rutilus frisii* begins spawning mainly in spring. For breeding, broodstock aged 2–3 years are preferred. During spawning, fish are transferred to special areas where water flow is increased to protect the adhesive eggs. Incubation conditions depend on temperature and oxygen levels, and incubation lasts 7–15 days. Disease control is crucial: water quality and fish health must be monitored regularly. Antibacterial and antifungal treatments, regular water filtration, and maintaining microbiological balance are critical. Vaccination can also help prevent infections. The cultivation period varies depending on age, water conditions, and diet. Optimal market size for best flesh quality is 200–300 g.

Conclusion:

Rutilus frisii is a fish species with high aquaculture potential. Its cultivation and propagation represent a highly promising field. Under proper water conditions, feeding practices, and high-quality diets, kutum can achieve high productivity. Its production meets strong demand in both local and international markets, making it economically attractive for aquaculture. With proper management and optimal farming conditions, the species' economic value can increase in domestic and foreign markets.[14,15] Large-scale cultivation of kutum can significantly contribute to the development of the fisheries sector, food supply, and national economic growth.

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