

Article

Pathological findings of an eye anomaly in Randall's threadfin bream *Nemipterus randalli* Russell, 1986 from the Mediterranean Sea (Antalya Gulf-Türkiye)

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Abstract: Genetic, environmental and nutritional conditions seriously affect the health of natural fish stocks. In addition, increasing human pressure on aquatic systems in recent years is threatening fish populations. Under the influence of increasing environmental pressures and other factors, different types of abnormalities are observed in fish. Among these, morphological abnormalities, pigmentation abnormalities, eye abnormalities, visceral abnormalities and reproductive abnormalities are commonly observed. There is limited information on eye abnormalities in Mediterranean fish species. In the present study, the body abnormality observed in a trawl-caught specimen of Randall's threadfin bream, in which the eyes were missing, and its causes are reported and the pathological findings discussed.

Keywords: Red Sea; Lessepsian; Randall's threadfin bream; ocular abnormalities

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1. Introduction

Several types of abnormalities have been reported in fish. These abnormalities include morphological abnormalities, pigmentation abnormalities, ocular abnormalities, visceral abnormalities and reproductive abnormalities [1, 2]. These abnormalities may be due to genetic, environmental, nutritional and stress factors. Abnormalities observed in fish can affect the health and quality of life of the fish in several ways. These effects can often have a negative impact on the fish's general physiological functions, growth rate, reproductive ability and even survival rate [3, 4]. Among the abnormalities observed in fish, ocular abnormalities have a very important impact on fish health. It is reported that microphthalmia, anophthalmia, cataract, abnormalities in eye size and location are common among eye abnormalities. Eye abnormalities in fish have been reported under both aquaculture conditions and from natural stocks [5].

This paper describes the physical body abnormality observed in an individual (*Nemipterus randalli*) without its eyes, collected from the Gulf of Antalya, in the Mediterranean Sea, on 18 March 2024. The number of studies on the distribution and ecology of *N. randalli* in the Mediterranean has increased in recent years [6-11]. As far as it is known, this study is the first record of eye deformity of Randall's threadfin bream along the Mediterranean. Simultaneously, this report constitutes the pathological findings of this deformity.

2. Materials and Methods

2.1. Ethics statement

This study follows all relevant international, national, and institutional guidelines for the collection and experimental use of fish samples. The fish species examined are not listed in the IUCN Red List of Threatened Species and are not classified as endangered, vulnerable, rare, or protected in Türkiye. Additionally, the sampling sites are situated outside of any designated protected areas, making an ethics statement unnecessary.

2.2. Study design

The specimen of *N. randalli* obtained from the Gulf of Antalya was caught during trawl surveys on 18 March 2024. Fish samples were transported directly to the lab, where measurements were made of their weight (total weight W to the nearest 0.1 g) and length (total length cm TL, precision 1 mm). The gonads were examined both macroscopic and microscopic to determine the sex. During the necropsy, the eyes of the fish were examined grossly and then carefully enucleated. The eye samples were collected, and the fish were fixed in 10% neutral formalin. Normal fish eye were also collected for comparison. The formalin-fixed tissues were embedded in paraffin following standard processing with an automatic tissue processor (Leica ASP300S; Leica Microsystems, Nussloch, Germany). Using a Leica RM 2155 rotary microtome (Leica Microsystems, Nussloch, Germany), serial sections with a thickness of 5 µm were cut. Hematoxylin and eosin (HE) staining was applied to each section, and each was inspected under a light microscope. The Database Manual Cell Sens Life Science Imaging Software System (Olympus Corporation, Tokyo, Japan) was used for microphotography.

3. Results

Abnormality was recorded in one specimen of *N. randalli* obtained from Antalya Gulf. The Randall's threadfin bream specimen was obtained from with trawl surveys. The specimen had a normal body shape, but eyes were missing with no injury (Figure 1). The total body length was 18.4 cm, and the total weight was 69.3 g.

