Morpho-Ecological Features Of Pikeperch (Stizostedion Lucioperca) In Lakes Of Ayakagytma In Uzbekistan

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Annotation: This study presents the morpho-ecological features of pike perch fish in the conditions of Ayakagytma Lake. It described that a comparative analysis of growth and morphometry between Ayakagytma and Dengizkul fishes. Also, it is informed on the nutrient content and fertility of pike-perch in Ayakogytma Lake..

Keywords: pikeperch, morphology, zooplankton, nectobenthos, copepoda, cladotcera, kolovratka , invertebrate, vertebrate

1. Introduction

The Pikeperch or sudak *(Stizostedion Lucioperca)* has commonly spread in Central Asia, especially in Uzbekistan. Pikeperch, mostly freshwater species found in Amu Darya, Syr Darya, Zarafshan and Qashqadaryo rivers (Nikolskiy 1940, Berg 1949, Abdullaev 1989, Amonov 1983, Haqberdiev 1985, Sayfullaev 1995). During 1963-1965, in order to enhance a fishery and reduce the amount of non-industrial fish in Uzbekistan, the pikeperch is brought to Syr Darya, Surkhan Darya and Amu Darya reservoirs. Pikeperch was spread to Zerafshan river from Amu Darya by the Amu Bakhara and Amy Karakul channels (Komilov 1973, Haqberdiev 1983, Amonov 1985, Abdullaev 1991 Mirzaev 1994, Sayfullaev 1995). Variours years old of population in pikeperch were observed in Tudakul lake (till 9+), Tuzkan lake (till 8+), ABMK (till 6+, 7+) by Sayfullaev G.M et al (1995). Pikeperch lives in Ayakagytma lake since 1988 (Figure.1).

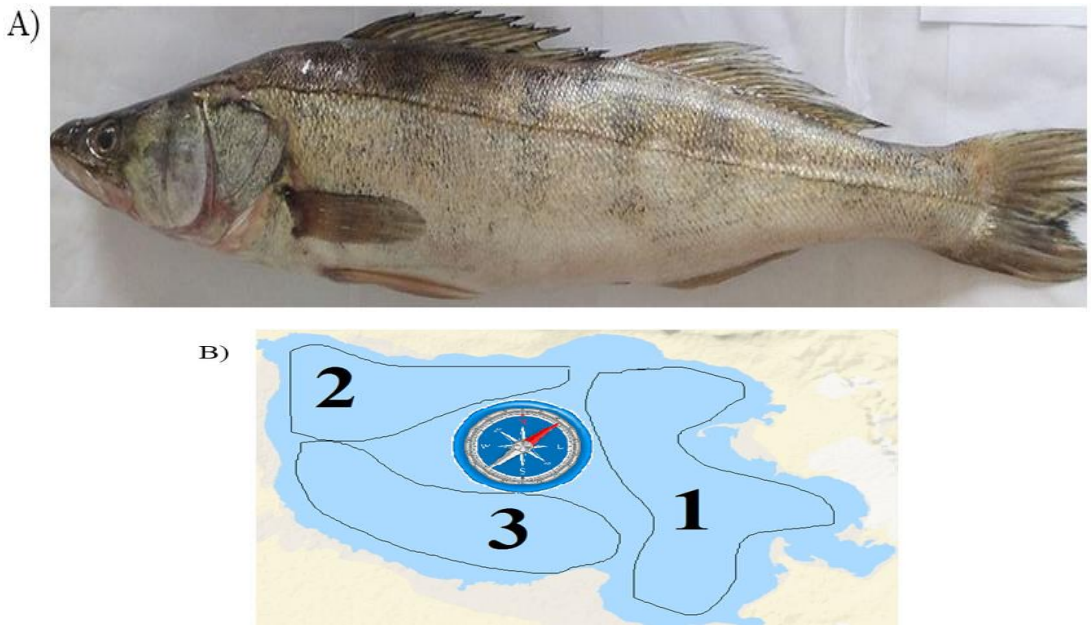

Figure.1. Introducing of Pikeperch fish (*Stizostedion lucioperca*) (A) and study area in Ayakagytma Lake (B)

2. Materials and methods

A seasonal caught of pike perch fish was conducted from 2017 to 2019 in Ayakagytma Lake. The fishes were caught by various nets with a grid of 24–100 mm.

The collected materials were studied by a number of ichthyologic methods (Chugunova, 1959; Pravdin, 1966; Ivankov, 1985). Our experiments were continued according to the method of N.F. Pravdin (1966).

