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STOCKING PLAN FOR THE BUNAYSKA RIVER

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Abstract

The Wild trout density and biomass in Bunayska River, Aegean catchment area, was estimated on the basis of electrofishing. The mean population size in the Bunayska River was 630 individuals per hectare and the trout biomass 21.73 kg·ha^{-1} was well below the established average values for the other rivers in Bulgaria. The number of individuals allowed for fishing according to the Law for Fisheries and Aquaculture is very low too. We recommend a restocking of 6000 young fish per year (with weight 3–5 g per individuals). The fish used for restocking should be bred from trout inhabiting the river in the area.

Key words: Wild trout, stocking plan, density and biomass of population.

Introduction

The stock and biomass of Wild trout were examined by many authors in connection with management of trout streams as well as in order to estimate the influence of some factors on trout populations. The most extensive investigation on Wild trout in Danube drainage and in Aegean drainage in Bulgaria was done by Yankov (1988), an ichthyologist from Union of hunters and fishermen in Bulgaria. Yankov explored the catchments area of rivers of Iskar and Vit as well as in Aegean drainage – catchments area of rivers of Mesta, Vucha, Chaya and Struma. He examined also the populations dynamics of trout, status of Wild trout stock, growth rate, sexual maturity and fertility of the species. In all studied rivers Yankov (1988) calculated mean density of trout population of 1123 ha^{-1} and mean biomass of 52.81 kg·ha^{-1}.

Other detailed study on Wild trout was done by Karapetkova et al. (2000), who studied density, biomass, and dynamics of Wild trout populations in the creeks of Veleka, Mladezhka and Aydere, belonging to Black Sea drainage. The above mentioned authors estimated mean density of a trout population. Kirka (1969b) studied the population characteristics (age structure, growth rate and fertility), and relationships between species of Wild trout (*Salmo trutta morpha fario* L., 1758) and sculpin (*Cottus poecilopus* H., 1836) in rivers Orava and Vah. In the same year Kirka (1969a) published results of an experiment for restocking with trout some rivers of northern Slovakia.

Kirka (1974) performed a study on the population dynamics of trout in the river Jeleśni. The author studied age structure of populations, growth rate, fertility, mortality, population size and biomass. He reported average biomass of trout in

three stations of the river Jeleśni: 1st – 13.61 kg·ha^{-1}, 2nd – 21.58 kg·ha^{-1}, 3rd – 7.76 kg·ha^{-1}, respectively.

Libosvárskỳ and Lusk (1970a, 1970b) published results of four-year study of trout in the river Loućka. They examined age structure of population, sex ratio, growth rate, sexual maturation, fertility, mortality and production and found that the biomass of trout in the river Loućka fluctuates between 27 and 191 kg·ha^{-1}.

In 1973 Libosvárskỳ and Lusk published a study on some biological requirements of trout. The authors examined some parameters of trout population – age structure, reproduction, mortality and spatial structure. Libosvárskỳ and Lusk (1973) analyzed the methods and standards of stocking trout used on the territory of former Czechoslovakia.

The objective of the study was to assess the current stock of Wild trout in the Bunayska River for the purpose of development of stock management plan.

Materials and Methods

Study area

The study area was the Bunayska River. The river springs below the peak Bich (1448.9 m a.s.l.) in Central Stara planina Mountains. It is a left tributary of Luda Yana River and both are tributaries of Maritza River, belonging to Aegean basin. Bunayska River is 18.8 км long and the watershed of the river is covered by beech (*Fagus sylvatica* L.) forests. Bunayska River watersides are occupied by Black Alder (*Alnus glutinosa* L.), White willow (*Salix alba* L.) and by many bushes and grasses. The river bad is rocky, solid, covered with big gravels, sands and big stones, with many water pools below the stones.

In the past Bunayska River possessed the local populations of Wild trout. In recent years the association of hunters and fishermen stocked the river with 10,000 trouts (weighed 3–5 g) per year, originating from aquaculture “Toshkov chark” in the Rhodope Mountains.

Equipment, methods and layout

The water capacity of Bunayska River was calculated by measurement of water velocity and calculation of bed transverse surface. Air and water temperatures were measured by mercury thermometer, with 1 ºC accuracy.

For estimation of oxygen dissolved in water we took water samples and fixed them in 2 ml $MnS0_4.H_2O$·100 ml^{-1} water. The quantity of the oxygen dissolved in water was calculated according to Winkler’s method, in the chemical laboratory of University of Forestry – Sofia.

pH of the water was estimated in the chemical laboratory of University of Forestry – Sofia by potentiometric method, using the “Hanna HI 98130” apparatus.

The study material was caught by electrofishing, according to Seber and Le Cren (1967) removal method with two catching passes. This method is reliable when minimum 50 % of individuals in the catching area are harvested during the first pass. It was recommended by Yankov (1988) as the most suitable for studies in inner Bulgarian creeks.