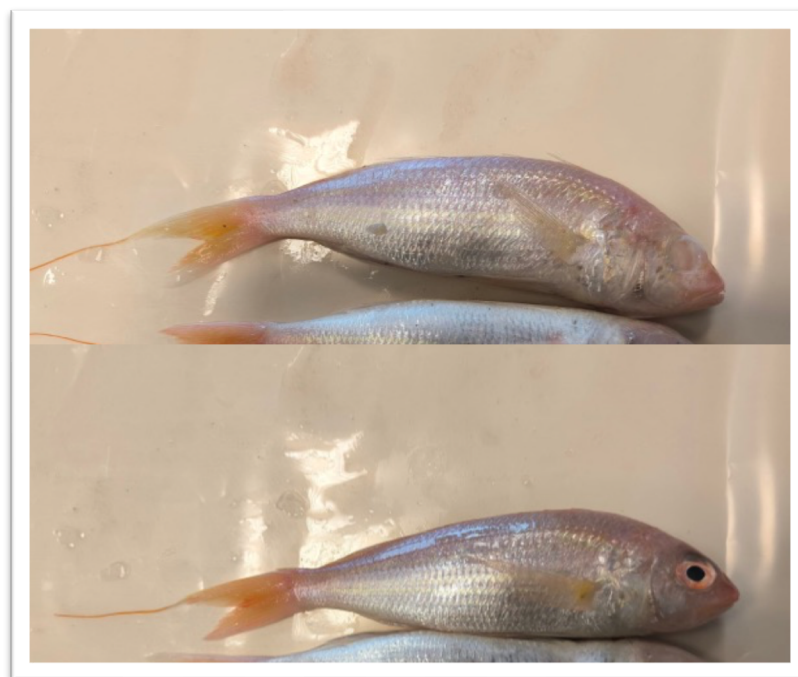


Figure 1. Macroscopic appearance of normal and anomalous fish, iris and pupil of the normal fish and no iris and pupil of anomalous fish.

3.1. Gross Findings

During the macroscopic examination of the normal fish eye, a distinct yellow-orange iris and a prominent black pupil in the center were observed. In the eye of the anomalous fish, only scleral structures within the orbit were observed (Figure 1).

Macroscopic examination of the anomalous fish's body revealed normal body appearance but during the opening of the abdominal cavity, the organs appeared atrophic compared the normal fish (Figure 2).



Figure 2. Appearance of abdominal organs of the normal and anomalous fish.

Microscopic examination revealed that only the sclera was present in the eye. The retinal layer was completely undeveloped. No melanocytes were observed. Only a hypoplastic, small lens remnant was noted. No other ocular structures were seen (Figure3).