The coins were soaked in water for several days, and then thoroughly washed in a low percent of alcohol. The age and growth rate of pike perch were determined by MBI-10 binocular microscopy.

For ichthyo trophic analysis, the fish samples are firstly fixated, labeled and noted in a field journal.

The norm for transfer of young fish to be grown for the cultivation of underyearling fish is determined by the following formula. The natural fish productivity was calculated by equation.

$$A = \frac{G \cdot P \cdot 100}{B \cdot r}$$

Here, A - a norm of fish transfer;

G – The area of the growing pool (ha);

P - Natural fish product, mass (kg);

B - The weight of underyearling fish in the autumn;

r - The output of underyearling fish (%).

The obesity coefficient was calculated using the Fulton formula:

$$\text{K f} = \frac{Q*100}{13}$$

Sample The collection and processing of samples were carried out using traditional methods where common in ichthyology (Nikolsky G.V, 1974; Pravdin I.F, 1966; Koblitskaya A.F, 1981).

3. Results and discussion

Pikeperch is largely found in this lake (Table.1). A years old (1+) pikeperch mainly lives at the confluence area of the Shafirkan collector into the lake.

Table.1. Age composition of pikeperch in the lover Zerafshan reservoirs (as a percentage, %).

Reservoirs	**Age class (year)**								**Reference**
	1+	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	
Tudakul	6,4	8,6	12,7	18,8	23,8	15,6	8,6	5,5	Sayfullaev (1995)
Dengizkul	0,9	7,8	9,5	19,9	23,5	17,4	14,3	6,7	Sayfullaev (1995)
Tuzkon	6,1	9,8	8,4	19,6	25,3	15,8	8,2	7,6	Sayfullaev (1995)
Ayakagytma	9,3	10,2	18	19,0	21	13,2	5	4,3	In study

A flock of pikeperch stock is consisted a three, four and five years old fishes in Ayakagytma lake.

The body of the pikeperch is a much longer, and compressed on both sides that is covered with small coins. The mouth is a large and there are around 90-100 side-line coins. Pike perch has two dorsal fins that the first has 13-14 hard beams and the second has 20-21 soft beams. There are 11-12 rays in the anal fin.

A comparative analysis of the morphological characteristics of the pikeperch fish in Lake Ayakagitma is given in Table 2. Similar morphological characteristics of pikeperch were determined from Ayakagytma compared to Dengizkul Lake. The only differences in the characters were pointed the length of the back of the head, the pectoral fin, the ventral fin and the distance of V-A.

Table.2. Comparetive analysis based morphological traits of pikeperch in Ayakagytma and Dengizkul lakes.

Morphological features	**Ayakagytma M ±T n =110 (in study) I**	**Dengizkul M ±T n = 25 (Sayfullaev et al 1995) II**	**Mdiff I-II**
Number of lateral line scales	91,7±0,58	90,2±0,2	2,7

Number of D_1 rays	14,3±0,25	14,5±0,06	0,8
Number of D_2 rays	1,7±0,06	1,7±0,06	0,0
Number of D_2 soft rays	22,5±0,35	21,9±0,1	1,7
Number of A rays	11,1±0,06	11,1±0,06	0,0
Length of body without tail, %			
Length of beak	7,2±0,07	7,1±0,20	0,5
Diameter of eye	4,1±0,19	3,9±0,10	1,2
Back side of eye	19,0±0,17	18,6±0,08	2,6
Length of head	30,3±0,08	28,1±0,08	2,2
Height of head	15,0±0,19	14,8±0,07	1,1
Width of forehead	4,0±0,03	4,00, ±04	0,02
Maximum height of the body	23,1±0,01	22,9±0,20	1,0
Minimum height of the body	8,4±0,06	8,4±0,07	0,03
Antidorsal distance	32,0±0,70	30,0±0,04	2,8
Postdorsal distance	42,8±0,21	42,6±0,14	1,2
Length of tail base	22,8±0,01	22,7 ±0,10	1,0
Length of D_1 base	28,1±0,17	28,3±0,10	1,4
Length of D_2 base	24,5±0,06	24,6±0,08	1,8
Height of D_1	10,2±0,01	10,2±0,08	0,07
Height of D_2	11,0±020	11,3±0,11	1,7
Length of A base	13,0±0,16	13,2±0,05	1,3
Height of A base	11,4±0,08	11,3±0,06	1,8
Length of P	15,8±0,14	15,5±0,07	2,4
Length of V	16,1±0,01	15,0±0,07	2,8
P –V distance	34,5±0,01	34,5±0,11	0,1
V-A	39,6±0,03	39,2±0,15,	2,7

The pikeperch is distinguished by its better grow in the conditions of Ayakagytma lake. The length of growth is usually accelerated until age 4+ and then slightly decreased (Table.3).

