

## FRESHWATER AQUACULTURE IN CENTRAL AND EASTERN EUROPE: NEEDS FOR RESEARCH AND DEVELOPMENT

- JOHANNES PUCHER<sup>1</sup>, LUDWIG HÖLZLE<sup>1</sup>, ANGELIKA THOMAS<sup>1</sup>, ULFERT FOCKEN<sup>2</sup>, CHRISTIAN SCHLECHTRIEM<sup>3</sup>, YVONNE FEUCHT<sup>4</sup>, MARK SCHUMANN<sup>5</sup>, LÁSZLO VÁRADI<sup>6</sup>, BÉLA HALASI-KOVÁCS<sup>6</sup>, BÉLA URBÁNYI<sup>7</sup>, ZOLTÁN BOKOR<sup>7</sup>, ÁKOS HORVÁTH<sup>7</sup>, ZSÓFIA TARNAI-KIRÁLY<sup>7</sup>, ANDRÁS PÉTERI<sup>8</sup>, TOMÁS POLICAR<sup>9</sup>, VESNA POLEKSIC<sup>10</sup>, DANIEL MATULIC<sup>11</sup>, DANIELA BORDA<sup>12</sup>, ADRIAN GROZEA<sup>13</sup>, PETER RASPOR<sup>14</sup>, MARIJA ZUNABOVIC<sup>15</sup>, TANIA HUBENOVA<sup>16</sup>, BORIS GRIGOROV<sup>16</sup>, ANDRZEJ PILARCZYK<sup>17</sup>, VITALIY BEKH<sup>18</sup>
- <sup>1</sup>University of Hohenheim, Bioeconomy Center, Wollgrasweg 43, 70599 Stuttgart, Germany  
<sup>2</sup>Thünen Institute for Fish Ecology, Wulfsdorfer Weg 204, 22926 Ahrensburg, Germany  
<sup>3</sup>Fraunhofer Institute for Molecular Biology and Applied Ecology (IME), PO Box 1260, 57377 Schmallenberg, Germany  
<sup>4</sup>Thünen Institute for Market Analysis, Bundesallee 50, 38116 Braunschweig, Germany  
<sup>5</sup>Fischereiforschungsstelle Langenargen, Argenweg 50/1, 88085 Langenargen, Germany  
<sup>6</sup>NACEE and MASZ, Annaliget 8, 5540 Szarvas Hungary  
<sup>7</sup>Szent István University, Dept. of Aquaculture, Páter Károly utca 1, 2103 Gödöllő, Hungary  
<sup>8</sup>Research Institute for Fisheries, Aquaculture and Irrigation (HAKI), PO Box 47, 5541 Szarvas, Hungary  
<sup>9</sup>University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, Zátiší 728/II, 389 25 Vodňany, Czech Republic  
<sup>10</sup>University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11070 Zemun, Serbia  
<sup>11</sup>University of Zagreb, Faculty of Science, Roosveltovc trg 6, 10000 Zagreb, Croatia  
<sup>12</sup>Dunarea de Jos University of Galati, Food Science and Engineering Faculty, 111 Domneasca Street, 800201, Galati, Romania  
<sup>13</sup>Banat University of Agricultural Sciences and Veterinary Medicine, 8 Nera Street, 307160 Dumbravita, Timis, Romania  
<sup>14</sup>University of Primorska, Faculty of Health Sciences, Polje, SI-6310 Izola, Slovenia  
<sup>15</sup>University of Natural Resources and Life Sciences, Institute of Food Science, Muthgasse 18, 1190 Vienna, Austria  
<sup>16</sup>Institute of Fisheries and Aquaculture, Plovdiv, 248 V. Levski Str., 4003, Plovdiv, Bulgaria  
<sup>17</sup>Polish Academy of Sciences, Institute of Ichthyobiology and Aquaculture in Golysz, Zaborze, ul Kalinowa 2, 43-520 Chybie, Poland  
<sup>18</sup>Institute for Fisheries, Ukrainian Academy of Agricultural Sciences, 135 Obukhivska Str., 03164 Kyiv, Ukraine