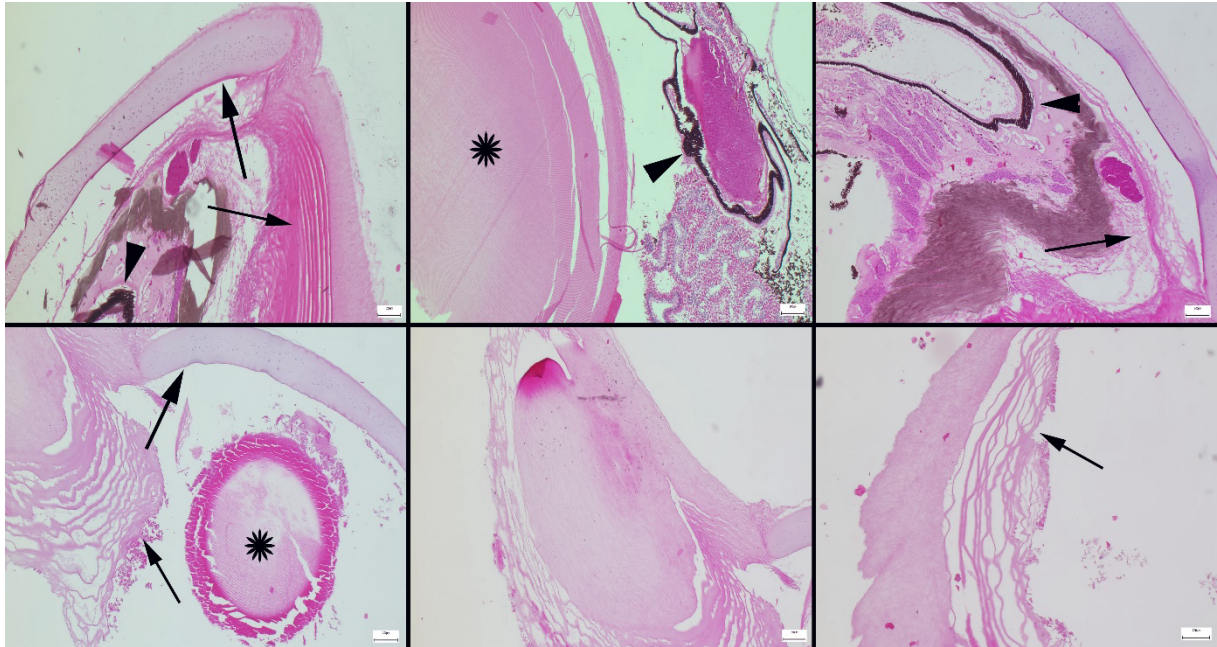


Figure 3. Normal (upper row) and anomalous eyes (below row) histopathology findings. Scleral cartilages (thick arrows), and scleral stroma (thin arrows), normal lens of normal fish and atrophic lens in anomalous fish (stars) and retinal layer (arrowhead) in normal fish but no retina in anomalous fish, HE, scale bars= 200μm.

4. Discussion

Nemipterus randalli has a wide geographical distribution from the coasts of eastern and western India to Pakistan, the Persian Gulf, the Red Sea, the Gulf of Aden, East Africa, Seychelles and Madagascar in the western Indian Ocean [10, 12-14]. *N. randalli* was first recorded in Israel in the Mediterranean. In the following years, it showed a widespread distribution in the Mediterranean. This species, which has been caught in high density in the Mediterranean coast of Turkey in recent years, is economically utilized. It has a high economic value due to its similarity to coral species. This species, which has been caught in high density in the Mediterranean coast of Turkey in recent years, is economically utilized.

Some abnormalities have been reported due to different reasons in the natural habitat of this species and in the Mediterranean Sea. Pigment anomaly was reported in the natural distribution area of *Nemipterus* [15]. Pugheadness anomaly was reported in Gökova (Muğla) populations of *Nemipterus* which introduced to the Mediterranean Sea [16]. A number of factors have been identified as contributing to fish abnormalities, including unfavourable abiotic conditions; and pollutants such as pesticides, chlorinated hydrocarbons, organophosphates, heavy metals, infectious agents, inappropriate nutrition and genetic factors [2, 3, 17].

According to Smith, Donahue [5], the abnormalities found in fish eyes include opaque or cloudy eyes, exophthalmia, missing eyes, hemorrhagic eyes, emboli, and gas bubbles in the eye. A number of factors, such as gas imbalances that cause exophthalmos, toxicants that cause hyperemia, cataract, retinitis, and keratitis, low temperatures and osmotic imbalances that cause cataract, on the other hand

nutritional deficiencies that cause cataract, retinal and corneal, diseases, parasitemias that cause exophthalmos, keratitis, cataract, radiation damage that causes keratitis, cataract, trauma from iatrogenic factors, and injuries from uncontrolled culture systems, can lead to eyes lesions[18]. When the abnormalities reported in this species were analysed, it was found that no eye anomaly had been reported before. In the study, it was determined that the eyes abnormalities one specimen of *N. randalli* showed macroscopic and microscopic differences compared to normal individuals. It is thought that this situation negatively affects the fish physiologically.

5. Conclusions

To the best of our knowledge, this survey reports the first eye abnormalities in *Nemipterus randalli*. The causes of the eye anomaly found in *N. randalli* are unknown. In countries bordering the Mediterranean Sea, increasing human activities are changing the quality of seawater. Numerous physiological and morphological changes in marine organisms have been reported as a result of water quality. Nervous necrosis virus (NNV), which is reported to infect about 40 fish species worldwide, was detected in *N. randalli* in a study conducted in the Mediterranean Sea [19]. NNV infection targets the central nervous system, including the brain, spinal cord and eye. Due to the fact that the Randall's threadfin bream is commercial species, further studies are needed in order to assess the eye abnormalities in Mediterranean populations.

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Conflicts of Interest: The authors declare no conflict of interest.

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