Table.3. Age-related length (sm) of pikeperch under variours years in Ayakagytma Lake

	Age class (year)								**n=examples**
Years	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	
2017	16,6	26,5	38,9	49,6	58,3	66,8	70,1	74,0	132
2018	16,9	27,3	38,1	48,7	56,5	64,7	68,8	71,0	105
2019	16,8	26,2	38,3	49,5	60,6	68,1	69,5	72,0	86

The growth rates of pikeperch were compared between Ayakagytma Lake with the lower Zerafshan River and it is given in Table 4. From the comparison, clearly indicated that the growth rates of pikeperch fish is a similar in the lower Zerafshan watershed until adulthood. In all other ages, it is found as a long-term increase in the length of the pikeperch fish in Ayakagitma lake.

Table.4. Age-related length (sm) of pikeperch in the lover Zarafshan reservoirs

	Age class (year)								
Reservoirs	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**Reference**
Dengizkul	16,7	24,3	28,1	39,6	42,3	47,3	69,6	--	Abdullaev(1989)
Shurkul	17,8	24,2	34,6	40,8	47,3	--	--	--	Abdullaev(1989)
Qoraqir	15,3	25,1	36,2	43,1	--	--	--	--	Abdullaev(1989)
Ayakagytma	16,7	26,6	38,4	49,2	58,4	66,5	69,4	72,3	In this study

There was no significant difference between Ayakagytma lake compared to Dengizkul and Tuzkon lakes in terms of pikeperch weight. The weight of the pikeperch was found to be slightly higher in Ayakagitma lake. It indicates the abundance of food component and quantity for growing of pikeperch in Ayakagitma Lake. A comparative analysis of the length and weight growth for pikeperch in the Ayakagytma lake is given in Table.5.

Table.5. Comparative analysis of pikeperch based age-related length (mm) and weight (g).

	Age class (year)								
Features	**1+**	**2+**	**3+**	**4+**	**5+**	**6+**	**7+**	**8+**	**Reference**
Dengizkul									

Annual growth length, average (mm)	177	279	386	486	578	673	710	--	Sayfullaev (1995y)
Annual growth weight, average (g)	237	298	472	1130	1670	4100	5072	--	Sayfullaev (1995y)
Tuzkon									
Annual growth length, average (mm)	169	268	371	477	581	668	--	--	Sayfullaev (1995y)
Annual growth weight, average (g)	195	280	460	1100	1660	3950	--	--	Sayfullaev (1995y)
Ayakagytma									
Annual growth length, average (mm)	167	266	384	492	584	665	694	723	In this study
Annual growth weight, average (g)	219	312	484	1402	1700	4303	4963	7794	In this study

Note: This numbers calculated based on the information for three years.

The pikeperch (after 6 sm) lives as a predatory in all waters. A 17.5-18.3 sm size fish feeds with local fishes in Khorezm waters (Haqberdiev 1983). In the waters of Surkhandarya, the pikeperch (1-2 years old) becomes full predator that can eats a fast fish (*Alburnoides bipunctatus eichwaldi*), sharp spear fish (*Capoetobrama kuschakewitschi*), carp (*Cyprinus carpio*), chramilia (*Varicorhinus capoeta Heratensis n. Steidachneri*) and also own species (Amonov 1985). Other reference showed that pike perch starts to predatory when it is 6.3-6.8 sm in length. It feeds on fast fish (*Alburnoides bipunctatus eichwaldi*), sharp spear fish (*Capoetobrama kuschakewitschi*), Aral shemaya (*Chalcalburnus chalcoides aralensis*), silver fish (*Carassius auratus gibelio*), carp (C*yprinus carpio*), odonata larvae, mizids (Abdullaev, 1989). According to G.V.Nikolsky (1940), the pike perch eats mainly the swordfish (*Pelecus cultratus*), Aral roach (*Rutilus rutilus aralensis*), and Aral bream (*Abramis brama orientalis*). In the Lower of Zerafshan river, a 7-10.1 sm long and 7.1-9.6 g weight pikeperch is fed by zooplankton (0.8 -1.1 sm) including an shrimps and larvae of shrimp chironomid (Sayfullaev 1995).

