The First Record of Color and Area of Diplodus vulgaris by Using Computer-Based Image Analysis

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Abstract

Objective: Determination of the morphological characteristics of fish species is essential for the correct identification. The most important of these morphological features is undoubtedly the color properties. The determination of color characteristics by Computer-Based Image Analysis (CBI) rather than individual identification gives more objective and consistent results. In this study, color and area analysis of Diplodus vulgaris, which color and area characteristics have not previously determined by Computer-Based Imaging Systems (CBI), was performed.

Methods: Twelve fresh samples were used for the study. For color and area analysis CBI system was used. A color reference card was put to determine the color, and the \( L^* \), \( a^* \), and \( b^* \) values were 66.49, -0.57, and 0.18, respectively. A 16 cm² reference square was utilized for area analysis. The two-image method was carried out with computer software (LensEye).

Results and conclusion: According to the results, the mean color parameters of the samples was determined as 59.08 ± 2.23, -0.06 ± 0.31, 3.36 ± 1.33, 8.74 ± 0.81, and 57.73 ± 2.21 for \( L^* \), \( a^* \), \( b^* \), Chroma, and Whiteness, respectively. The average area of the Diplodus vulgaris was 101.78 ± 9.58. The ISCC-NBS System of Color Designation color name was determined as medium gray to light brownish gray. For future studies, it is recommended that other fish species can identify by using CBI.

Keywords: Diplodus vulgaris; Color; Area; Fish; Computer-based imaging systems.

Introduction

Diplodus vulgaris includes the Sparidae, and the living area is Eastern Atlantic, Mediterranean, and Black Sea. According to Mouine et al., [1], these family members have high commercial value. However, there are no data about the world’s total production of Diplodus vulgaris in the literature. Also, many species in this important Diplodus [1] and the successful differentiation of a species require expertise.

For determining fish species, some researches have been done by using molecular identification [2], DNA-based methods [3] and biomarkers [4]. However, these methods need time, experienced labor, and expensive devices. Before these methods, fish species were identified, named, and classified by their visible properties [4]. All fish species have their color and shape characteristics. These features help them survive in their living environments.
environment. The most important physical property used when determining the type of fish is ‘color.’ It includes general expressions about color when defining fish species. However, using colors in numbers instead of these expressions offers a more precise and objective approach.

Color is affected by many different factors, such as the angle of light, light intensity, and color blindness when color is evaluated by human appearance. Some instrumental devices are used for color determination. However, some researchers mentioned that the instrumental devices had not analyzed the non-homogenized color surfaces like fish [5,6]. The best results for these surfaces are obtained by Computer-Based Image Analysis (CBI). Many scientific researches have been successfully done about seafood and color determination using computer-based image analyses [7-13] used image analysis for the determination of fish species. This study aimed to determine the color characteristics and area of Diplodus vulgaris using CBI analysis for the first time in the literature. Thus, it makes it possible to determine the fish species using these features.

Materials and methods

Fresh samples of Diplodus vulgaris from a local fish supplier were landed as soon as they were caught in April 2019 in Canakkale, Turkey. Twelve fish samples with an average length of 21.5 cm and an average weight of 313.16 g were transferred with a foam-box in ice to the laboratory. The samples were washed with tap water and dried with a paper towel before taken pictures.

The samples’ pictures with both sides were then taken in a light-box, according to Alçiçek & Balaban [14]. The light-box was 122 cm high, 61 cm wide, 46 cm deep, and had 2 LED light sources (one up and one bottom) (ForLife FLP-15, India) with color temperature 6500K (D65 illumination). The upper light source surface was covered with a polarizing sheet (Rosco, Stamford, CT, USA). A Nikon D300 digital camera (Nikon Corp., Tokyo, Japan) with an 18-200 mm zoom Nikkor lens with a 72 mm diameter circular polarizing filter attached was used to take pictures in the light-box with a USB cable. The Nikon Camera Control Pro (Nikon Corp., Tokyo, Japan) was used to control camera settings and take pictures by computer. The camera was set to manual mode, with an ISO setting of 200. The pictures (2144*1424 pixels) were transferred to a desktop PC. A color reference (Gretag Color Checker, X-Rite Inc., Grand Rapids, MI, USA) was placed in the box to determine the right color. A reference square (16 cm²) was used for determining the area of the samples. Lens Eye software (Gainesville, FL, USA) was used to analyze the samples’ color and area. The pictures were segmented and then analyzed (Figures 1, 2, & 3). SPSS 23.0 for windows (IBM, IL, USA) was used for the frequency analysis of samples and the determination of mean and standard deviation values.

Results & discussion

The color and area properties of Diplodus vulgaris were shown in (Table 1). The frequency area value of the samples was shown in (Figure 4). According to results, a Diplodus vulgaris with an average length of 21.5 cm and an average weight of 313.16 g has a 101.78 cm² area. These results are consistent with Moune et al [1]. The L* value of the samples was ranged between 53.26 to 63.49 (Figure 5). This result showed that Diplodus vulgaris has a light color and was confirmed by the low a* and b* values (Figures 6 & 7). These values were -0.05 and 6.36 for a* and b*, respectively. Whiteness frequencies results (Figure 8) compatible with the L* value, and Chroma frequencies of the samples (Figure 9) with the b* value. According to the color scheme (NBS) determined by the Inter-Society Color Council [15], Diplodus vulgaris was changed between medium gray to light brownish gray. These results are very identical for Diplodus vulgaris Because there is no data on this species’ color in the literature. It is predicted that the data obtained from this study can be used to determine this species. It is recommended to analyze other fish species’ color and area values using CBI as an accurate, fast, and objective identification method for future studies.
Figure 4: The frequency of the area of Diplodus vulgaris samples.

Figure 5: The frequency of L* value of Diplodus vulgaris samples.

Figure 6: The frequency of a* value of Diplodus vulgaris samples.

Figure 7: The frequency of b* value of Diplodus vulgaris samples.

Figure 8: The frequency of Chroma value of Diplodus vulgaris samples.

Figure 9: The frequency of Whiteness value of Diplodus vulgaris samples.
Table 1: The color and area properties of the samples.

<table>
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<tr>
<th>Properties</th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Sum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
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<td>Area (cm²)</td>
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<td>b*</td>
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References