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## Inland aquaculture of carps in Poland: Between tradition and innovation

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**Title:** Inland aquaculture of carps in Poland: between tradition and innovation

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1 **Title:** Inland aquaculture of carps in Poland: between tradition and innovation

2

3 **Highlights**

- 4 - The research considers the role of innovation along the carp aquaculture value-chain in
- 5 Poland.
- 6 - The research is mostly based on the Schumpeterian theory of innovation, where the
- 7 entrepreneur enhances economic processes via adaptation of innovations.
- 8 - While carp aquaculture mostly remains traditional by nature, various innovations were
- 9 observed at each stage of the value chain.
- 10 - Market-oriented innovations (new products, new outlets, etc.) appear to be the most promising
- 11 ones.
- 12 - Further collaboration and cooperation can be needed to further develop and replicate
- 13 innovative processes, including in other production system.
- 14 - Public authorities have a role to play to facilitate the dissemination and adoption of innovative
- 15 processes, including through structural funds (EMFF; coordination; empowerment).

16

17 **Abstract:**

18

19 This paper examines how the traditional carp sector in Poland developed during the recent period,  
20 paying a particular attention to the different forms of innovations that have been implemented. Mostly  
21 based on first-hand, face-to-face interviews, the paper shows that despite the fact that aquaculture of  
22 carp is still characterised by strong traditional and cultural features, different categories of economic  
23 agents along the value-chain engaged in various kinds of technical, market and institutional  
24 innovations. These innovative strategies could be further replicated and developed through  
25 collaborative process, where policy makers have a potential role to play. The research results showed  
26 the existence of huge potential for innovation in traditional carp sector in Poland, especially in terms  
27 of alternative ways of marketing products for small and medium scale farms.

28 **Keywords:** Innovation; value-chain; competitiveness; carp; aquaculture; expert interviews.

29

30 **1. Introduction**

31 In Europe, inland aquaculture (e.g. trout, carp) only represents a very low share of the seafood  
32 production, and is hardly known by most of the consumers. However, in some areas, traditional land  
33 aquaculture has a central cultural, historical and societal importance. This is the case of the carp sector  
34 in Barycz Valley, part of Lower Silesia Province in Poland, one of the most important and the biggest  
35 European carp breeding regions.

36 Fisheries and aquaculture, as parts of the primary sector, are often considered as old-fashioned and  
37 declining activities, facing competitiveness challenges. However, in these sectors too, there have been  
38 remarkable developments for the past decades, in order to maintain or improve the competitiveness  
39 situation. This is for example reflected by the OECD work on monitoring innovations, in which the so-  
40 called "*Fisheries & Aquaculture Innovation Platform*" compiles the patents registered in fisheries and  
41 aquaculture technology, as well as the patents related to new products and markets<sup>1</sup>. In the same vein,  
42 a recent publication from the OECD Green Growth and Sustainable Development forum considered  
43 around 15 types of innovations in the fisheries sector (Girard and Du Peyrat, 2017). Additionally,  
44 innovation and competitiveness were at the heart of the recently finalized Horizon 2020 research  
45 SUCCESS<sup>2</sup>. Around 15 types of innovation developed in Europe were indeed documented in the  
46 synthesis report dedicated to the impact assessment of technological and regulatory innovations  
47 (Friðriksson and Haraldson, 2018), organised in 4 key innovation categories:

- 48 - Regulatory innovations,
- 49 - Technological innovations,
- 50 - Marketing innovations, including labeling, branding, new outlets and consumer preferences,
- 51 - Market structure and value-chain management, including e.g. the vertical integration of fish  
52 feed activities.

53 These four key innovation categories will be referred to when considering the case of carp aquaculture  
54 in Poland, which is the central topic of the paper. The term "innovation" derives from latin word  
55 '*innovare*' and means "doing something new", which gives a wide spectrum of its interpretation. The  
56 concept of economics "*innovation*" was introduced by Joseph Schumpeter (1934; 1942), for whom  
57 innovation is one of the most important features for company wishing to maintain a high position in  
58 the market. Here, the economic approach is perceived as a dynamic process of crisis and balance,  
59 where the "Unternehmer" (entrepreneur) enhances economic processes via the adaptation of  
60 innovations.

61 Schumpeter's work was mostly influential in unorthodox economics, whereas in mainstream  
62 economics, economic growth and innovation were determined by exogenous factors not influenced by  
63 public policy. In the 80's, there was an effort to address these shortcomings with so-called endogenous  
64 growth models. This was an effort to find what factors led to more efficient use of labor, capital,  
65 natural resources and other factors of production, such as investments in human capital and innovation  
66 (Romer, 1994). In the past decade, innovation has been much more in the spotlight. This renewed  
67 interest seems to have been driven more by practical consideration rather than scientific interest, at  
68 least in the beginning. Both policy makers and the private sector have been seeking ways to increase

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<sup>1</sup> OECD, [www.oecd.org/fisheries-innovation](http://www.oecd.org/fisheries-innovation).

<sup>2</sup> E.g. see the Newsletter number 2 on the SUCCESS webpage (<http://www.success-h2020.eu/media-center/newsletters/>).

69 productivity through innovation. Most firms seem to believe that innovation is a key factor in  
70 becoming, or remaining competitive (Churstin et al. 2017). However, according to the innovation  
71 theory literature (e.g. Ryan and Gross, 1943), innovations should be perceived as a neutral  
72 phenomenon.

73 The tradition of pond fish farming in Poland dates back to the eleventh and twelfth centuries. It was  
74 connected with the activities of the Cistercian Order, which played a crucial role in the organization  
75 and operation of ponds during this period. Along with the strengthening of Polish territory with the  
76 Christian religion, there was a need to comply with a number of fasts (more than 200 days a year  
77 (Guziur, 2008)), thereby increased the demand for fish. This period, until the turn of the sixteenth and  
78 seventeenth century, is often considered *the Golden Era* of Polish carp farming, due to the fact that  
79 huge ponds with the unit area from a 100 ha to even more than 1000 ha were built then. Even though  
80 they were truncated, they survived until the present time (especially in the Barycz Valley, located in  
81 the south-western part of Poland on the border of the Lower Silesia Province and the Greater Poland  
82 Province). Currently in the Barycz Valley operates the largest carp breeding centre in Poland and the  
83 whole Europe (Milicz Ponds).

