

MARINE SCIENCE AND TECHNOLOGY BULLETIN

Effects of different feather colors in chub mackerel (*Scomber japonicus* Houttuyn, 1782) handline used at Gökçeada Region on fishing efficiency.

Emirhan Akyasan¹, Alkan Oztekin¹, Ugur Altinagac^{1*}, Adnan Ayaz¹

¹Faculty of Marine Science and Technology, Çanakkale Onsekiz Mart University, Çanakkale, Turkey

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ABSTRACT

In this study, fishing efficiency was analyzed by using different colored feathers in chub mackerel fishing (*Scomber japonicus* Houttuyn 1782) at Gökçeada. Catching lengths of green, brown (grayed), pink, white and orange feathers were determined to be 33.7 cm, 34.2 cm, 33.6 cm, 34.7 cm and 35.9 cm, respectively. When the fishing efficiencies of different colored feathers used in the study were compared at the end of the study, brown (grayed) color was found to have caught 164 individuals, having a catching rate of 35%. Orange colored feather was found to have caught 95 individuals, having a catching rate of 21% while white colored feather was found to have caught 49 individuals, having a catching rate of 11%. Green colored feather was found to have caught 70 individuals, having a catching rate of 15% and pink colored feather was found to have caught 82 individuals, having a catching rate of 18%.

Introduction

Chub mackerel (*Scomber japonicus* Houttuyn 1782) is a medium sized species, which is widely spread in the warm and mild transition areas in Atlantic, Indian and Pacific Oceans. These fish, which live in shoals and migrate, has been found to spread down to 300 m. of depth from the surface (Collette and Nauen 1983). Numerous studies have been carried out on the species' biology all around the world due to its commercial importance (Perrotta 1992; Castro and Del Pino 1995; Kiparissis et al. 2000; Yukami et al. 2009; Cikeš Keč and Zorica 2012).

Regarding the waters of Turkey, age, growth and reproduction information for the species has been provided from the Sea of Marmara (Tuggaç 1957), Black Sea (Atlı 1959; 1960), Gulf of İzmir (Bayhan 2007) and Gulf of Saros (Cengiz 2012). Sever et al. (2006) analyzed the stomach contents of the juvenile individuals caught from the Gulf of İzmir. Ergüden et al. (2009) analyzed and compared metric and

meristic characteristics of the chub mackerels caught from Mediterranean Sea, Aegean Sea, Sea of Marmara and Black Sea. Özekinci et al. (2009) studied hermaphroditism of the species in the Çanakkale Strait.

Especially purse seine, seine net and special feathered handline rods are used in chub mackerel fishing in the waters of Turkey. Handline fishing is commonly performed with feather rods at Gökçeada shores in Çanakkale. There had not been any scientific studies regarding the feather colors of the rods used for fishing of this species. This study intends to determine the fishing efficiencies of green, brown (grayed) pink, white and orange colored feathers used for fishing of the chub mackerel.

Material and methods

This study was performed around Gökçeada shores between 2015 and 2016 in order to determine the effects of the feather colors in the handline used for chub mackerel (*Scomber japonicus* Houttuyn, 1782) fishing around Gökçeada region on the fishing efficiency (Figure 1).

Green, brown (grayed) pink, white and orange handline rods were used in the experiments. These colors were not selected randomly. The most frequently used feather colors

*Corresponding author

E-mail address: ualtinagac@yahoo.com (U. Altinagac)