Zooplanktons makes up 30% of body weight in the period of 0.8–1.0 sm of pikeperch in Ayakagytma lake. A 5-8 cm long and 15.1 g weight of pikeperch has much wider nutrient components. It feeds the zooplankton, nectobenthos and fishs. It found that a 1-2 gambusia (2 sm length and weighing 1.6 g) and one fast fish in the each stomach of pikeperch (2 sm and 1.2 g weight). They make up 18.5% of body weight for pikeperch.

Table 6 shows that the shrimp and opossum shrimps in the nutrient content is decreased every years.

Table.6. Nutrient content of pikeperch for three years (2017-2019) in Ayakagytma Lake

Nutrient content	**2017**		**2018**		**2019**	
	Total nutrient (g)	**(%)**	**Total nutrient (g)**	**(%)**	**Total nutrient (g)**	**(%)**
Invertebrates						
Copepod	0,2	0,05	0,77	0,2	0,77	0,2
Water flea	-,32	0,1	0,65	0,16	0,65	0,6
Rotifers	1,03	0,3	0,15	0,09	0,1	0,03
Odonata larvae	3,91	1	6,94	1,7	4,17	1,0
Beetles	4,17	1,1	3,25	0,8	4,31	1,04
Shrimp	25,12	6,4	12,6	3,1	0,70	0,18
Opossum shrimps	15,3	3,9	3,64	0,9	0,56	0,13
Type of fishes						
Gambusia affinis holbrooki	20,42	5,2	55,65	13,5	41,55	10,1
Alburnoides bipunctatus eichwaldi	42,4	10,8	91,12	22,1	79,61	19,0
Cyprinus carpio	76,67	19,5	96,22	23,4	118,18	28,6

Abramis brama orientalis	51,38	13,1	51,56	12,5	64,97	15,6
Rutilus rutilus aralensis	31,38	8,0	39,31	9,5	46,42	11,2
Carassius auratus gibelio	72,82	18,55	39,03	9,5	34,40	8,3
Stizostedion lucioperca	47,25	12,0	10,37	2,5	16,56	4,0
Total	**392,31**		**411,26**		**412,98**	

In 2017, the opossum shrimp was a 3.9% in the content of nutrient, but it is decreased to 0.13% in 2018, while shrimp was also decreased from 6.40% to 0.18% in 2017-2018 respectively. Such intensive feeding of pikeperch with shrimp and mussels is resulted in a decrease of some industrial fishes. In 2017, the common carp was 19.5% in the food content, while it was 28.6 % in 2018.

In the pike perch's nutrient ration was consisted around 12.91% of invertebrates and 87.2 % of fishes in 2017. In 2018, invertebrates accounted for 3.1% and fish for 97.2%. There are 3-5 fish, 8-10 mussels, 3-6 shrimp in each intestine.

The coefficient of fish obesity indicated as 1.11-1.35 in the Dengizkul (Amanov, Yudin, 1971), a 1,09-1,20 in the South Surkhan reservoir (Amanov, 1985), a 0,69-2,36 in the Khorezm lakes (Khaqberdiev, 1983). Average coefficient of obesity was indicated as a 1.21 in the lower Zerafshan watershed (Sayfullaev, 1995).

The coefficient of fish obesity occur a different by seasons in Ayakagytma Lake. Most obesity usually observes during the autumn. It is fluctuated from 2.05 to 2.50, average is a 2.3 (Table.7).

Table.7. The coefficient of fish obesity in Ayakagytma lake (2017-18 y).

Month	Length (sm)	weight (g)	Fulton	n=examples
IV	16,3	250	1,23	27
V	17,4	268	1,25	20
VI	19,0	310	1,40	25
VIII	24,0	379	1,98	17
X	30,3	405	2,3	15

According to references, the onset age of maturity shows variations between lakes and water reservoirs. For examples, the pikeperch is matured in 2-3 years old, 36-40 sm long in the Kayrakkum reservoir (Karimov 1976), 2-3 years old, 30-35 sm long in the Surkhandarya water basins (Amonov 1985), 2-3 years old, 26-26.6 sm in the Khorezm watersheds (Haqberdiev 1983), males grow up to 2-3 years in the Amudarya water basins (Guseva, Jaldasova 1986).