84 Over the centuries, although the method of fish farming slightly evolved with the use of  
85 mechanization, the fish production preserves its traditional character (e.g. in terms of feeding,  
86 harvesting). Its specificity still rests on low intensification of production (up to 1500 kg /ha), a large  
87 share of natural food (growing in the pond) in fish diet (half of the fish growth comes from plankton),  
88 or the use of unprocessed, natural cereals in fish feeding, which greatly increases their taste (and the  
89 perceived quality (Raftowicz-Filipkiewicz, 2013)). Additionally, all agro-fishing farms which breed  
90 carps apply the so-called Dubisch system (Rice, 2003), which facilitates fish farming of the high  
91 quality and desired generic features.

92 The changes associated with the transformation of the Polish economy influenced the structure of the  
93 fish farms in a crucial way. The dominant (before 1989) monopolists (national budget entities) in the  
94 field of freshwater fish farming in the Lower Silesia Province (especially carp) soon had to face new  
95 competitors (in the form of small and medium-sized farms, for which it was easier to adapt to rapidly  
96 changing environmental conditions). Their flexibility and relatively low share of fixed costs in total  
97 production gave them a stronger, competitive position on the market.

98 The structure of the supply chain over the years has also changed radically. The supply chain as  
99 defined by Harrison and Van Hoek (2014) means "*network of partners, who in a joint operation*  
100 *transform the basic raw material (the supply phase) into the final product (the distribution phase) of a*  
101 *specific value for the end customers and manage the returns on each stage. Each partner in the supply*  
102 *chain is directly responsible for the process, which increases the product value. As a part of this*

103 *process, the input of materials and information is converted into products in the form of goods and*  
104 *services".*

105 The paper explores how the traditional carp sector developed during the recent period, paying  
106 particular attention to the different forms of innovations that have been implemented. The section 2  
107 presents the materials and methods, with firstly a description of the carp aquaculture production  
108 system in the Lower Silesia Province, and then a presentation of the approach developed to understand  
109 the structuration of the value-chains. The section 3 presents the results of the survey, considering some  
110 key economic agents along the value-chain. A discussion is then proposed in section 4 and a  
111 conclusion in section 5.

112

## 113 **2. MATERIALS AND METHODS**

### 114 **2.1. Description of the carp aquaculture sector in the Lower Silesia Province**

115 In 2011 there were 36 farming areas with a total area of 9375 hectare (ha) on the territory of the Lower  
116 Silesia Province. However, the surface structure was still dominated by the complex Milicz Ponds – of  
117 which the current owner is the local government of the Lower Silesia Province - including 5 large  
118 areas of 7.3 million ha (more than 78% of all areas). In the following years, there was a dynamic  
119 increase in issuing permits required by the Water Law Act, which resulted in the fact that by 2015  
120 there were 48 farming areas registered, as shown in Appendix 2.

121 Despite the increase in the number of farming areas, the total area decreased since 2011 by 9.4% to 8.5  
122 million ha. It is worth noting that between 2011 and 2015 there were more than 327 hectares of new  
123 farming areas built, owned by small, private investors.

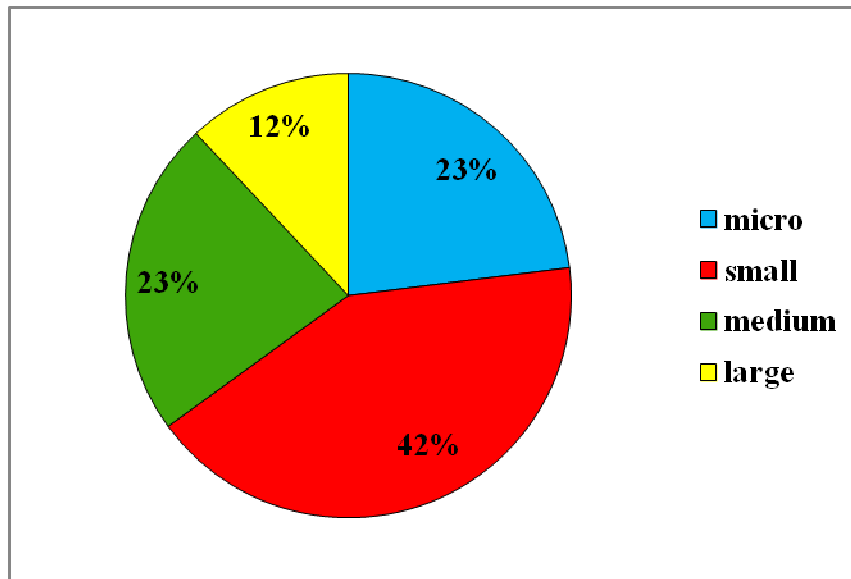
124 Analysing the quantitative structure of breeding farms, they were grouped into 4 categories, as shown  
125 in Figure 1:

- 126 • micro up to 10 ha,
- 127 • small from 10 to 80 ha,
- 128 • medium from 80 to 300 ha
- 129 • and large, over 300 ha.

130

131 Figure 1. The quantitative structure of farming areas in the Lower Silesia Province (in % of the  
132 number of farms)

133



134

135 Source: own study based on the list of the farming areas established by the Lower Silesia Marshal  
 136 Office, Decisions of the Governor of the Lower Silesia Province in the years 2002-2005, 2006-2010  
 137 and 2006-2014.

138

139 From such perspective, it is clear to see that from 48 farming areas, most belong to the group of micro  
 140 and small farms. However, those areas represent only a small part of the total area of fish farms, as  
 141 shown in Table 1.

142

143

Table 1. The structure of farming areas in the Lower Silesia Province

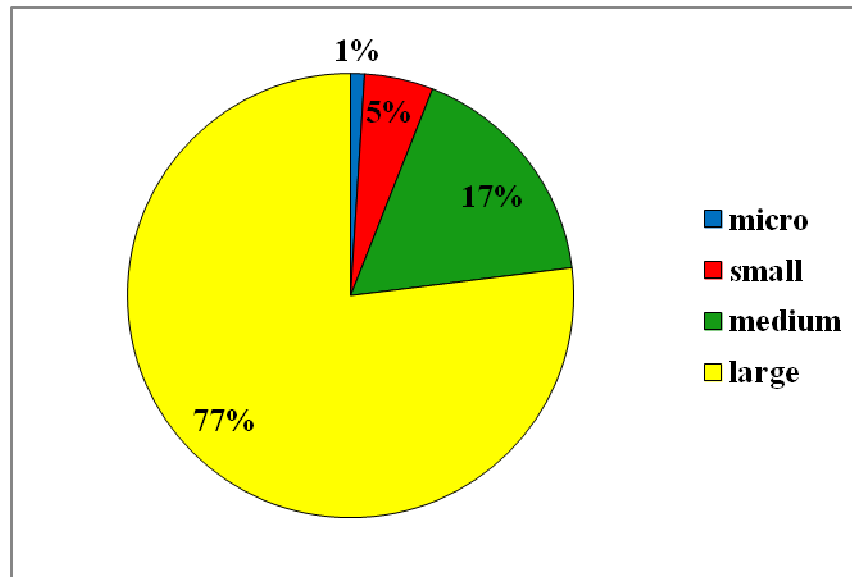
categories	scale [in ha]	amount	Area [in ha]
micro	<10	11	74
small	10-80	20	464
medium	80-300	11	1404
large	>300	6	6550
<b>Total =</b>		<b>48</b>	<b>8493</b>

144 Source: own study based on the list of the farming areas established by the Lower Silesia Marshal Office,  
 145 Decisions of the Governor of the Lower Silesia Province in the years 2002-2005, 2006-2010 and 2006-2014.