Tel: +90 286 218 00 18 fax: +90 286 218 05 43

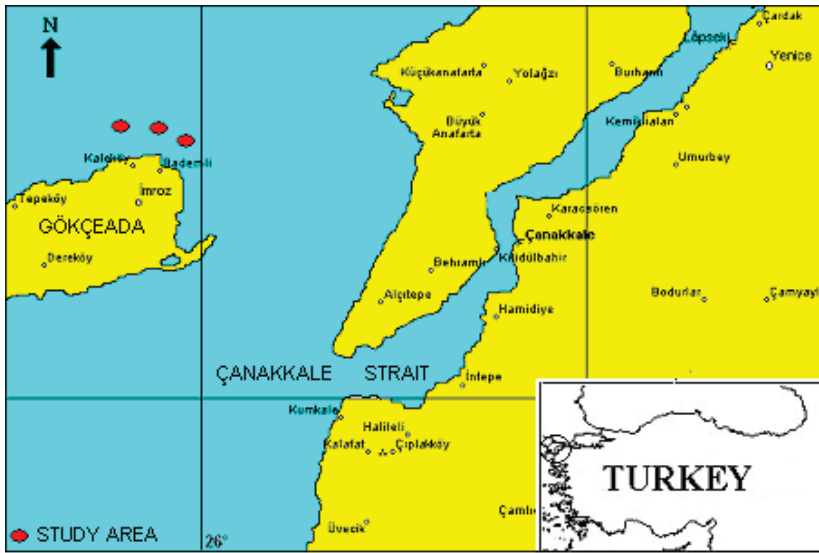


Figure 1. Study Area.



Figure 2. Feathers used in handline.



Figure 3. Feather with the hook.

by the fishers were determined by questionnaires conducted within the scope of the project and the colors determined were used in the study. Vertical handline was used in the experiments (Figure 2 and 3). The hooks were tied to 20.0 cm long snoods and the middle line was equipped with 25.0 cm gaps. In vertical handline, snoods were made of 0.35 mm fishing line, and of 0.50 mm fishing line in middle line (Figure 4). Finally, 5 different feathers were placed on the hooks and the kit was made of 20 hooks in total (Figure 5). 600-1000 gr sinker was used for the kits. Fishing was performed in 100-120 cm depths. All the handlines used had the same characteristics. For this reason, in order to minimize the effects of handling sensitivity, experience and fishing skills, no inter-changes were made among the users similar to the previous studies. The fish caught were put in special, partitioned buckets regarding the feather color and their sizes and weights were measured by using measuring board with 1 mm sensitivity and scale with 1 g sensitivity.

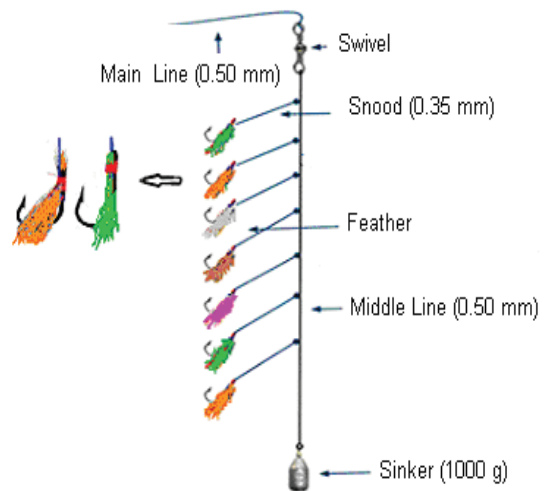


Figure 4. Shape of the handline used.