Electrofishing was conducted with unpuled direct current (DC) and two up-

stream passes. We used the backpack electrofisher SAMUS 725G – (Samus special electronics, Poland), powered by a 12 V accumulator battery with 75 Ah capacity.

The electrofisher converter provides DC impulses with frequency ranging between 5 and 100 Hz, duration 0.03–3 ms and maximum power of 650 W. It is suitable for water resistance from 25 to 1000 Ω. The amperage in load condition was from 5 to 65 A.

The catchments areas were 100 m long, blocked off in upper and lower borders with 5 mm square mesh nets. Three catchments areas were established in the creek.

The catch was carried out by two persons passed together into the catchments area upstream with the fishing nets. One of the nets represented a single 28 cm hoop anode. The cable cathode was immersed into the creek several meters above.

The fish size was measured on-site by ruler with accuracy of 1 mm and weighted with electronic portable scale with accuracy of 0.1 g. The caught fish were kept alive in wire basket and plastic pail and after the measurement were released back.

The fish identification was done according to Kottelat and Freyhof (2007) and Stefanov (2007).

The trout's age was determinated by scalimetry. We took scales from the back part of fish body, as recommended by Baglinière and Le Louarn (1987). The scales were examined in laboratory by microscope Olympus C X 31, with multiplication 2X.

The habitat quality index of the Wild trout was found by indirect method, based on annual grow, proposed by Libosvárskỳ (1970b).

The estimation of fish abundance was done according to Seber and Le Cren (1967) formulas for two catching passes. The theoretical number of fish was calculated using:

$$N_e = \frac{C_1^2}{C_2 - C_1}, \qquad (1)$$

where C_1 and C_2 are, the number of fish during first and second catching pass, respectively.

The variance of the real number of fish N_e was calculated using the equation:

$$Var[N_e] = \frac{N_e \cdot q \cdot (1 + \bar{q})}{\overline{p^3}}, \qquad (2)$$

where $\bar{q}$ is mean catch ability for each removal pass, $\bar{q} = \frac{C_2}{C_1}$;

$$\bar{p} = 1 - \bar{q}.$$

The study results are reliable if

$$N_e \cdot p^3 > 16q^2 \cdot (1 + \bar{q}). \qquad (3)$$

The biomass B was calculated as sum of individual weights of all Wild trout individuals located in each catchments area.

The theoretical biomass B_e was calculated using Mahon et al. (1979) formula, ex Yankov (1985, 1988)

$$B_e = \frac{B \cdot N_e}{N}, \qquad (4)$$

where: B_e is theoretical biomass;

B – biomass of caught individuals;

N – number of caught individuals.

Results and Discussion

Water quantity and qualities of stream Bunayska

The maximum water capacity of the creek Bunayska was estimated in June of 267 $l \cdot s^{-1}$ in the lower part of the river, while in the middle part water capacity was between 100 and 125 $l \cdot s^{-1}$. In two tributaries of the Bunayska River, streams Elak and Bunay we measured water capacity about 63 $l \cdot s^{-1}$. According to the local forest guards minimum water capacity of Bunayska River in September and August was half the capacity we established.

Water velocity determined was between 0.26 and 0.28 $m \cdot s^{-1}$. Water temperature during the summer mornings in June, at air temperature 21 ºC, was 14 ºC. In the afternoons when the air temperature reached 28 ºC the water temperature increased to 18 ºC. The oxygen dissolved in water calculated by Winkler's method was 5.14 $mg \cdot l^{-1}$, and the saturation of water with oxygen we calculated was 58.58 % at water temperature 18 ºC. Acidity of the water of Bunayska River (pH) was 7.7.

Bunayska River is a creek with moderately fast water velocity, its bottom is solid and water capacity in summer is between 30 and 300 $l \cdot s^{-1}$. The maximum temperature in the mildest days of the year obviously exceeds rare 18 ºC. Kirka (1969a) pointed similar indicators of the water quality of the tributaries of the Orava River.

Therefore, our conclusion was that the water conditions in the Bunayska River meet Wild trout requirements.

Species composition, age structure and density of Wild trout in Bunayska River

During our investigation of Bunayska River in winter of 2007, we found four fish species: Aegean chub (*Squalius orpheus* Kottelat & Economidis, 2007), Struma spined loach (*Cobitis srtumicae* Karaman, 1955), Maritza barbel (*Barbus cyclolepis* Heckel, 1837) and Wild trout (*Salmo* sp.). In our later studies we investigated only the trout zone and we caught only Wild trout. The Wild trout was found along about 12 km of creek Bunayska. In the Bunayska River the mixed barbel-trout zone doesn't exceed 750 m in altitude. Probably in this river barbel and the other fish species avoid the fast water course and the cold water under the tree canopy.

To estimate the density and biomass of the Wild trout we used 3 catchments areas. Two of them we put between city of Panaguriste and the united point of tributaries Elaka and Bunay. The last catchments area we disposed on the Elaka stream.