146

147

148 Figure 2. The structure of farming areas in the Lower Silesia Province (in % of the total farming area)



149

150 Source: own study based on the list of the farming areas established by the Lower Silesia Marshal Office,  
 151 Decisions of the Governor of the Lower Silesia Province in the years 2002-2005, 2006-2010 and 2006-2014.

152

153

154 While analysing the situation of aquaculture sector in the Lower Silesia, the specific environmental  
 155 conditions in which it operates cannot be disregarded. It should be stressed that this activity is located  
 156 in natural and valuable areas, which since 2004 i.e. since the accession of Poland to the European  
 157 Union, are included in the *Natura 2000* network. Currently, there are 99 areas under the *Natura 2000*  
 158 protection in the Lower Silesia, including:

- 159 • 11 areas of a birds special protection with total area of 0.3 million ha,
- 160 • 88 special areas of habitats protection with total area of 0.4 million ha.

161 Location of fish farms in the natural and valuable areas often leads to conflicts between  
 162 ecological and economical objectives. The growing population of protected piscivorous birds seems to  
 163 be the biggest threat to the industry. Fishery sector also strongly depends on the hydro and weather  
 164 conditions and exposure to diseases (especially KHV virus). As a result, most of the breeding farms  
 165 are struggling with the problem of insufficient fish production, and they are facing competitiveness  
 166 issues (Lasner et al., 2017).

167

## 168 2.2. Description of survey

169 The research was anonymous and was conducted in July and September 2016 by expert interviews,  
 170 based on a prepared questionnaire (see Appendix 1) according to the methodology of Bogner et al.  
 171 (2009) and group discussions with a focus group. The respondents were participants in the supply  
 172 chain on the carp market in the Lower Silesia. At each stage of the supply chain, four entities were  
 173 interviewed. At the producers' level, 4 out of 48 were selected for conducting the research following



174 the typical farm approach, which consists in five steps (Lasner et al., 2017). Table 2 is presenting the  
175 way the typical farm approach has been applied in the case of carp aquaculture in Lower Silesia:

176

177

Table 2. Research scheme of the typical farm approach

Steps	State of Play	Comments
Selection of markets and species	Done	As from the start of the research
Selection of the regions	Done	The biggest centre of carp breeding in Europe – Barycz Valley in the Lower Silesia Province
Definition of production systems	Done	Contribution to the Carp Case study of the H2020 SUCCESS project <sup>4</sup>
Focus group (pre-panel) with farmers, consultants and researchers	Done	June 2016
Interviews	Done	July 2016

178

Source: own elaboration from Lasner et al., 2017

179

180 The biggest one (leader), two medium farms and one small farm - using the same water resource - to  
181 get a reliable cross-section of data. These four farms cover more than 81% of fish farming areas in the  
182 Lower Silesia Province and can be considered representative of the different strategy production,  
183 including when considering intensification level.

184 In order to collect first-hand information and investigate the structure of the value chain of the Lower  
185 Silesia carps sector, direct interviews were conducted with several other categories of economic  
186 agents: 4 fish restaurants (only 4 out of 5 existing within 40 km), the 4 biggest trading networks in  
187 Lower Silesia Province, excluding retail customers, 4 fishmongers (4 out of 4 specialised only in fish  
188 selling) and 4 processing plants (4 out of 4 existing in Lower Silesia Province). In addition, interviews  
189 were conducted as well with a local Non-Governmental Organisation (NGO), "Partnerstwo dla Doliny  
190 Barycz", which also function as a Local Fishery Action Group (FLAG) and which, for instance,  
191 promotes year-round consumption of carp (see below). Altogether, 25 interviews were thus conducted,  
192 with the exception of micro farms, because the usual profile of fishing activities did not constitute  
193 their core business, and besides, most of the production is allocated to its own consumption.

194

195

### 196 3. RESULTS

#### 197 3.1. Description of the current value-chain

198 One of characteristics on the carp market in the Lower Silesia is the fact that the bulk of sales (80-  
199 90%) takes place in the period of the Christmas, where carp is the main dish on the table. This custom

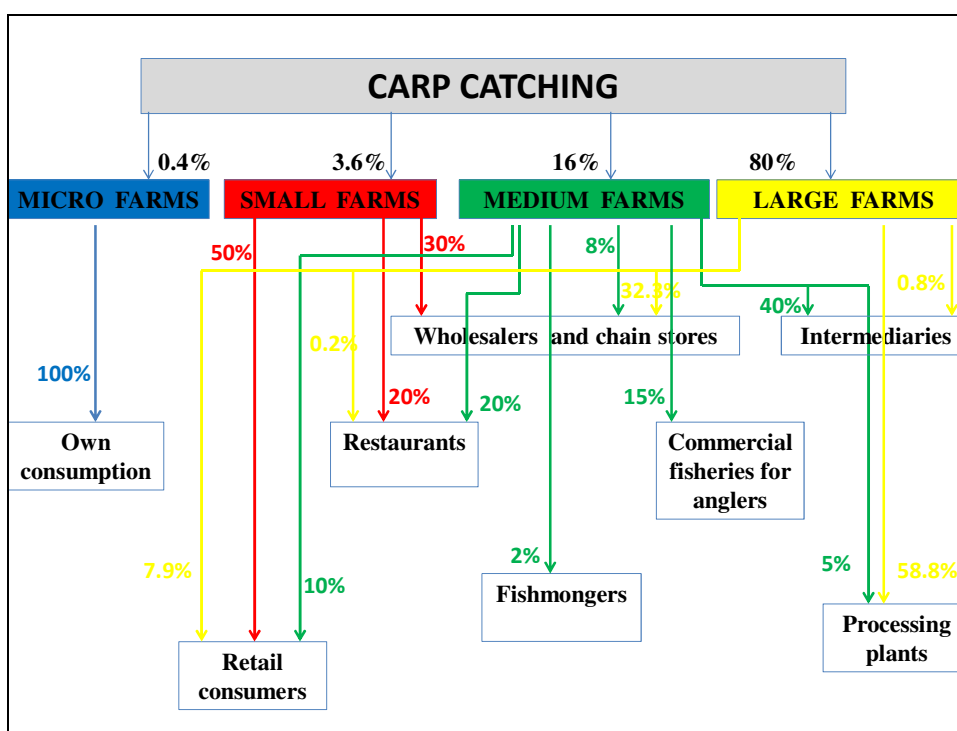
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<sup>4</sup> <http://www.success-h2020.eu/case-studies/carp/>

200 shaped the specific carp supply chain starting from fish farms, through intermediaries, fish shops and  
 201 ending up with the final customers.