Figure 5. Feather color scale of the handline used

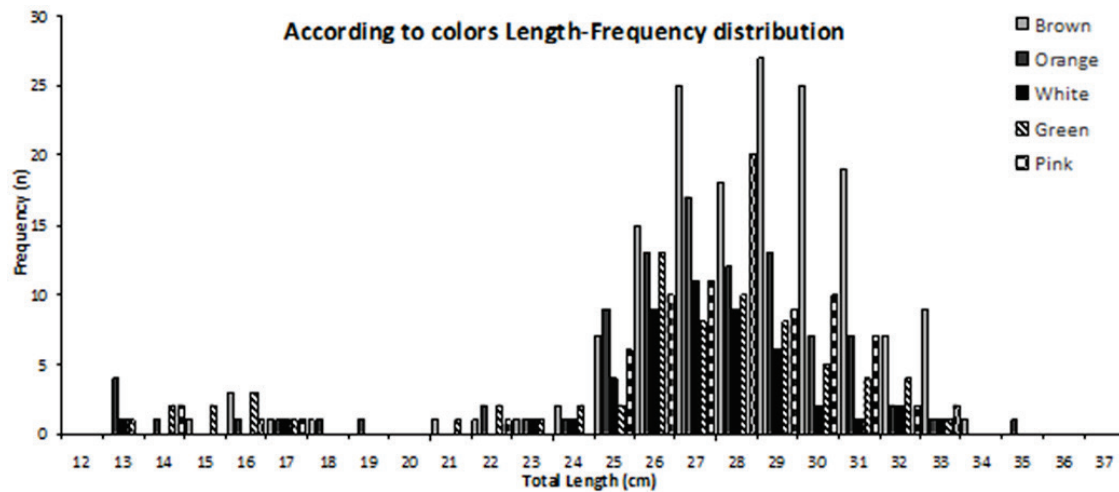


Figure 6. Size-frequency distribution of chub mackerel (*Scomber japonicus*) according to colors.

Results

A four hundred sixty chub mackerels, which sizes ranged from 13.0 cm and 36.0 cm were caught in this study. Size-frequency distributions of the fish are given in Figure 6.

Regarding the color of the feather, highest number of chub mackerel was caught with brown (grayed) feather (164 individuals, 35%) and lowest number of chub mackerel was caught with white feather (49 individuals, 11%). Number and size values of chub mackerels caught during the study performed with feather chub mackerel handline at Gökçeada are given in Table 1 according to fishing efficiencies of feather colors.

As given in Table 1, 164 individuals out of 460 chub mackerels (*Scomber japonicus* Houttuyn, 1782) were caught with brown feather, having 35% of fishing efficiency. Minimum size of the individuals caught with brown feather was 15.6 cm while the maximum size was 34.2 cm. Orange colored feather provided 21% fishing efficiency by catching 95 individuals. Minimum size of the individuals caught with orange feather was 13.1 cm while the maximum size was 36.9 cm. White colored feather showed 11% fishing efficiency by catching 49 individuals. Minimum size of the individuals caught with white colored feather was 13.6 cm while the maximum size was 33.7 cm. Green colored feather provided 15% fishing efficiency by catching 70 individuals. Minimum size within the individuals caught by green feather was 13.1 cm and the maximum size was 33.7 cm. Pink colored feather provided 18% fishing efficiency by catching 82 individuals. Minimum size of the individuals caught with pink colored feather was 14.3 cm and the maximum size was 33.6.

CPUE (Catch per unit effort) per hook is given in Table 2. In these values, unit per hook means catch. In this table fishing efficiency order is the same in terms of weight and number.

Discussion

When fishing efficiency of this study performed at Gökçeada was analyzed, fish were observed to be caught mostly by orange and brown (grayed) feathers. In this study, maximum catch sizes according to the feather colors were found to be 33.7 cm, 34.2 cm, 33.6 cm, 34.7 cm and 35.9 cm for green, brown (grayed) pink, white and orange colored feathers, respectively.

Numerous factors can affect fishery in the fisheries management in the seas directly or indirectly. There can be many factors affecting the efficiencies of the feathered handline and baited handline as well. The most important factor within these is the fact that the feathered handline does not attract the fish. While this fact depends on the material used for the feathered handline, it is also closely related with the color of the handline as well as its conformity with the environment.

This study, which was performed with feathered handline, intended to determine fishing efficiencies of feather colors by determining the color which the chub mackerel (*Scomber japonicus* Houttuyn 1782), which was commercially caught around Gökçeada Region, was mostly affected by (green, brown, orange, white, pink).

Table 1. Number and size values of chub mackerels (*Scomber Japonicus*) regarding to feather colors.

Colors of feather	Number	%	Total Length (cm)		
			Minimum	Maximum	Average. ± S.E.
Brown	164	35	15.6	34.2	28.67±0.256
Orange	95	21	13.1	35.9	27.98±0.448
Pink	82	18	14.3	33.6	27,98±0.384
Green	70	15	13.1	33.7	26.53±0.578
White	49	11	13.6	33.7	27.45±0.457

Table 2. Total CPUE values per hook

Colors of feather	CPUE (Number)	CPUE (Weight)
	Per hook	Per hook
Brown	0.85	0.214
Orange	0.49	0.106
Pink	0.42	0.099
Green	0.36	0.075
White	0.25	0.056

