



DECLINE OF ARTISANAL FISHERIES IN THE CROATIAN SECTION OF THE SAVA RIVER

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ABSTRACT

The aim of this research is to analyse the trends of the total artisanal fish catch in the Croatian section of the Sava River. All 17 years of the study (2004-2020) showed a negative trend that became highly statistically significant ($p < 0.01$) in the last eight years. In addition to the total catch, the catch per unit effort (CPUE) also decreased significantly ($p < 0.05$) throughout the study. The reasons for these negative trends are discussed, including a possible decline in artisanal interest, higher fishing pressure from anglers from the Croatian side and both groups of fishermen from the river bank of Bosnia and Herzegovina, as well as negative influence of the polluted waters of the large Bosnian river Bosna, which prior to flowing into the lower section of the Sava River, passes through urban and industrial cities. It is suggested to activate the old idea of a common fisheries management body that would include both groups of fishermen (anglers and artisanal fishermen), government representatives and scientists from both countries.

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INTRODUCTION

Freshwater commercial fisheries are still a very important source of food at the world level, providing food for nearly a billion people, and are important in the livelihoods of millions of households worldwide. However, there are very big differences in their importance in different areas of the world. In most of Africa, Southeast Asia and Latin America, it is a significant source of food and income, particularly for small-scale artisanal fishermen in rural populations in those low-income countries with extensive freshwater resources (Lynch, 2020).

On the other hand, its importance has been declining in Europe, North America and Australia for several decades. In Europe, after a slow expansion from the 1950s to the 1980s, catches have steadily declined over the past decades, more so in the north and west than in eastern countries (Treer et al., 1999; Sipponen, 2010; Cowx, 2015). The Sava River is the longest Croatian river with the largest catchment area and is part of the Danube catchment area (Hrvatske vode, 2017). The upper part of the river is entirely located in Croatia where only recreational angling is allowed. In the lower part of the river, which flows along the border with Bosnia and Herzegovina, both angling and commercial (i.e. artisanal) fisheries are allowed in both countries.

Human-driven changes to aquatic environments threaten small-scale fisheries. It is reflected even in scientific publications. Smith et al. (2021) analyzed 302 publications in ecology journals and found that inland fisheries were understudied. Therefore, the aim of this research is to analyse trends in the total artisanal catch in the Croatian section of the Sava River.

MATERIAL AND METHODS

The official data was obtained by the competent Directorate of fisheries of the Croatian Ministry of Agriculture on the basis of annual artisanal reports (MP, 2004; 2005; 2006; 2007; 2008; 2009; 2010; 2011; 2012; 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020). Despite any potential limitations, this data is fundamental to supporting the sustainable management of freshwater fisheries and may be useful in defining catch trends (e.g. Fitzgerald, 2018; Group Author, 2020; Schubert, 2022).

For all data, the correlation between the average annual catch size and CPUE with the respective year was determined. Catch per unit effort (CPUE) relates to the average annual catch of active fishermen who reported catch. Statistical analysis was calculated using IBM SPSS Statistics ver.19.0.

RESULTS AND DISCUSSION

The total artisanal fish catches in the Croatian section of the Sava River showed the usual oscillations in all 17 years of the study (Treer and Kubatov, 2017). However,

even they expressed a slow negative trend (slope of the regression line $b = -121.044 \text{ kg year}^{-1}$). This negative trend became statistically highly significant ($p < 0.01$) during the last eight years (Fig. 1), so the catch in 2020 became only about a quarter of that in 2013 and 2014. This can be a consequence of a combination of different reasons.

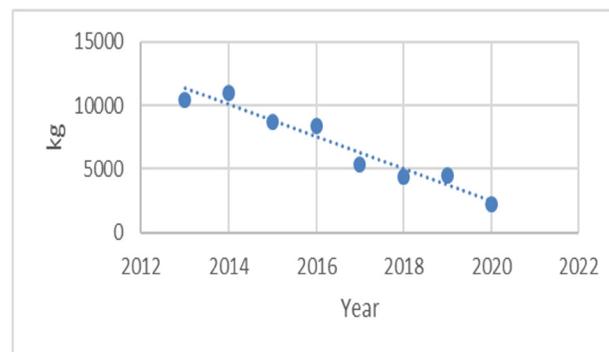


Fig 1. Total fish catch (kg) of artisanal fishermen in the Croatian section of the River Sava from 2013 to 2020 ($R^2=0.942$; $p < 0.01$)