In Bunayska River we caught totally 42 specimens of Wild trout. The age composition of Wild trout population was dominated by first age group (1+) – 92 % of the total catch. The oldest trout were 3-year-old (3+). The two age groups (2^{nd} and 3^{rd}) accounted for 8 % of the total catch. We caught only two Wild trout individuals with size allowed for fishing, according to the Bulgarian Law for Fisheries and Aquaculture (2001). Young Wild trout (0+) were not caught.

We estimated that the trout growth rate in the first year is fast and in the second one is moderately fast. However, the fast growth rate in the first year is probably due to the good feeding conditions in hatchery, whence they spring.

Despite better living condition for trout in Bunayska River the density of the Wild trout was very low (Table 1). The trout number and biomass in the river was well below the established average for the other rivers in Bulgaria (according to Yankov, 1988: 1123 individuals·ha^{-1} and 52.81 kg·ha^{-1}).

Table 1. Mean density and mean biomass of the Wild trout in the streams Bunayska

Stream Bunayska areas	N_e ha^{-1}	N_e km^{-1}	B_e ha^{-1}	B_e km^{-1}
1	395	134	18.52	6.30
2	427	128	16.41	4.92
3	1067	128	30.45	3.65
Mean	630	130	21.73	4.96

Note: N_e – individuals; B_e – mean biomass, kg.

According Kirka (1969a,b) recreational fishing reduces the stock of trout from 0 to 50%. Yankov (1988) found that in rivers where fishing is permitted trout stock was two times less than in rivers where fishing is prohibited. Considering the fact that there are about 600 fishermen in the near town Panaguriste, and that there is not restriction for fishing in the Bunayska River, we assumed that the trout population is under strong pressure from sport fishing. This assumption was supported by the fact that the age structure of trout population in this river was very uneven with domination of first age group. Probably the amplified fishing in the Bunayska River led to reducing the number of trout fertile too.

Management plan of the Bunayska River for recreational fishing

We believe that under these conditions for the restocking of trout in the river is to prohibit fishing at least 3 years. This will allow normalizing the age structure of the trout population, increasing the number of breeding herd and contributing to the cultivation of fish allowed for fishing according to the Law. However, due to low number of trout in Bunayska River we considered that only limitation of fishing will not be sufficient to restore the population of trout in the river. Therefore we believed that will be necessary to carry out stoking with young fish. The area is situated the Bunayska River belongs to NATURA 2000 environmental network. To satisfy the requirements of NATURA 2000 is a necessary the restocking material used to be derived from trout inhabiting waters in the area (Bunayska River, Panagurska Luda Yana River, Strelchenska Luda Yana River). Production of young fish, with provenance from local trout with guaranteed origin, can be ordered in companies. To restoking the Bunayska River trouts with weight from 3 to 5 g can be used. As stocking rate we preferred to use computed by Leger (1930) in Kirka (1969a) rate of 0.2 trout with weight from 3–5 g·m^{-2} norm for rivers with middle habitat quality index such as Bunayska River. To maintain the stock of trout in the water of the Bunayska River along 12 km and average width of 2.5 m, will be required annually to import 6000 trout with weight from 3 to 5 g.

It is desirable the effect of stocking, surviving percentage of trout in the river and the amount of trout, allowed for fish-

Table 2. Suggested surviving percentile of stock material in the Bunajska River

Fish age groups	From fish farm, numbers	Breeding in the river, numbers	Surviving, %
One-summer-aged	6000	500	100
One-year-aged	2400	200	40
Two-years-aged	1800	150	75
Three-years-aged	1440	120	80
Four-years-aged	1150	100	80

ing according to the Law to be controled annually by electrofishing.

Accepting that the Bunayska River naturally spawning annually receives about 500 trout one summer aged, as well as 6000 will be imported annually from fish farms. After four years in the river could be expected about 1250 trout allowed for fishing according to the Law (Table 2). Considering that the catch norm is to the 8 trout by day, according the Law, in Bunayska River will be suggested annually about 160 days recreational fishing.

Hence, for stocking of the Bunayska River yearly will be needed about 6000 individuals of one-summer-aged trout. Accepting that the young fish with provenance from local trout that will be twice as high total annual cost of stocking the river Bunayska, expected to be about 1500 €·year^{-1}.

Conclusions and Recommendations

- Hydrological and hydro chemical characteristics of the Bunayska River satisfy the requirements of Wild trout;

- Ichthyofauna of the Bunayska River is dominanted by Wild trout;

- The density and the biomass of trout in the Bunayska River are below the average for Bulgaria, established by Yankov (1988);

- To increase the stock of Wild trout in the Bunayska River it is desirable to prohibit fishing for three years;

- To support natural reproduction and maintain possibilities for angling in the Bunayska River it is desirable to import 6000 fish by year;

- The fish used for stocking must come from parents living in the river, according to the NATURA 2000;

- The populations of Wild trout should be monitored annually through capture control;

- It is necessary to adjust the size of the catch and rates of stocking.

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