## GAJENJE SLATKOVODNIH RIBA U CENTRALNOJ I ISTOČNOJ EVROPI: POTREBE ZA ISTRAŽIVANJEM I RAZVOJEM

### *Apstrakt*

Gajenje slatkovodnih riba ima veoma važnu ulogu za stabilizaciju biodiverziteta, resursa podzemnih voda, klime regiona kao i za snabdevenost hranom u Centralnoj i Istočnoj Evropi. Velika konkurencija cena ribe na međunarodnom tržištu i promene u navikama ishrane ljudi pojačavaju pritisak na mala i srednja preduzeća u Centralnoj i Istočnoj Evropi koja se bave gajenjem ribe i mogu da ugroze predeo oko uzgojnih jezera. Da bi povećali vrednost svih karika u lancu proizvodnje slatkovodnih riba, naučnici i proizvođači su identifikovali uobičajene i potencijalne izazove. Da bi se procenile potrebe sektora akvakulture u centralnoj i istočnoj Evropi, sprovedeni su polu strukturirani intervjui sa proizvođačima i prerađivačima ribe i udruženjima u Poljskoj i Češkoj, u okviru projekta SIAD i FP7 EU projekta TRAF00N. Takođe su održane radionice sa istraživačima u sektoru akvakulture duž svake karike lanca proizvodnje riba u Centralnoj i Istočnoj Evropi. Različite interesne strane su identifikovale nekoliko izazova koji ometaju razvoj slatkovodne akvakulture u Centralnoj i Istočnoj Evropi. Razvoj akvakulture zahteva postojanje harmonizovanog regulativnog/pravnog okvira. Razmena znanja bi imala pozitivan uticaj na razvoj uniformnih standarda za održivost, i pomogla bi stvaranju pravnih procedura za izdavanje dozvola i licenci. Potrebno je izvršiti ekonomsku procenu usluga koje ekosistem ribnjaka pruža. Poboljšana tehnologija koja je povoljna po životnu sredinu i sistemi za upravljanje kvalitetom u proizvodnji i preradi su neophodni da bi se obezbedila ustaljenija ponuda proizvoda od ribe visokog kvaliteta. Potrošači treba da budu bolje informisani o funkciji koju slatkovodna akvakultura i njeni proizvodi imaju za životnu sredinu.

Da bi došlo do održivog razvoja sektora akvakulture i da bi se izgradilo poverenje javnosti, veoma je važno podstaći društvene inovacije koje su primenljive na pojedinačni sektor ili pojedinačnu teritoriju. Da bi došlo do održivog razvoja sektora slatkovodne akvakulture potrebno je razviti strategije makro regionalnog razvoja koje su prilagođene određenim tržištima, uslovima životne sredine, ponašanju potrošača, kulturi i tradiciji i koje nude potencijal za razvoj izvan granica jedne zemlje. Razvoj i adaptacija ključnih tehnologija potrebni su da bi se stabilizovala konkurentna i održiva proizvodnja i prerada ribe u čijoj su proizvodnji resursi efikasno iskorišćeni.

*Ključne reči: akvakultura slatkih voda, buduće teme za istraživanje, agenda za strateško istraživanje i inovacije, Evropska akvakultura*

*Key words: freshwater aquaculture, future research topics, strategic research and innovation agenda, European aquaculture*

### INTRODUCTION

The "Blue Economy" in Europe not only offers possibilities for aquaculture in coastal and marine areas but also in freshwater aquaculture. Especially in Central and Eastern Europe with the abundant water resources, freshwater aquaculture has a great potential to increase European fish production and generate income in rural areas as targeted in the (EATiP 2012).

Fish and seafood play an important role in human nutrition by providing essential fatty and amino acids, minerals and vitamins (FAO 2014). However, fish consumption in Central and Eastern European regions is the lowest in Europe (FAO 2014) and is below the level recommended by nutritionists. The demand of European consumers for sustainably produced and high quality fish products can only be covered if aquaculture makes a substantial contribution (FAO 2014). European markets depend to a large extent on imported fishery and aquaculture products mainly from Asia (FAO 2014). However, China may change from the world's largest exporter to a net-importer of fish products in the next two decades as their own domestic market expands (World Bank 2014). Utilizing the potential of freshwater aquaculture production in Europe could be part the EU's Blue Economy Strategy to increase food security in the Europe and reduce dependence on imports in the long-term.

Ponds are one of the most important sites for aquaculture and have several functions in addition to food production. They play an important role in the landscape by maintaining biodiversity, fostering the regeneration of groundwater resources, stabilizing the regional climate, diversifying land utilization and food supply, and increasing income potential (Kerepeczki et al., 2011). Ponds have been an element of the landscape for centuries with pond fish as an essential feature of traditional and religious cuisine. However, aquaculture can only fulfil the above functions if production is economically, socially and environmentally sustainable. In Central and Eastern Europe, consisting also of land-locked countries, pond aquaculture has been more important and more prominent than in other European regions. In the current stressful economic environment, production from pond aquaculture in these countries has already decreased in the past 20 years or is at risk to decrease in future. This poses a threat to the ecological and cultural functions of ponds in the region. In addition, the current severe price competition in international markets for fish and the associated changes in dietary habits of the population increase the pressure on small and medium-sized enterprises (SMEs) that produce and process fish in Central and Eastern Europe, and threaten the existence of the local pond aquaculture landscape. The Central and Eastern European region is undergoing political and economic transformation and so this is a perfect time to implement strategies for sustainable aquaculture development in order to maintain the ecological function of pond aquaculture and increase food quality and rural development.