Usually, the pikeperch lays approximately 45-491 thousand calves in the Kayrakkum reservoir (Fedora 1972). About 72 sm in length, 4560 g, weight of pikeperch produce a 827 thousands eggs in the Khorezm waters (Haqberdiev 1983), in the lower Zarafshan waters it was observed around 25.66 thousands and 193.3 thousand eggs from 35 sm and 47 sm in length of pikeperch fish respectively (Sayfullaev 1995).

Our research shows that the number of calves also increased with age. Here, a 36-38 sm in length of pikeperch lays around 48.09 thousands, (1997), 34-39,5 sm in length fish produce a 48.8 thousand and 68.8-74 cm long fish produce an average of 451.6 thousand calves (see Table.8).

Table.8. Absolute fecundity of pikeperch in Ayakagytma lake (as 1000 calves)

Age(year)	Length (sm)	Average weight	Absolute fecundity		n=examples
		2016 y			
3+	36-38,5	559	35,4-60,3	48,1	15
4+	38,5-45,9	890,7	178,3- 201,7	193,11	20
5+	47,1	1524,9	340,7-459,0	389,2	10
6+	57,5-63,4	2723,5	429,1	463,0	10
7+	64,0-68,7	3200,4	430,5-459,0	443,4	5
8+	68,8-74,3	5753,1	438,2-460,0	451,6	5
		2017 y			
3+	33-36,4	389,3	32,5- 60,8	47,9	18
4+	38,0-45,5	800,7	180,4-202,3	192,1	22
5+	45,4-49,9	1192	340,1-419,5	381,1	8
6+	50,7-59,4	1557,2	415,3-434,7	422,1	8
7+	61,5-65,2	2683,9	422,0-455,2	433,2	5
8+	65,0-71,3	4631	415,2-443,0	438,3	5

		2018 y			
3+	34,0-39,5	393,0	32,1-59,9	48,8	15
4+	37,7-44,0	553,4	178,5-201,3	193,1	16
5+	44,5-50,8	953,5	338,1-428,7	385,2	8
6+	55,0-61,3	1695,5	415,2-430,4	422,8	5
7+	59,7-66,1	2200,0	412,7-429,5	424,1	5
8+	65,0-70,9	4505,5	440-455	450,3	5

In the Kayrakkum reservoir, the pikeperch spawns from late of March to December at 8-17ºC of water temperature (Karimov 1976). The spawning procedure continues from end of March to May 5 in the Arnasay lake systems. The intensive period of spawning corresponds in April at a temperature of 10–16ºC (Golubenko 1977). In the waters of Khorezm, it happens from April 10 to May 15 (Haqberdiev 1983). The spawning of pikeperch usually carries out from early March to May when the water temperature is 13-15ºC in the Lower Zarafshan waters. The lakes of Lower Zarafshan river is a differ climate from the Ayakagytma lake. Therefore, the spawning of pikeperch is started from the beginning of April to May 10 in the conditions of Ayakagytma Lake.

The pikeperch throws the calf to the beginning of the Ayakagytma lake, where the Shafirkan canal flows to the lake. Because the water flow is fast in this part and the dissolved oxygen in the water is 8.5 g/litr, as well the salinity is 6-8 g/litr, which is a very convenient for pikeperch. Usually the spawning peaks at 5-6 PM, when the water temperature becomes to 12-14ºC. The pikeperch spawns on the muddy-sandy shores of the lake. The diameter of the eggs is 0.68-1.05 mm in the stage of IV-V.

4. Conclusion

A high obesity coefficient was observed in the autumn season (October), it is fluctuated from 2.05 to 2.50, with an average of 2.30 in Ayakagytma Lake.

Based on our observation, it shows a female pike-perch usually reach sexual maturity at the age of 2-3 years when it is 28-35 sm length in the conditions of Ayakogitma Lake. This fish throws cubs around 48.09 at 36-38 sm length, a 47.9 thousand at 33-36, a 48.8 thousand at 34-39.5 sm length and a 451thousand at 68.8-74.3 length. The spawning period occurs from late of February to early May.

The pikeperch spawns to the beginning part of Shafirkan canal flows, because there is a fast flow of water, dissolved oxygen in the water is a 8.5 g/l, salinity level is a 6-8 g/l, which is a very convenient for fish. The spawning period reaches to peak at 5-6 PM, when the water temperature is 13-15ºC.

The pikeperch has flexible features in terms of ecological terms. Therefore, this fish is economically important to our fishery in the south part of the country.

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