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Study on the Amount of Twist per Meter of Acetra Gillnets in Golestan Province, Iran

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Abstract: Each year, at the end of the sturgeon fishing season, sturgeon management experts of Golestan province, classified as special acetra gill nets capability in the next season, according to physical features such as yarn strength and color, respectively, to 75%, 50%, 25% and obsolescent. Many past studies showed that amount of yarn twist is proportional to breaking strength. Samples of new, 75%, 50%, 25% and obsolescent special acetra gillnets were prepared and amount of yarn twists of this nets was tested. The mean and standard deviation of twist respectively was (215.4±2.28), (225.6±6.23), (223.96±3.04), (214.8±5.24) and (201.04±4.47). The mean of twist in each classes of net showed that there were significant differences among the means of twist per meter in obsolescent, with an mean of twist per meter in 25%, 50%, 75% and new ($P<0.05$). Also there were significant differences between mean of 25% with means of 50% and 75% ($P<0.05$). As well as there were significant differences between mean of new with means of 50% and 75% ($P<0.05$). In this study there was no significant differences between mean of 25% with new, also, between mean of 50% with mean of 75% ($P>0.05$). It is important to note that the rate of increase of twist gradually reduced from obsolescent to 75% net. Therefore in each net purchase the mean of yarn twist was lower than before. We suggest that, in the case of twist test, sturgeon management experts of Golestan province should have the required accuracy when purchasing new nets.

Key words: Sturgeon · Yarn Twist · Classes

INTRODUCTION

Due to high value of caviar and meat production, the sturgeons have a special place of importance. Considering that over 90% of this fishes catch from the Caspian Sea, that is the most important; Sea of Azov is accounted 3% to 5%. The Black Sea is less than 1% and the rest of the world to account for 2% to 3% [1]. Sturgeon fishing from the Iranian part of Caspian Sea in 2009 was 131 tones that share of Golestan province from this amount, was 47 tones; Also in that year, the overall 0.4 tones processed caviar was exported that the export value was 2470 thousand dollars [2]. In fishing grounds until 1991, catch statistics of three species of *Acipenser persicus*, *Acipenser gueldenstaedti* and *Acipenser nudiventris* was collected and was recorded as acetra [3]. In stock assessment of Iranian part of the Caspian Sea, acetra numbers more than other species of sturgeon [4, 5]. Also in sturgeon fishing ground, unlike the others, there is no time limit during fishing season for special acetra gillnets and in the total duration of the fishing season it is in use.

In the southern part of the Caspian Sea (Iranian side) most of the sturgeon catches are made around the rivers. As the result of legislative restrictions on gear (for protecting the sturgeon), only gillnets have been used for catching the sturgeon [6]. Gill net is single layered netting in which the fish is trapped by its gills or is wedged when it tries to swim through. The catching efficiency of gill

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nets depends on the use of the right materials having least thickness without reduction in strength, lesser visibility, softness, desired elasticity and knot strength. The color of material, mesh size and hanging ratios also influence the efficiency of gill nets [7]. Gillnets are usually set across the direction of the migrating fish, so that they try to make their way through the meshes of the netting. Stationary gillnets set on the bottom between stakes and anchors are used in lakes and coastal fisheries for catching the most common commercial fish [8]. Bottom-set gill nets are used to fish water space with any concentration of fish, irrespective of sea-bed type and, in most cases, hydrographic conditions. Once the suitable type of net has been chosen, it is necessary then to determine its optimum size, material, mesh size, twine thickness, hanging ratios, color, size of mainlines, etc [9]. Gill nets are highly selective both for upper and lower size ranges of fish and their meshes are frequently regulated by legislation. Their simplicity of construction and operation makes them one of the most basic and widespread methods for fishing inland waters and the preferred method in most lakes and reservoirs [10]. Yarn of gillnets like many other nets, are mainly made from polyamide fibers and certainly characteristics and physical properties of this yarns has a direct effect on fishing efficiency and durability of this nets [11].