202 Before analysing the different innovative practices identified (3.2), a description of the full value chain  
 203 can be proposed (Figure 3), in line with the economic theory developments (e.g. Porter, 1980, 1985;  
 204 Kaplinsky, 2000; Gereffi et al., 2005; Knútsson et al., 2008). Such an approach, based on the  
 205 interviews conducted, enables in particular to capture the respective importance of each production  
 206 system to the global supply of carp, as well as the main market strategies implemented consequently.  
 207 For each production system, the average prices obtained for the different value-chain are described.

208  
 209 Figure 3. Presentation of the value chain  
 210



211  
 212 Source: own elaboration from the survey.  
 213

214 In the case of **small fish farms** (10-80 ha), direct sales to retail customers is the most popular, as  
 215 shown in Table 3.

216 Table 3. The supply chain of carp in the case of small fish farms.

	Market share - in [%]	Selling price in euro per kg
Retail Customers	50	2.8 - 3
Restaurants	20	2.4
Wholesalers and chain stores	30	2.4

217 Source: own study from the survey.

218

219 The supply chain for **medium-sized farms** is completely different, as illustrated in the value chain  
220 presented in Figure 3. The impacts differences in prices can be seen in the Table 4 below.

221

222 Table 4. The Supply chain, in the case of medium carp farms in the Lower Silesia Province

	Market share - in [%]	Selling price in euro per kg
Retail customers	10	3.2
Fishmongers	2	2.3-2.8
Restaurants - own + other	20	2.8
Own fisheries for anglers	5	2.3
Commercial fisheries for anglers	10	2.3
Processing plants	5	2.1
Wholesalers and chain stores	8	1.8
Intermediaries	40	1.8-2.1

223

Source: own study from the survey.

224

225 In this type of farms, the supply chain is considerably varies, which can be explained by the  
226 fact that they produce many more fish. Their real output level ranges from 60 to 120 tons of carp per  
227 year and the potential can reach even the value of 150 tons.

228 A completely different supply chain model was presented by **large farms**, as shown in Table  
229 5.

230

Table 5. The supply chain for large carp farms in the Lower Silesia Province.

	Market share - in [%]	Selling price in euro per kg
Retail customers	7.9	3.1
Supermarkets	31.3	1.6
Own restaurant	0.2	-
Processing plants	58.8	1.6
Wholesalers	1.0	1.6
Intermediaries	0.8	1.6

231

Source: own study from the survey.

232

233 In that case, most carps are sold to wholesalers and supermarkets throughout Poland. The  
234 lowest selling price of carp is 1.6 euro par kg (net of VAT), and the highest selling price of carp is 3.1  
235 euro par kg.

236 As described, the price obtained can strongly vary between the different productive systems  
237 and the type of clients targeted. The following section analyses the actual and potential role of  
238 innovation in this development.

239

### 240 **3.2. Alternative and innovative initiatives**

241

242 In order to improve the competitiveness of the full carp value-chain, some key initiatives that  
243 can be implemented by the different categories of economic agents are described below.

244

#### 245 3.2.1. Development of direct selling

246

247 In general, engaging in direct selling and shortening the value chain can be a way to increase  
248 the unit value obtained for each fish, and then the total revenues of the firm. In our case, engaging in  
249 direct selling could result in an increase of 0.4-0.6 euro per kg. Most often the owner of the farm, in  
250 the period around Christmas, becomes a salesperson on his own and personally sells fish at the street  
251 market in the centre of the nearest city, thus promoting the brand of his farm and inviting to use the  
252 services of rural tourism, which is run during the summer. With direct sales, there is also an incredible  
253 opportunity to track the carp market trends. Most frequently, the customers are local residents of  
254 Lower Silesia and Greater Poland. As such a strategy is only possible when limited quantities are  
255 involved it is mostly relevant for small size aquaculture facilities.

256

257

#### 258 3.2.2. Expanding the period of sales

259

260 The concentration of the consumption around the Christmas period has some adverse effect on both  
261 the prices and the cash-flows of the farms. In order to avoid this several outcomes of the survey  
262 suggest that carp could be proposed on a yearly basis.

263 It has been reported by farms that every year they could see more retail customers who would  
264 like to buy fish not only in December, particularly those farms which have their own restaurants or  
265 commercial fisheries. Farms are thus becoming open to the needs of tourism, recreation and  
266 gastronomy - especially with respect to regional products (see below).

267 In this context, an important but relatively new link in the supply chain of carps relates to local  
268 restaurants specializing in serving dishes made of carp. These restaurants adventure with carp - as a  
269 regional product, was launched in 2005, thanks to the initiative of the association: "Partnerstwo dla  
270 Doliny Baryczy", which organizes the mentioned "*Carp days*" in late September and October. One of  
271 the event ideas is to promote a year-round consumption of carp. The association strongly solicited to

272 make the carp identified with the region and to add it to the menus of local restaurants. Only a decade  
273 ago, the restaurateurs were not interested in serving carp - but agreed to an experiment, of which the  
274 idea was to serve fish dishes - supplied by the association, which took on the role of searching for  
275 customers willing to visit the restaurants. The aim of this action was to change culinary habits and to  
276 promote year-round consumption of carp from surrounding farms - not only during the Christmas  
277 period. The experiment turned out to be a spectacular success, as now, in each of the surveyed  
278 restaurants, carp is the main dish on the menu (including different forms of commodities - such as  
279 dumplings of carps), and they have lots of customers willing to try their specialties, especially at the  
280 weekends.

281

282           Such trend can be also observed at the retailing level. One of the surveyed retail chains,  
283 located in the Lower Silesia, had in its full year offer both live and gutted carps. While carps sold there  
284 were not bred in the Lower Silesia Province, or not even in Poland, this new approach suggest that a  
285 demand exists for carps even outside the traditional Christmas period. In the same vein, another  
286 retailing chain proposes a full-year offer of gutted carp - whole or fillets, while another key retailer  
287 just started to supply smoked carps on a regularly basis as from September 2018.