## MATERIALS AND METHODS

To assess the needs, challenges and potentials of the freshwater aquaculture sector in Central and Eastern Europe, several stakeholders from the aquaculture sector were included into the analysis. To assess the needs of small and medium fish producers, semi-structured interviews with aquaculture producers, processors and associations were performed in two Central European countries (Poland and Czech Republic) within the EU FP7 project TRAF00N. The findings were quantitatively and qualitatively analysed by a multi-stakeholder workshop (7-8/10/2014, Vodnany, Czech Republic). Within the SIAD project, two workshops of researchers of different aquaculture disciplines were organized (4-5/6/2014, Vodnany, Czech Republic, and 1-3/12/2014, Stuttgart, Germany) to identify common challenges of and potential solutions for the freshwater aquaculture sector specifically in the Danube region. The Central European Aquaculture Conference (27-28/11/2014, Budapest, Hungary) was performed to identify common challenges and potentials of the aquaculture

sector in Central and Eastern Europe (and associated countries). The results of the inventories and the four workshops were used to collectively develop this paper.

## RESULTS AND DISCUSSION

Within the multi-stakeholder workshops the following challenges and potentials of boosting freshwater aquaculture in Central and Eastern Europe were identified. The development of aquaculture is not only influenced by the legislation specific for the aquaculture sector but also by numerous other laws such as the water framework directive, other environmental and natural conservation legislation, and regulations governing regional planning and construction, animal welfare, food safety etc. Some of these regulations from different sectors have conflicting effects on the aquaculture sector and need to be harmonized in order not to impede its development. Many of the challenges facing Central and Eastern European freshwater aquaculture are common to all parts of the region. Sharing knowledge and best practices will help to develop uniform standards for sustainability, and facilitate the legal procedures for the granting of permits and licences.

The prerequisite for aquaculture and its development is the achievement/ conservation of good water quality in the rivers and water sources. Sustainable aquaculture development depends on the enforcement of water quality regulations at regional and local levels. An economic valuation is urgently needed to quantify the ecosystem services of pond aquaculture. A specific compensation payment system for fish ponds should be elaborated based on the value of ecosystem services achieved by pond aquaculture and should apply the principle “public money for public goods”. There is a need for farmers to improve environmental-friendly technologies and quality management systems in order to ensure a steadier supply of high quality fish. This can be achieved by combining extensive and intensive production technologies and polyculture systems which will improve the efficiency of resource use, animal welfare, and net economic returns and place greater emphasis on the ecological function of aquaculture systems. Adaptation strategies must be developed so the region can be resilient in the face of climate change and the threat of fish diseases as well as development of new food-borne diseases.

Higher consumption of freshwater fish as a healthy food must be promoted. Consumer attitudes and behaviour must be evaluated at regional and trans-regional levels to identify consumer groups that can be targeted specifically by a differentiation of fish products and improvement of product presentation to meet the needs of consumers nutritionally and culturally. The development of technologies and standards in production and processing is essential to increase all aspects of fish product quality including nutritional value, sensory attributes and product safety. Consumers need to be informed more intensely about the environmental function of freshwater aquaculture and its products by means of awareness campaigns that target the different consumer groups with appropriate information. Suitable use of labelling, certification and quality standardization are essential so that consumers will trust aquaculture products and include them in their diets on the long term. In order to allow sustainable development of the aquaculture sector and build public confidence, it is important to encourage the formation of producer and consumer associations, and communication platforms for stakeholders at all points along the production chain.

Worldwide, freshwater aquaculture is the predominant production system for fish. The leading countries outside the EU in terms of quantity of production are China, India and

the ASEAN countries. The country with the most intensive systems is Israel. Fostering cooperation with these regions will be beneficial to the development of European aquaculture.

## CONCLUSIONS

The sustainable development of the freshwater aquaculture sector requires macro-regional development strategies that are tailored to specific markets, environmental circumstances, consumer behaviour, cultures and traditions and offer the potential for cross-border development. This development and adaptation of key technologies is needed to stabilise a competitive, sustainable and resource-efficient fish production and processing. The development of the aquaculture sector in this region should be guided by principles of sustainability (environmental, social, and economic) and by the potential for increasing human and animal welfare.

## ACKNOWLEDGEMENTS

We thank the EU FP7 project TRAF00N (grant no. 613912), the SIAD project (German BMBF, grant no 01DS13022), and the European Fishery Fund for financially supporting these activities. We especially thank the fish producing farmers for sharing their perspectives.

## REFERENCES

EATiP (2012) The Future of European Aquaculture - Our Vision: A Strategic Agenda for Research & Innovation. European Aquaculture Technology and Innovation Platform.

Kerepeczki, É., Gyalog, G., Halasi-Kovács, B., Gál, D., Pekár F. (2011) Ecosystem functions and values of extensive fishponds (Hungarian). *Fisheries & Aquaculture Development* 33:47-54

FAO (2014) The state of world fisheries and aquaculture. FAO Fisheries and Aquaculture Department. Rome.

World Bank (2014) Fish to 2030 prospects for fisheries and aquaculture. World Bank Report No 83177-GLB. Washington, DC, World Bank.