The breaking strength is understandably one of most important properties that the fisherman and the net makers must consider when selecting a material for a certain job [12]. Twist plays an important and significant role on the yarn quality and its production. It provides cohesion between the fibers and gives strength to the yarn particularly when the yarn is subjected to any external force [13-16]. In twisted yarns, strength increases up to a twist angle of about 7°, when the effect of obliquity leads to a reduction in strength [17]. Twist is the number of turns about the axis of a yarn based on its nominal gauge length before untwisting. Twist should preferably be expressed as turns per meter (turns/m), but it may be expressed as turns per centimeter (turns/cm) (ISO 2061, 1995). This is indicated by the capital letters S and Z. The product has S twist if, when it is held in a vertical position, the spirals or helices formed by the fibers or filaments around its axis incline in the same direction as the central portion of the letter S. The product has Z twist if, when it is held in a vertical position, the spirals or helices formed by the fibers or filaments around its axis incline in the same direction as the central portion of the letter Z. Netting yarns of the same diameter for the same hardness therefore require the same twist (t/m), independent of the kind of fiber materials. In general three degrees of twist are distinguished: soft, medium and hard twist. In some cases it would be advantageous to use a fourth degree: very hard. The desired level of twist of a netting yarn naturally also depends on the requirements for the type of fishing gear for which it is to be used. Gill nets usually need a soft twist; bottom trawls, purse seines and many types of small fishing gear need a medium twist and mid-water trawls and various lines a hard twist [13].

Each year, at the end of the sturgeon fishing season, sturgeon management experts of Golestan province, classified as special acetra (included of *Acipenser persicus, Acipenser gueldenstaedti* and *Acipenser nudiventris*) fishing gillnets capability for the next season, according to physical features such as breaking strength and color, respectively, to qualitative features of 75%, 50%, 25% and obsolescent nets. It looks like classification of these nets, based on appearance, is very personal and individual method. Even in some cases, fishermen were not satisfied than classification. Darvishi [18] with study of physical properties of polyamide yarns of domestic production in gillnet confirmed that quality of yarn produced in the country does not accordance with international standards. These reviews was include the breaking strength, percent of elongation, the amount twist, weight of five meters yarn in and percent of shrinkage. He showed that in case of the number of yarns 12, 30, 36 and 54 tex, except about the twist of No. 30 and 54 yarns, in other cases, there are significant differences among characteristics of this yarns and the specified standards. Only research conducted about the classification accuracy of sturgeon gillnets related to Aminianfatideh [11]. He showed that amount of yarn twist per meter in special acetra fishing gillnets in Golestan province in class of 25% no significant difference with 50%; While 50% have a significant difference with 75% ($P<0/05$). But in this study has not been investigated the amount of twist in class of new and obsolescent gillnets. In his study the mean of yarn twist in 25% net was more than 75%. According to the above, it is vital a more accurate measure and compare the amount of twist of new nets, 75%, 50%, 25% and obsolescent, to check the accuracy of the classification method being carried out in Golestan province. Because from acetra gillnet are used for fishing three different species of sturgeons, in this study classification accuracy of this net from the stand point of amount of yarn twist is being investigated.

MATERIALS AND METHODS

To begin the process of implementation of this study, prepared 15 yarn samples from each five classes of special acetra fishing gillnets include of new, 75%, 50%, 25% and obsolescent. There are five sturgeon fishing and processing center in Golestan province. This fishing grounds include of Faridpak N53°54'20" and E37°19'29", Turkmen N53°56'00" and E37°14'30", Khajenafas N54°00'14" and E37°02'02", Ashooradeh N53°57'18" and E36°54'44" and finally Mianghalah N53°48'35" and E36°54'09" (Fig. 1).