288

289 3.2.3. Making the promotion of locally produced products.

290

291 The origin of seafood product can play a role in differentiating local products from other conventional  
292 or imported products. Examples of such schemes include for instance protected Geographical  
293 Information (PGI) for mussels in Spain and Italy<sup>5</sup>, the Pescaderias scheme in Galicia, or the Seabass  
294 liners from the edge of Brittany label<sup>6</sup>. This research shows that such a local label has also been  
295 created here, with the development of the '*Milicki carp from Lower Silesia*' label, inscribed in 2006 on  
296 the List of Traditional Products by the Ministry of Agriculture and Rural Development, and two years  
297 later submitted for registration in the EU system of regional products protection as a Protected  
298 Geographical Indication.

299           The increased consumers interest in issues connected with regional products in the Lower  
300 Silesia region can be explained by the increasing attitude of consumer ethnocentrism, which in Poland  
301 is seen especially in relation to food products, and affects as many as 40% of the population  
302 (Raftowicz-Filipkiewicz, 2014). All surveyed restaurateurs indeed emphasised that the main criterion  
303 for choosing suppliers is the quality of the fish, confirmed with certification.

304           In this context, an interesting initiative was taken recently by the Fish Producers Association,  
305 which plans to start a partnership, uniting its members and, as an intermediary, to buy up the carp on

---

<sup>5</sup> In the EU, 21 aquaculture products were marketed under a PGI / PDO scheme ; EUMOFA, 2018.

<sup>6</sup> E.g. see Eurofish magazine, 2017, for an overview ('Finding a formula for Success ; pp.56-57)

306 the basis of contracts. This project, which would allow reducing the atomicity of the farmers and  
307 facilitating the market-driven approach, is in the preliminary stage of negotiations<sup>7</sup>.

308 Another interesting link in the supply chain of carp in the Lower Silesia is the association:  
309 ‘*Partnerstwo dla Doliny Baryczy*’ acting also as the Fishery Local Action Group (FLAG). It does not  
310 participate directly in the search for customers, but promotes integration, establishment of new  
311 contacts and exchange of associated farms views. The association played an important role in  
312 obtaining EU funds under the Operational Programme and promoting year-round consumption of carp  
313 in the studied area (see also above).

314 Such a collective, regional branding approach is also fostered by the fact that surveyed  
315 medium and large farms are also members of the Lower Silesia Fish Breeders Cluster. The Cluster,  
316 created in 2012 and which consists of a group of nine fish farms and local governments, has indeed  
317 possibilities to effectively promote regional product, the Milicki carp.

318 Majority of respondents acknowledged that the sale of certified carps (e.g. The sign “*Barycz*  
319 *Valley recommends*” awarded by the jury of the association: ‘*Partnerstwo dla Doliny Barycz*’) is an  
320 asset at the sale, and customers (especially retailers) very often ask for the certificate. However, it does  
321 not affect the negotiation of prices - especially for the large customers, for whom the price is still a key  
322 part of the transaction. All the surveyed farms are certified with the *Barycz Valley recommends* sign  
323 that highlights the relationship with the region, traditionalism, environmental friendliness,  
324 sustainability, uniqueness, high quality and ability to intra-sectorial cooperation of the fish farm.

325

#### 326 3.2.4. Vertical integration

327 In order to ensure both the quality and the regularity of the feed, at least one fish farm innovated in the  
328 supply chain, through the cultivation of part of their ingredients. While such an alternative approach is  
329 not always feasible, it is reported to also reduce the feed and transaction costs, and make the product  
330 more local, as feed ingredients also have a local origin. Also, the development of cooperative feed  
331 production organisation could be envisaged.

332 Downstream integration initiatives include several types of alternative and innovative  
333 practices, which can also contribute to the development of direct selling (see above).

334 For instance, most of the surveyed farms manifest their innovation through the usage of modern,  
335 specialist fish transport regardless the size of their farms territory. These vehicles were mostly  
336 purchased with the contribution of the EU funds (in particular the European Fisheries Fund - EFF), so  
337 that the same farms can deliver the product to the customer without any loss during the transport,  
338 loading and unloading.

---

<sup>7</sup> A similar case, related to the Fasolari fisheries in Italy, has been identified as part of the H2020 SUCCESS project (Malvarosa and Cozzolino, 2016).

339 At least one of surveyed farm indicated having diversified into the establishment of their own  
340 restaurant, directly located on the farm facilities. In addition to the restaurant, the farm also invested  
341 into a smokehouse, a processing plant and a recreational fishery, so it can achieve a higher price for  
342 fish, keeping the full-year liquidity. This farm can indeed organise a whole-year selling of carps, and  
343 can capture part of the margins otherwise collected by intermediaries. Also, such an innovative  
344 initiative improves the traceability regarding the origin of the product, and can improve the regularity  
345 of the quality. Here again, the farm benefited from EFF and EMFF axis 4 contribution, which strongly  
346 reduced the investment cost for the farm, and thus the risk occurred.

347

348 This research has shown that there is a challenge related to regular supplies of fish, due to the  
349 fact that there is a lack of live carp on the market during the summer time. Restaurateurs can buy carp  
350 only from the farms which have rinsers on their premises. The rinser is a device for storing live fish in  
351 the flowing clean water. With the rinser, year-round storage and fishing out on demand is possible. At  
352 least two farms indicated having invested in such facilities.

353

#### 354 3.2.5. Other promising innovative developments

355

##### 356 3.2.5.1 Marketing innovation – pre-payment.

357 All tested fish farms also confirmed that customers pay for the deliveries without delays. Only in some  
358 particularly special cases (small and medium-sized farms) there is a possibility of credit - but only for  
359 friends and trusted customers. In the period ‘after the harvest’ (i.e. October / November) and before  
360 the Christmas time, in this group of farms, there is a possibility of advance payment, which allows to  
361 get a reduction in the fish price at the delivery in December.

362 However, none of the examined farms have a signed contract for the regular supply of fish. It  
363 is complicated because only ‘after the catches’ it is possible to accurately assess the volume of the carp  
364 supply. During this period, large farms sign ‘framework agreements’ with retail chains or the  
365 processors, as those entities want to have a guaranteed supply of carp in December.

366 Although, the farms declare the best customer is a regular customer, each of them tries to  
367 become independent from one recipient. No signed procurement contracts create the risk that existing  
368 customers, especially the wholesale, may not collect their fish orders. Therefore, diversification of  
369 sales is preferred, in order to prevent the formation of any kind of monopsony structure.