There had not been any previous studies found to be performed within the scope of our study. However, effects of gillnets and seine nets, which are rather different fishing tools, on fishing was previously studied in terms of their use in different colors. Fishing capabilities of 8 different colored gillnets (red, black, white, blue, light green, dark green, yellow and brown) on 4 different fish species were analyzed and different colors were found to catch different types. In this study, tones of the colors used in fishing were found to affect the caught fish species as well. The most efficient nets according to the fishes caught in Beyşehir Lake were found to be red, black, white, light green, yellow, blue, dark green and brown colored nets respectively and the most efficient net color for zander was found to be brown followed by light green, yellow, white, red, black, blue and dark green, respectively (Balık and Çubuk 2001).

In a study carried out in India, white colored nets were found to be more efficient than yellow, green, brown and blue nets (Narayanappa et al. 1977).

In another study, dark green colored gillnets were found to be a more favorable for the Baltic Sea (Stinberg et al. 1985).

In another study on the North Sea, light colored nets were found to be more efficient than dark colored nets (1.43/1.71) (Steinberg et al. 1985).

Some researchers (Steinberg 1964; Jester 1973) stated that color selection in fishing targeted species would be favorable and catching non-targeted species could thus be decreased as well as that color selection would also be favorable for stock management. It has been found that different gillnet materials and materials colors has an effect on fishing efficiency, the light colored material having 1.8 times more efficiency than that of nets having dark colored materials (Twedle and Bodington 1988).

In another study, (Duman and Orsay 2009) fishing efficiencies were compared by using green, blue and black colored monofilament gillnets and comparing different weather conditions (Sunny, cloudy). According to the results obtained, while 193 fish out of 677 (28.50%) were caught under sunny weather, 448 other fish (71.49%) were caught under cloudy weather. When the caught fish numbers and weather conditions were compared, cloudy weather conditions have been found to be more efficient.

In a study on zander and silver-gray pond fish (Balık and Çubuk 2006) effects of gillnets and net colors used in fishing (black, white, blue, yellow, red, light green, dark green and brown) on fishing efficiency were analyzed. The most

efficient net color for zander in the lake was found to be white, while for silver-grey pond fish the color was found to be dark green.

Considering these assessments, studies that have similarities with our study have shown that fish were sensitive to colors and colors affect the fishing efficiency. As it can be understood from the data we obtained, fishing efficiency changes according to colors in fishing with handlines as in the case of other fishing equipment (Gillnets and seine net). In our study, it has been found that fish can distinguish the colors, therefore changes in fishing efficiencies according to the colors of the feathered handlines have been found to be significant.

Feather colors used in chub mackerel (*Scomber japonicus*) handline have been found to have an effect on fishing efficiency and in this study carried out at Gökçeada, considering the fishing efficiencies according to the colors, highest number of individuals were caught with brown feathers (164 individuals, 35%) while lowest number of individuals were caught with white feather (49 individuals, 11%). These values can possibly change according to different colors of equipment used for fishing in lakes and seas as well as the fish species.

Besides the structure and equipment of the fishing gears, environmental factors such as temperature, light, wind and current in the environment in which fish live are also considered to be within the factors affecting the fishing efficiency. These factors also have positive or negative effects on the general behaviors of the fish and their reactions to the fishing gears (Özdemir 2003).

Light is one of the most effective environmental factors for the fish to see (Dickson 1989). Besides light, characteristics of the object or living creature to be seen also have a significant role for the process of seeing. The facts that the light is absorbed more and the colors of the objects are changed in the deeper sections are also factors affecting fishing. One of the most important factors within these is the fact that the color of the feed which the fish has in its living space becomes more attractive for that particular fish to be caught.

As the fact that the depth in which the fish were caught during this study was 10-120 m may affect the visibility of the feather. Therefore, different colors can be efficient in the studies performed in more shallow waters. In this study, considering the effects of feather in chub mackerel (*Scomber japonicus* Houttuyn 1782) handline on fishing efficiency, highest fishing efficiency was gained with brown feather with 164 individuals out of 460 chub mackerels in total, having a rate of 35% as also given in Table 1 and Table 2. White colored feather was found to provide the lowest efficiency with 49 individuals, having a catch rate of 11%.

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