In each of these fishing grounds, for each class, three numbers of net was selected. The classification accuracy of chosen fishing nets was confirmed by experts, liable and the fishermen present in that fishing grounds. For multifilament yarns take an initial length of 500±0.5 mm if the nominal twist is <1250 turns/m (ISO 2061, 1996). From each of these nets by opening of the knots was separated a yarn with 500 mm length. Based on standard of ASTM D1423 (1992), in the case of multifilament yarns, it is enough the five samples from each treatment or class to determine amount of twist. For greater certainty of results in this study, five treatments were tested that each treatment had 10 repeats. Yarn material of this net is polyamide and multi-filament made ??from three strands. Number of yarn is 24D210, opening of mesh is 300 mm, height of net is 18 meshes (5400 mm), length of net is 120-144 meshes (about 18000 mm) and hanging ratio of prepared net is 50%. As regards the net opening of mesh is 300 mm, it must be opened at least three knots to get a knotless yarn with 500 mm length. To calculate the amount of twist in each samples of treatment, used Electronic twist tester, L10-E1320, made in England. Experiments were done in the fiber physics laboratory of textile faculty of Amirkabir University in Tehran.

The twist of yarn is one of its more important morphological properties. This property has so far been difficult to test and the methods employed for that purpose continue to be a matter of dispute. The amount of twist inserted in a yarn is a factor on which are dependent not only the tensile properties of the yarn but also a number of other properties which qualify the yarn for a particular use. Testing twist in a laboratory presents many difficulties and the most common method consists in untwisting and then re-twisting the yarn in the opposite direction. This method has certain imperfections which make the method inaccurate. Inherent in the method is the possibility of the fibers slipping along the yarn axis as the yarn is being untwisted. This results in uncontrolled elongation of the test length, the consequence of which is that the reverse twist is inserted in a greater amount than that of the original twist. Another imperfection of the untwist-twist method is that the fibers of an untwisted yarn pose a greater resistance to twisting when the yarn is being twisted in the opposite direction. The value of the resistance depends on the parameters of the fibers and the yarns and the specificity of the spinning system [19].

It has been shown that the results of the untwist-twist method vary with the value of the pre-tension applied to the test specimen [20-22]. According to the above, in this study, the direct counting method was used

Fig. 1: Sturgeon fishing grounds of Golestan province.

to determine the amount of yarn twist. In this method, the twist in a known length of yarn is removed by rotating one end of the specimen with respect to the other until the components of the yarn being tested are parallel. The exact number of turns required to remove the twist is reported in terms of turns per unit length of yarn. Twist counter, consisting of a pair of clamps, one of which is rotatable in either direction and positively connected to a revolution counter. The position of one or both clamps shall be adjustable to permit testing yarn lengths from10 mm to 500 mm. Means shall be provided for applying tension to the specimen and for rapidly determining the specimen length with an accuracy of ± 0.5 mm or ± 2 %, whichever is smaller (ISO 2061, 1996). According to the standard 139 (2005), Standard conditions of temperature should be 20±2°C and 65±4% relative humidity. As well as according to the standard 2061 (1996), generally, it is not necessary to precondition samples before conditioning for twist tests.

Finally, data were analyzed by SPSS software that for comparison of tested mean values by use of One- way ANOVA analysis. Also for drawing the chart Microsoft Excel software was used.

RESULTS

The Results of Electronic Twist Tester Device: Amount of twists has been determined by using electronic twist tester device and in accordance with all the terms of the International Standards Organization. Sample value ??of 5 different treatments is presented in Table 1.

The Results of the Data Analysis of Yarn Twist per Meter: The mean twist per meter values of studied five treatments showed that 75%, 50%, new, 25% and finally useless nets respectively were had the highest values. In Fig. 2 compared the mean values ??of twists per meter of five intended treatment.

