



A new trend in Central European recreational fishing: More fishing visits but lower yield and catch

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ABSTRACT

Recreational fishing is a major leisure activity in many European countries but social aspects of angling are still understudied. This study aimed to examine long-term social trends in recreational fishing. Data was obtained from annual angling reports collected by the Czech Fishing Union. Data from annual angling reports is based on data from individual angling logbooks collected from 238 fishing grounds over the course of 11 years in Prague and Central Bohemia, Czech Republic. It was discovered that the numbers of individual anglers and angling visits on fishing grounds have been increasing. An average angler visits higher diversity of fishing grounds but anglers keep on returning to individual fishing grounds less frequently. Frequency of angling guard controls on fishing grounds has been increasing as well. On the other hand, angling yield and catch have been decreasing. The number of anglers who take home at least one fish has been increasing but percentage of anglers who take home at least one fish has been decreasing. In conclusion, recreational fishing is on the rise but fish catch and yield are decreasing.

1. Introduction

Recreational fishing is defined as fishing of aquatic animals (mainly fish) that do not constitute the individual's primary resource to meet basic nutritional needs and are not generally sold or otherwise traded on export, domestic, or black markets (FAO, 2012). Cooke and Cowx (2004, 2006) roughly estimated that all anglers around the world might catch up to 47 billion fish annually. Further, they claimed that the overall catch in recreational fishing is about 12% of catch in commercial fishing. By studying inland fisheries in developed countries, previous research has suggested that recreational fishing is more widespread than commercial fishing (Arlinghaus et al., 2002; Arlinghaus and Cooke, 2005; FAO, 2010). Arlinghaus et al. (2015) claimed that approximately 10.5% of population in developed countries practice angling. Many studies reported that recreational fishing has been on the rise (Marta et al., 2001; Rasmussen and Geertz-Hansen, 2001; Freire et al., 2012; Gupta et al., 2015). People still seek fishing experience and tranquil natural surroundings despite having access to variety of tempting ways to spend leisure time in the world of electronic gadgets and virtual reality (Morales-Nin et al., 2015). Angling is a major recreational activity in many countries because it holds many socio-economic benefits like recreation, socialization, and escape from reality (Arlinghaus and Cooke, 2009; Tufts et al., 2015). On the other hand, some authors recently reported downfall of recreational fishing in

Canada, Finland, Norway, Sweden, England, Wales, Ireland, and USA (Post et al., 2002; Schramm et al., 2003; Salmi et al., 2006; Aprahamian et al., 2010; Cowx, 2015).

Several authors suggested that recreational fishing has been overlooked and understudied even though it has significant effect on fish stocks (Arlinghaus et al., 2002; Cooke and Cowx, 2004; Altieri et al., 2012; Elmer et al., 2017). Post et al. (2002) claimed that recreational fishing has been collapsing but the collapse went unnoticed due to lack of interest between scientists, management, and anglers. Many studies suggested that better monitoring of the aspects in recreational fishing is required in order to understand its current state (Arlinghaus et al., 2002; Post et al., 2002; Ward et al., 2016; Elmer et al., 2017). Anglers throughout the world keep complaining that “fishing is not what it used to be” but scientific proof of this statement is lacking (Post et al., 2002). Humans are a crucial part of freshwater ecosystems and their behaviour should receive more attention because all inland waters are greatly influenced by human activities (Rasmussen and Geertz-Hansen, 2001; Post et al., 2002; Cooke and Cowx, 2004). Several researchers suggested that social aspects of recreational fishing are poorly understood and studies regarding social aspects in fishing are urgently needed (Arlinghaus et al., 2002; Lewin et al., 2006; Beardmore et al., 2015; Ward et al., 2016). It has been stated that social aspects play a very important role in sustainable management of recreational fishing and monitoring of trends in recreational fishing should definitely receive

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Table 1
List of variables that were used in statistical analyses in this study.

Tested parameter
Number of anglers per fishing ground
Number of angling visits per fishing ground
Number of anglers per hectare of fishing grounds
Number of visits of a fishing ground by individual anglers
Angling yield [kg] per hectare
Angling catch [individual fish] per hectare
Angling yield [kg] per angler
Angling catch [individual fish] per angler
Number of anglers who took at least one fish
Percentage of anglers who took at least one fish
Number of angling guard controls per fishing ground
Number of angling guard controls per hectare of fishing grounds

more attention (Arlinghaus et al., 2002).

This paper aimed to examine long-term social trends in recreational fishing. Twelve basic parameters in recreational fishing were used to assess the trends (Table 1). It was expected that a majority of the observed parameters would show an increasing trend over time because recreational fishing seems to be gaining popularity. It is believed that an examination of those trends is important in order to understand the complex socio-ecological system of recreational fishing.