370

##### 371 3.2.5.2 Market structure innovation – new (export) market.

372 In the recent period, more and more clients are asking about the possibilities of exporting  
373 carps to Great Britain and Ireland before Christmas time. This new situation can be explained by the

374 high number of Poles, who migrated there since 2004, i.e. just after the accession of Poland to the EU.  
375 Unfortunately, the medium farms without a processing plant and additional workforce cannot face up  
376 to this increasing export demand. While being a promising development, some collective actions are  
377 required to enable the fragmented aquaculture sector reaping the benefits of it (e.g. through the  
378 development of a producer organisation export-oriented; the investment in dedicated storage facilities,  
379 etc.).

380

381 3.2.5.3 Market structure innovation – change in the value-chain.

382 A new feature also concerns the fact that live carp can be now sold in the hypermarkets during  
383 the Christmas period, while even a decade ago, a live fish could have been only purchased directly  
384 from the manufacturer or through intermediaries at the markets and bazaars, or in specialized fish  
385 shops. This new structuration of the value chain can thus facilitate the access to raw product,  
386 especially for middle class people living in big cities.

387

#### 388 4. DISCUSSIONS

389 Our findings suggest that there is a discrepancy in the structure of the fish farms in terms of factors  
390 determining the competitive advantage in the supply chain, which implies that differentiated strategies  
391 might be relevant. For small farms, the distance and reliability of supply, the quality of fish -  
392 certification, the acquaintanceship with suppliers and the reputation are essential. For medium-sized  
393 suppliers additional factors to these important elements are the mobility, flexibility and adaptability to  
394 customer needs. For large farms the main advantage is the size and knowledge of the brand. In order to  
395 address these differences, our research shows that diverse innovative answers have been developed.  
396 More than 10 types of innovation have indeed been identified at different levels of the value chain to  
397 improve the competitiveness of the economic agents. In general, these innovations enable to increase  
398 the whole value of the carp production, including through the development of new consuming trends,  
399 such as the development of year-round consumption, the direct selling to final consumers or  
400 restaurants, the promotion of the origin of the products or the rise in exports. Other innovative  
401 approaches aim at limiting the production costs, e.g. by integrating the feeding process.

402 Interestingly, it seems that most of these innovations can be replicated, whether in the carp  
403 sector or in other cases of inland aquaculture. This can be indeed reflected by some recent work in the  
404 carp sector in other regions of Poland (Farnet Magazine, 2018) or elsewhere<sup>8</sup>. In most countries for  
405 instance, the local origin of the products tend to become an important competitiveness factor (Zander  
406 and Feucht, 2018). However, the dissemination of the innovations can face some challenges. One of  
407 them is a mental and cultural barrier, which strongly reveals the lack of willingness to share  
408 knowledge and a deficit of trust between partners, especially from the leader (Raftowicz-Filipkiewicz,

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<sup>8</sup> E.g. in Germany with the Aischgrund FLAG and the 'Carpland', European Commission, 2017. FARNET.



409 2014). Another challenge relates to access to financial resources. As indicated above, it appears that  
410 the European Fisheries Funds has facilitated the development of some innovations during the recent  
411 period. There is a clear policy implication here, as both national and local authorities have a role to  
412 play to overcome these challenges. Although the relationship between public policy, regulatory  
413 frameworks, innovation and economic growth can be complex (Dimos and Pugh, 2016), financial  
414 supports for innovation might generate some benefits for the society as a whole (Radicic et al., 2015).  
415 Moreover, not all the innovative strategies are necessary seen as relevant by all the economic agents,  
416 e.g. the development of direct selling for large farms. This can explain why some innovation are not  
417 adopted by the all fish farmers, or why some innovations fit better to smaller farms than to larger  
418 farms for instance (e.g. Rogers, 2003). It is all about the perceived relative advantage on entrepreneur  
419 level, although this advantage needs to be well understood and disseminated.

420 The novum is also (unprecedented before) the diversification of fish farming activities by  
421 putting emphasis on direct selling, catering and recreation development such as angling. These  
422 activities shorten significantly the supply chain and can also facilitate the links between the  
423 aquaculture sector and tourism, having in mind that tourism is one of the most dynamic economic  
424 sectors in the recent years (UNWTO, 2018).

425 Some future developments, such as the potential exports of carps to United Kingdom and  
426 Ireland because of the massive migration of Poles, would be required collective answers from the  
427 sector in order to let the economic agents located along the value-chain reaping the benefits of it. For  
428 instance, this would require the development of processing activity, which is practically non-existent  
429 currently in the Lower Silesia Province, as well as the development of export-based producers'  
430 organisation. However, this potential is likely to be limited or impeded by the Brexit, which might  
431 result in drastic changes in the trade in seafood between the EU-27 and the United-Kingdom (Le  
432 Gallic et al., 2017).

433 This analysis shows that the diffusion of the described carp innovations spread slightly, not as  
434 a radical change as Schumpeter described it in his theory of the renew process of economics (sub)  
435 systems. Such a development is indeed more in line with the concept of incremental innovation (e.g.  
436 see Dewar and Dutton, 1986, for an overview), as in the case described by Harsen for an application to  
437 the seafood sector (Harsen, 2014).

438

## 439 5. CONCLUSION

440 The research shows that, over the centuries, the carp supply chain in the Lower Silesia  
441 Province in Poland was strongly determined by historical, geo-political and even religious factors.  
442 This implicates why about 80-90% of carp sales (especially wholesale) takes place in the period of  
443 Christmas. Fortunately the situation slowly but surely is changing primarily thanks to recent  
444 development such as the new cooperative devices like "*Lower Silesia Fish Breeders Cluster*", the

445 supplying of carp products in restaurants and the role of the local FLAG. They are all related to the  
446 promotion a year-round consumption of carp, cooperation and information exchanging. While the  
447 research showed the existence of a mental barrier in the form of deficit of trust between some partners,  
448 several other promising innovative initiatives were identified to increase the creation of wealth  
449 generated from the carp traditional production sector, including the upstream and downstream  
450 integration of some activities. To recapitulate, the research showed that in Poland, there is a huge  
451 potential for innovation in this sector, which could be fostered by the use of some E(M)FF measures.  
452 Also, some schemes are currently being developed to promote a greater cooperation between the  
453 economic agents and the institution located in the Lower Silesia region, aiming, among other things, at  
454 developing new carp products (e.g. fish and chips) and alternative supply chain (e.g. school canteens).

455

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462

#### 463 **References:**

464 Bogner A., Litting B., Menz W., 2009. *Interviewing Experts*. Research Methods Series. Palgrave  
465 Macmillan, London.

466

467 Churstin A., Vlasov Y., Marakov Y., 2017. *Innovation as a Basis for Competitiveness: Theory and  
468 Practice*, Springer, Cham, Switzerland.