Table 1: Amounts of twist per meter of tested yarn samples in five different treatments

Treatments Samples	Obsolescent	25%	50%	75%	New
1	204.4	217.6	221.2	210.8	218.4
2	202.4	213.2	225.6	226.4	218
3	204.8	209.2	229.6	226	215.2
4	194.8	203.6	222.8	227.6	211.6
5	208.4	218.4	226.4	230	214
6	202.4	212.4	223.2	219.2	217.2
7	199.2	216.8	222.4	226.8	215.6
8	198.8	217.2	219.6	232.4	213.2
9	194	218.8	222	227.2	217.2
10	201.2	220.8	226.8	229.6	213.6
Means	201.04	214.8	223.96	225.6	215.4

Table 2: One-way ANOVA that showed ??there are significant differences of the mean values

Twist	Sum of squares	df	Mean square	F	Sig.
Between groups	3809.352	4	952.488	47.182	0.000
Within groups	908.448	45	20.188		
Total	4718.4	49			

Table 3: Results of pair-wise comparison of treatment mean twists per meter with tukey test (P<0.05)

		Subset for alpha = 0.05		
Treatment	N	1	2	3
obsolescent	10	201.04		
25%	10		214.8	
New	10		215.4	
50%	10			223.96
75%	10			225.6
Sig.		1.000	0.998	0.924

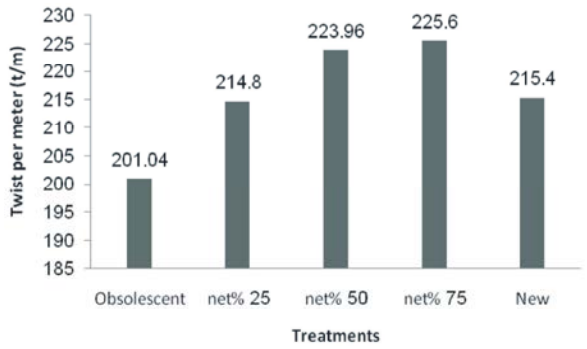

Fig. 2: Diagram of comparing the means of twists per meter of five treatments

One-way ANOVA was used for comparison of means in five classes of special acetra fishing gill nets. In Table 2, the results showed that there was significant differences among the means ($P<0.01$).

Tukey analysis test used for comparison of pair-wise means. Overall, Tukey analysis test that is presented in Table 3 showed that there were significant differences among the mean amount of twist per meter in obsolescent net, with means of twist per meter in 25%, 50%, 75% and new nets ($P<0.05$). Also there were significant differences between mean of 25% net with means of 50% and 75% nets ($P<0.05$). As well as there were significant differences between mean of new net with means of 50% and 75% nets ($P<0.05$). In this study there was no significant differences between mean of 25% with new net, also, between mean of 50% with mean of 75% net ($P>0.05$).

DISCUSSION

Twist is the spiral disposition of the components of single yarn, folded yarn, or netting yarn. As a numerical value the term indicates the number of turns per unit of length (amount of twist), for instance, per 1 meter (t/m) or per 1 inch (t/i). The amount of twist has a very great influence on the breaking strength and the extensibility of netting yarns [13]. Therefore the differences of breaking strength in classes of the classified gillnets, could be justified by using the twist experimental results. As previously mentioned, breaking strength is the most important factor for classification of special acetra fishing gillnets.

It is important to note that, according to the results, of the rate of increase of twist gradually reduced from obsolescent to 75% net. Difference between the amount of twists of obsolescent with 25% net, 25% with 50% and 50% with 75% respectively was 13.76, 9.13 and 1.64.

As an unusual result in this study was that amount of twist in new net was greater than 25% net, but there was no significant difference with that. Also amount of twist in new net was significantly lower than 50% and 75% nets ($P<0.05$). This shows that purchased new nets, are not comply with the standard terms and recommendations. As previously mentioned, amount of yarn twist is proportional to breaking strength. The results showed that in each net purchase, the mean of yarn twist was lower than before. Therefore, in the case of twist test we suggest that sturgeon management experts of Golestan Province should have the required accuracy when purchasing new nets.

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