2. Methods

2.1. Study area

The study was carried out in the regions of Prague (50°N, 14.5°E) and Central Bohemia (49.5°–50.5°N, 13.5°–15.5°E), Czech Republic, Central Europe. The region covers an area of 11 500 km² (Fig. 1). The Central Bohemian region has mostly agricultural character. Prague, the capital of the Czech Republic, has mostly urban character. The study area is dominated by the rivers Elbe and Vltava. Both rivers belong to the upper Elbe River Basin. All rivers in the study area belong to the North Sea Drainage area. Studied fishing grounds are situated in lowlands with an altitude of 200–600 m above sea level. Waters in the study areas are mesotrophic or eutrophic. The study area includes salmonid streams (dominated by salmonids) and non-salmonid rivers and reservoirs (dominated by cyprinids).

2.2. Recreational fishing in the Czech Republic

Recreational fishing in the Czech Republic is organized by the Czech Fishing Union and is centralized for most of the country (with the exception of south-Moravian Region that is under supervision of the Moravian Fishing Union). Approximately 350 000 anglers are registered in the Czech Fishing Union. Professional and amateur angling guards are responsible for monitoring of angling activities in the field. Individual fishing grounds are managed by local angling organizations. One local angling organization usually shelters all anglers from one smaller city or one part of a larger city. Fishing grounds are defined as stream and river stretches where recreational fishing is conducted.

Each angler has to obtain a fishing license and a fishing permit before he or she can start practicing recreational fishing. A fishing licence allows anglers to practice fishing in the Czech Republic. A fishing permit allows anglers to practice fishing on individual fishing grounds (Table 2a).

Anglers are required to fill a report of both visits and catches in their own individual angling logbooks when they go fishing (Table 2b). Each angler is obliged to report a fishing visit even when he or she does not catch or keep any fish. In addition, each angler is obliged to write down every catch he or she wants to keep. Fish that are released back into water are not recorded. Anglers identify and measure each kept fish to the nearest cm. Anglers then assign weight to each fish according to

their own measurement or according to official length-weight calculations provided by the Czech Fishing Union for individual fish species. Those calculations are based on general long-term observations of fish in Czech rivers. At the end of the year, anglers are obliged to deliver summaries of their angling logbooks to the Czech Fishing Union (Table 2c). The content of each angling logbook is then checked by administrative workers for errors. Data from all angling logbooks is added to the central fisheries database. The database contains summarized information about each fishing ground for each year. An example of annual angling reports for two very different fishing grounds is provided in Table 3.

2.3. Data sources

Data from 238 inland freshwater fishing grounds over the course of years 2006–2016 was used for the purpose of this study. The data was originally collected by the Czech Fishing Union and then processed by the authors of this study. Studied fishing grounds cover an area of 128.5 km². Overall angling catch on selected fishing grounds over the course of years 2006–2016 was approximately 3.5 million fish and angling yield approximately 6 thousand tons of fish.

2.4. Statistical analysis

The statistical programme R (R i386 3.3.2., R Development Core Team, 2017) was used for statistical testing. Shapiro-Wilk test was used to test the data distribution. Generalized linear models (package ‘glm’) with Poisson data distribution were used to fit the models in statistical testing (Wilkinson and Rogers, 1973). Bonferroni correction was applied when multiple groups were compared in the statistical analysis. Minimum probability level of $p = .05$ was accepted for all the statistics, and all statistical tests were two-tailed. Twelve variables were used in statistical testing (Table 1). One fishing ground was used as one study unit for all the variables.

3. Results

3.1. Angling visits

The number of individual anglers who visited fishing grounds was increasing over time ($F = 27.6$, $p < .05$, d. f. = 2616). The number of individual anglers per fishing ground increased from 260 to 490 over 10 years but the number dropped to 360 anglers per fishing ground in year 2016; nevertheless, the overall long-term trend was increasing (Fig. 2a).

The number of all angling visits per fishing ground was increasing as well. The number of angling visits per fishing ground increased from 3500 to 4500 over the course of 11 years ($F = 6.78$, $p < .05$, d. f. = 2616). There was a drop in the number of angling visits per fishing ground over the course of years 2009–2012 but the overall long-term trend was increasing (Fig. 2b).

One hectare of fishing grounds was visited by more individual anglers each year ($F = 35.57$, $p < .05$, d. f. = 2616). The number of individual anglers per hectare of fishing grounds increased from 20 to 50 over the course of 11 years. The trend in the number of individual anglers per hectare of fishing grounds was stagnating over the course of years 2009–2013 but the overall long-term trend was increasing (Fig. 2c).

Anglers kept on returning to individual fishing grounds less frequently. The number of angling visits of each fishing ground by individual anglers was decreasing over time ($F = 58.1$, $p < .05$, d. f. = 2616). An individual angler visited one individual fishing ground 11 times a year in 2006 but the number of visits dropped to just 6 visits a year in 2016 (Fig. 2d).

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