Since 2014, when 17 artisanal fishermen were active, this number dropped to just seven out of eighteen who have licenses in 2020. This decline in interest is in correlation with similar trends in many other European countries (Wedekind, 2001; Rad, 2012; Cowx, 2015). Nevertheless, fishing pressure in this part of the river is high. In Vukovar-Sirmium County, participation in the total angler catch exceeds participation in the number of anglers compared to the entire Croatian Sava catchment (Piria et al., 2020). Furthermore, in this section of the Sava River, from its right bank, commercial and recreational fishermen from Bosnia and Herzegovina also catch fish. The additional indicator of high fishing pressure is the fact that the significantly ($p < 0.05$) smallest specimens and the smallest quantities of the four most important fish species are caught in the same county, compared to other counties at the Sava River (Treer, 2021; 2022). Khan (2016) demonstrated that the Indus River in Pakistan is threatened by discharges of untreated industrial and municipal effluents which have led to the collapse of artisanal fisheries. Canales-Gomez et al. (2022) reported the same for Mexico. Similarly, the additional negative influence could be the polluted waters of the large Bosnian river Bosna which, prior to flowing into the lower section of the Sava River, passes through urban and industrial cities (Tousova et al., 2019).

In addition to total catch, catch per unit effort (CPUE) also decreased significantly ($p < 0.05$) throughout seventeen years of research, with only one better year in 2008 (Fig. 2). Studying CPUE is essential to understanding the processes of exploited population dynamics and to manage heterogeneously distributed resources and uses (Leopold et al., 2014).

This is important for both commercial and recreational fisheries, as demonstrated by Skov et al. (2017) who analyzed this parameter over 62 years in a Danish Esrom Lake.

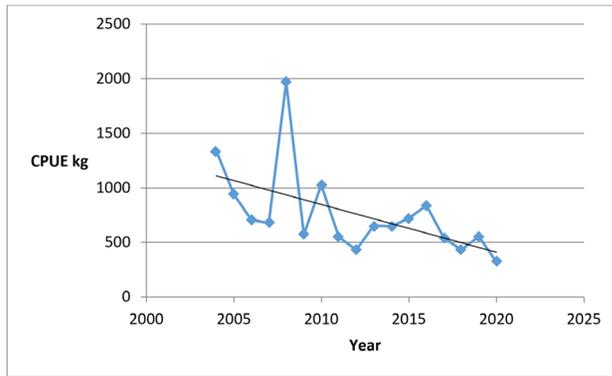


Fig 2. Total CPUE (kg) of artisanal fishermen in the Croatian section of the River Sava from 2004 to 2020 ($R^2=0.312$; $p<0.05$)

The decline in total catch and CPUE in the Croatian section of the Sava River is a clear sign of the decline of artisanal fisheries. Nevertheless, as these fisheries occur along the border river with Bosnia and Herzegovina, in order to provide successful management, it would be useful to activate an old idea of a common body that includes both groups of fishermen, government officials and scientists (Treer et al., 1999). There are many successful examples such as the Minho River between Spain and Portugal (Antunes, 2016), Lake Geneva between France and Switzerland (Treer, 2003) and shared natural resources in line with EU environmental and biodiversity conservation objectives between Albania, North Macedonia and Montenegro (Pietroock, 2019).

SMANJENJE PROFESIONALNOG RIBOLOVA U HRVATSKOM DIJELU RIJEKE SAVE

SAŽETAK

Cilj ovoga rada je analizirati trendove u ukupnom ulovu gospodarskih ribara na hrvatskom dijelu rijeke Save. Kroz 17 godina istraživanja (2004-2020) ukupni ulov je pokazao negativni trend, koji je postao statistički značajan ($p<0,01$) kroz posljednjih osam godina. Osim ukupnog ulova, i ulov po jedinici napora (CPUE) je značajno opadao ($p<0,05$) kroz cijelo istraživano razdoblje. Razlozi za ove negativne trendove su raspravljani, uključujući mogući pad interesa komercijalnih ribara, veći ribolovni pritisak hrvatskih ribiča i obje skupine ribara s bosanskohercegovačke obale, kao i utjecaj onečišćenih voda rijeke Bosne. Predlaže se aktiviranje stare ideje o uspostavi zajedničkog tijela za upravljanje ribolovom iz obje zemlje, koje bi uključivalo obje skupine ribara (ribiča i komercijalnih), predstavnike upravnih tijela, te znanstvenike.

Ključne riječi: slatke vode, gospodarski ribari, CPUE, ukupni ulov

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