469

470 Dimos, C. and Pugh, G., 2016. The effectiveness of R&D subsidies: A meta-regression analysis of the  
471 evaluation literature, *Research Policy*, 45 (4), pp. 797-815.

472

473 Dewar, R.D. and Dutton J.E., 1986. The adoption of radical and incremental innovations: an empirical  
474 analysis. *Management Science*. 32 (11), pp. 1422-1433.

475

476 EUMOFA, 2018. *The EU Fish Market*. 2018 Edition.

477

478 Eurofish magazine, 2017 (4).

479

480 European Commission, 2017. FARNET. [https://webgate.ec.europa.eu/fpfis/cms/farnet2/on-the-](https://webgate.ec.europa.eu/fpfis/cms/farnet2/on-the-ground/flag-factsheets/karpfenland-aischgrund-flag_en)  
481 [ground/flag-factsheets/karpfenland-aischgrund-flag\\_en](https://webgate.ec.europa.eu/fpfis/cms/farnet2/on-the-ground/flag-factsheets/karpfenland-aischgrund-flag_en) (accessed 30 June 2019).  
482  
483 Farnet Magazine, 2018. From the pond to the plate. Farnet Magazine. 16, pp. 2-8.  
484  
485 Friðriksson K., Haraldson G., 2018. Impact assessment of technological and regulatory innovations,  
486 WP5, D5.1. D5.1\_success.pdf. Available on <http://www.success-h2020.eu/outputs/deliverables/>  
487 (accessed 2 October 2019).  
488  
489 Girard P., Du Peyrat T., 2017. An inventory of new technologies in fisheries, Issue Paper, Greening  
490 the Ocean Economy, OECD, Paris.  
491  
492 Gereffi, G., Humphrey, J., Sturgeon, T., 2005. The governance of global value chains. Review of  
493 International Political Economy, pp. 78-104.  
494  
495 Guziur J., 2008. Z dziejów chowu ryb w Polsce i na świecie [From the history of fish farming in  
496 Poland and in the world], in: Szarek J., Skibniewska K., Guziura J., Technologia produkcji rybackiej a  
497 jakość karpia. [Fisheries production technology and the quality of carp], Olsztyn.  
498  
499 Harrison A., van Hoek R., 2014. Logistics Management and Strategy Competing through the Supply  
500 Chain, fifth ed. Pearson, Edinburgh.  
501  
502 Kaplinsky, R., 2000. Globalisation and Unequalisation: What Can Be Learned from Value Chain  
503 Analysis. Journal of Development Studies, Vol. 37, Issue 2, pp. 117-146.  
504  
505 Knútsson, Ö., Klemensson, Ó., Gestsson, H., 2008. Structural changes in the Icelandic fisheries' sector  
506 - a value chain analysis. Proceeding of the 14th Annual biennial Conference of International  
507 Institutes of Fisheries and Economics and Trade, IIFET2008. Nha Trang, Vietnam: IIFET 2008.  
508  
509 Larsen, H.B., 2014. Governance, Quality Conventions, and Product Innovation in a Value Chain: The  
510 Case of the Spanish Salted Fish Market. Growth and Changes. A journal of urban and regional policy.  
511  
512 Lasner T., Brinker A., Nielsen R., Rad F., 2017. Establishing a benchmarking for fish farming –  
513 Profitability, productivity and energy efficiency of German, Danish and Turkish rainbow trout grow-  
514 out systems, Aquaculture Research, 48, pp. 3134–3148.  
515

516 Lasner T., Mytlewski A., Nourry M., Rakowski M., 2017. How to maintain Carp Farming in Europe -  
517 A Matter of Region-Marketing? 23<sup>rd</sup> Conference of the European Association of Fisheries Economists  
518 (EAFE). Dublin, 25-27 April 2017.  
519

520 Le Gallic, B., Mardle, S., Metz, S., 2017. “Research for PECH Committee – Common Fisheries Policy  
521 and BREXIT - Trade and economic related issues”, European Parliament, Policy Department for  
522 Structural and Cohesion Policies, Brussels.  
523

524 Lower Silesia Marshal Office, Decisions of the Governor of the Lower Silesia Province in the years  
525 2002-2005, 2006-2010 and 2006-2014.  
526

527 Malvarosa L. and Cozzolino M., 2016. The role of PO and of co-management in the value. Proceeding  
528 of the 18th Annual biennial Conference of International Institutes of Fisheries and Economics  
529 and Trade, IIFET 2016. Aberdeen, Scotland.  
530

531 Ministry of Agriculture and Rural Development in Poland, [www.minrol.gov.pl/Jakosc-zywnosci/Produkty-regionalne-i-tradycyjne/Lista-produktow-tradycyjnych/woj.-dolnoslaskie/Karp](http://www.minrol.gov.pl/Jakosc-zywnosci/Produkty-regionalne-i-tradycyjne/Lista-produktow-tradycyjnych/woj.-dolnoslaskie/Karp-milicki)  
532 [milicki](http://www.minrol.gov.pl/Jakosc-zywnosci/Produkty-regionalne-i-tradycyjne/Lista-produktow-tradycyjnych/woj.-dolnoslaskie/Karp-milicki) (accessed 30 June 2019).  
533  
534

535 OECD, [www.oecd.org/fisheries-innovation](http://www.oecd.org/fisheries-innovation) (accessed 30 June 2019).  
536

537 Porter M. E., 1980. Competitive Strategy: Techniques for Analysing Industries and Competitors,  
538 The Free Press, New York.  
539

540 Porter, M. E., 1985. Competitive Advantage: Creating and Sustaining Superior Performance. The  
541 Free Press, New York.  
542

543 Radicic D., Pugh G., Hollanders H., Wintjes R., Fairburn J., 2015. The impact of innovation support  
544 programs on small and medium enterprises innovation in traditional manufacturing industries: An  
545 evaluation for seven European Union regions. Environment and Planning C: Government and Policy.  
546 34 (8), pp. 1425-1452.  
547

548 Raftowicz-Filipkiewicz M., 2013. Wpływ rybactwa śródlądowego na rozwój obszarów przyrodniczo  
549 cennych w Dolinie Baryczy, [The impact of inland fisheries on development of valuable natural areas  
550 in Barycz Valley], Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu,  
551 [Annals of the Polish Association of Agricultural and Agribusiness Economists]. 15(1), pp. 175-179.  
552

