The influence of Danube river hydrographic and thermic factors on fish stocks dynamics in Razim-Sinoe lagoon system

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Abstract

The Romanian fishing areas extends over 7000 km2 and 50% of the numbers of authorized fishers conduct their activities in the Danube areas. Inland fisheries are highly important for income, food security and nutrition. Inland peri-rural fisheries face degradation due to climate change. According to the European Commission, the dominant factor driving the change in water resources in Danube River basin is climate change. Global mean surface temperatures have increased, fact which causes a constant increase in water temperature as well. Razim-Sinoie Lagoon System represents the largest lagoon (1145 km2) in Romania and stands out for its ecological, historical and socioeconomic importance. The lagoon is connected to Danube River through the channels Dranov and Dunăvăț and receives significant river intake. This present study points out the vulnerability of fish stocks and Romanian fisheries in the context of climate change and global warming. Thus, the aim is to evaluate the influence of multiannual hydrographic and thermic regime on fish stocks status and structure from Razim-Sinoe Logoon System, between the years 2016-2018. Thus, a strong positive correlation was observed between the water temperature and the total quantity of fish catches. In case of fish stocks, a simultaneous decline of ichthyophagous fish species, while increasing the stocks of non- ichthyophagous fish species, is recorded. It is recommended that similar studies to be conducted also in other areas connected to Danube River hydrographic basin, in order to evaluate the magnitude of climate change and global warming impact on fish stocks status and structure.

Keywords: climate change, fish stocks, danube river, razim-sinoe

1. Introduction

Over the last century, the temperature of our planet has gradually increased (Zolnikov, 2018). Global mean surface temperatures have increased by 0.75°C over the past century, with the rate of change increasing from the 1970s (Harrod, 2016 Warming has also been observed for freshwater ecosystems worldwide (Harrod, 2016). Global warming, as a causal factor of climate change, has a strong impact on aquatic living resources (Lumban-Gaol et al., 2012). Unprecedented climatic conditions will occur first in the tropics and among low income countries where freshwater fisheries provide an important source of income and protein (Harrod, 2016). Freshwater ecosystems have been identified as the ones being most severely impacted by climate change, with having the highest proportion of species threatened (Central European University, 2008). Danube River supplies with water all the lakes in Danube Delta (Năstase et al., 2017). Razim Lake is the biggest of Romania's freshwater lakes and it constitutes a system of great ecological significance, playing also an essential role in the supply of water for irrigation, fishery exploitation, farming, flood prevention, recreational navigation and water tourism. Therefore, this present study aims to evaluate the influence of water thermic and hydrology regime on fish stocks distribution and abundance of freshwater fish species from Razim-Sinoe Lagoon System, between the years 2014-2018.

2. Results and Discussions

Fish stock dynamics and distribution in Razim-Sinoe Lagoon System are represented in Figure 4. The quantitative fish distribution reported in the Razim-Sinoe Lagoon System is presented in Table 1. Strong positive correlation between water temperature and total fish catches was observed (Pearson coefficient= 0.989), which can explain the high value in case of total fish catches in 2017, the year with the highest mean temperatures (17.26±9.18).

Radu (2012) noticed that in the years when water flow is higher, peaceful (non-ichthyophagous) species are advantaged, with more chances of escaping the predator

attack, and years with small water flow favoring raptors (ichthyophagous) fish species, fact confirmed by our study as well. We noticed that non-ichthyophagous fish catches are higher than ichthyophagous fish catches (Table 1.). Correlation analysis revealed that there is a direct positive correlation between both water temperature (Pearson coefficient=0.99955), respectively water level (Pearson coefficient=0.97916) and non-ichthyophagous fish catches in Razim-Sinoe Lagoon System. Also, according to Lumban-Gaol et al. (2012), global warming caused a decline in fish production in Indonesia, however, in upwelling regions, global warming seems to increase fish production due to an intensified upwelling process.

3. Conclusions

As main conclusion, it can be said that there is a direct positive correlation between water temperature registered in Danube River (at 71.3 and 103.8 river km) and total non- ichthyophagous fish catches from Razin-Sinoe Lagoon System, as well as between water level also registered in Danube River (at 71.3 and 103.8 river km) and total non- ichthyophagous fish catches from Razim-Sinoe Lagoon System. Therefore, both water temperature and water level of Danube River can be considered as determinant factors on the dynamics of non-ihtiofac fish catches from the Razim-Sinoe Lagoon System.

This study can be used for the elaboration of specific management plans for the protection of Danube Delta fish stocks.

However, it is recommended that similar studies to be made during longer time periods in order to establish a mathematical prediction model between water hydrological regime, water thermic regime and fish catches in lagoon system.

Table 1. Quantitative distribution of total fish catches in Razin-Sinoe Lagoon System

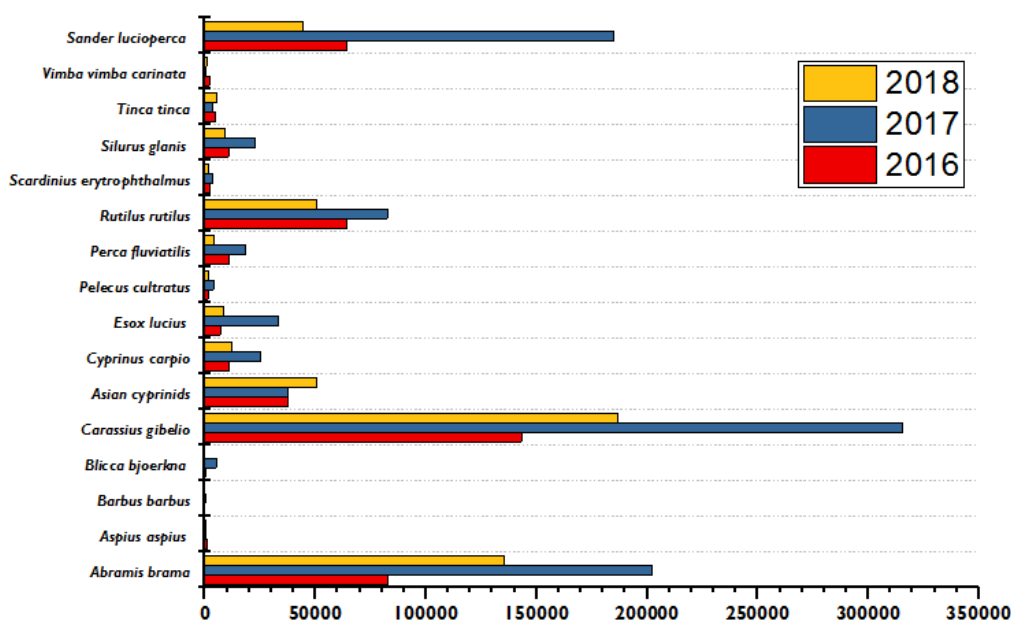| Study year	Ichthyophagous fish sp. (total kg)	Non-ichthyophagous fish sp. (total kg)	Total fish ctaches (total kg)
2016	348124	95107	443231
2017	234200	675700	909900
2018	443442	67738	511180

Fig. 4. Fish stock dynamics in Razelm-Sinoe Lagoon System in the studied timeline

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