553 Raftowicz-Filipkiewicz M., 2014. Klastry produktów regionalnych. Bariery rozwoju na przykładzie  
554 Dolnośląskiego Klastra Hodowców Ryb, [Clusters of regional products. Development barriers on the  
555 example of the Lower Silesia Fish-Breeders Cluster] Marketing i rynek [Marketing and market]. Nr 6  
556 (CD), pp. 602-610.  
557

558 Rice M. A., 2003. Aquaculture, in: Hazeltine B., Field guide of appropriate technology, Academic  
559 Press, San Diego - London, pp. 391.  
560

561 Rogers E. M., 2003. Diffusion of innovations, Free Press, New York.  
562

563 Romer P. M., 1994. The Origins of Endogenous Growth, Journal of Economic Perspectives. 8 (1)  
564 Winter.  
565

566 Ryan B., Gross N. C., 1943. The diffusion of hybrid seed corn in two Iowa communities. Rural  
567 Sociology. 8, pp. 15-24.  
568

569 Schumpeter J. A., 1934. The Theory of Economic Development, Harvard University Press,  
570 Cambridge, Massachusetts.  
571

572 Schumpeter J. A., 1942. Capitalism, socialism, and democracy, Harper&Brothers, New York, London.  
573

574 SUCCESS, Strategic Use of Competitiveness towards Consolidating the Economic Sustainability of  
575 the European Seafood sector, Newsletter nr 2 on the SUCCESS webpage. [http://www.success-](http://www.success-h2020.eu/media-center/newsletters/)  
576 [h2020.eu/media-center/newsletters/](http://www.success-h2020.eu/media-center/newsletters/) (accessed 30 June 2019).  
577

578 UNWTO, 2018. UNWTO Tourism Highlights. 2018 edition.  
579

580 Zander K., Feucht Y., 2018. Consumers' willingness to pay for sustainable seafood Made in Europe,  
581 Journal of International Food and Agribusiness Market 30 (3), pp. 251-275.  
582

583 Appendix 1. Survey for fishing farms:

- 584 1. Please specify the percentage of sales directions for carp (2-3 years)
- 585 2. Is production planning in the long term?
- 586 3. Have the distribution channels changed over the last 10 years? Are other sales channels  
587 considered in the future?
- 588 4. What are the main selling problems for individual customers?
- 589 5. Which customers are preferred and why?
- 590 6. Are you looking for fish clients on your own or are they themselves are reporting to you?
- 591 7. Do you use marketing tools to increase sales?
- 592 8. Is the certificate "carp milicki" as a regional product an asset in the sale? It raises the price  
593 of fish?
- 594 9. Are payments regulated on an ongoing basis?
- 595 10. Do you have a contract for regular fish supply?
- 596 11. Does the activity of the Local Fisheries Group help in searching for clients?
- 597 12. Who is responsible for transaction costs (eg. transport and risks when selling)?
- 598 13. Do you have your own stocking material?
- 599 14. Do you have in offer a fry? If so, who is the client?
- 600 15. Do you cooperate with other farms? or as part of the Cluster? in cooperation with research  
601 centres?
- 602 16. What constitutes the competitive advantage of your farm in the supply chain?
- 603 17. How is the percentage of fish losses during storage, loading, transport?
- 604 18. How do you solve the problem with overproduction - if it exists?

605

606 Appendix 2. The list of farming areas in the Lower Silesia Province

Names of farming area	area	District
	( ha )	
Complex of ponds inPracze	2.8	Milicz
Drogoszowice	4.9	Oleśnica
Complex,, Polny” in Żeleźniki	5.3	Milicz
Krzydlina Mała	5.4	Wołów
Obora	5.7	Lubin
Complex of five ponds in Uskorz Mały and Uskorz Wielki	7.0	Wołów
Godnowa	7.2	Milicz
Ponds in Brzeźnica	7.8	Ząbkowice Śląskie
Complex of ponds in Krzydlina Mała	8.9	Wołów
3 ponds in Dębno	9.3	Wołów

Bogatynia – Opolno Zdrój	9.7	Zgorzelec
Cieśle	10.2	Oleśnica
Jawor I Góry	10.4	Milicz
Modlikowice	11.2	Złotoryja
Raków	12.2	Wrocław
Trzebicko Dolne	12.5	Milicz
Milicz	12.9	Milicz
Jaśkowice Legnickie	14.0	Legnica
Nowy Folwark	14.9	Milicz
Wilka	15.4	Zgorzelec
Cieśle	16.2	Oleśnica
Mierczyce	19.0	Jawor
Ponds: Henrykowskie	19.7	Ząbkowice Śląskie
Four ponds in Pierstnica	21.8	Milicz
"RYBIENI"	22.3	Jelenia Góra
Kaszowo, Milicz	23.6	Milicz
Complex of ponds „Wszewilki”	27.7	Milicz
Miłkowice	41.9	Legnica
Complex of ponds „Wszewilki”	43.0	Milicz
Complex of ponds „Senne”	44.2	Zgorzelec
Complex of ponds "Uroczce"	71.2	Bolesławiec
Szczodre, Domaszczyn, Pruszwice	88.9	Wrocław
Complex of ponds „Syczków”	93.6	Zgorzelec
Ponds in Nowy Dwór	94.0	Oława
Wrzosy, Rudno	103.7	Wołów
Complex of ponds „Paulinki”	112.3	Legnica
Bieniowice, Reszotary	115.3	Legnicki
Complex of ponds in Podgórzyna	125.2	Jelenia Góra
Raszowa Mała, Buczynka	126.1	Lubin
Complex of ponds „Dębowe”	153.2	Zgorzelec
Ruda Żmigrodzka	175.0	Trzebnica
Complex of ponds „Stare”	217.1	Zgorzelec
Complex Zamienice, Kompleks Goliszów, Niedźwiedzice	435.7	Legnica
Complex of ponds: Ruda Sułowska Północna and Ruda Sułowska Południowa	770.5	Milicz
Complex of ponds: Potasznia, Bartniki, Gądkowice	791.6	Milicz
Complex of ponds: Krośnice, Żeleźniki, Goszcz I, Goszcz II i Goszcz III	1273.3	Oleśnica i Milicz
Complex of ponds: Niezgodą, Stary, Jelenie, Jamniki, Kokoty, Koniowskie, Przytockie, Zielony Dąb, Sanie, Raki and Ruda Żmigrodzka	1581.4	Trzebnica
Complex of ponds: „Milicz, Stawno, Stawno – Grabownica, Raków	1697.8	Milicz i Wrocławski
<b>Total</b>	<b>8493.3</b>	

607 Source: own study based on the list of the farming areas established by the Lower Silesia Marshal  
608 Office, Decisions of the Governor of the Lower Silesia Province in the years 2002-2005, 2006-2010  
609 and 2006-2014.  
610