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PERCEPTION OF ECOSYSTEM SERVICES PROVIDED BY CARP PONDS IN PASŁĘK, POLAND

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ABSTRACT: An assessment of perceptions of fishpond ecosystem services was conducted in Pasłek, a town located in northeastern Poland. Ninety-four expert interviews were conducted with non-fishermen. The survey included a list of 28 possible ecosystem services provided by fishponds. Environmental benefits were considered the most important, followed by social and productive services. Respondents rated the ponds' function as a place for fish spawning and reproduction highest, followed by their role as fire reservoirs and as a place for recreation and leisure. A comparison with other surveys showed that perceptions of ecosystem services in local surveys could be influenced by a number of conditions, including, among others, the nature and location of fish ponds. The survey showed that people not involved in fisheries and fish farming are aware of the wide range of ecosystem services fishponds provide. This is a positive social recommendation for European fisheries policy, which aims to develop aquaculture without deteriorating the environment, creating a balanced relationship between producers and consumers of production and non-production aquaculture products.

KEYWORDS: ecosystem services, multifunctionality, fishponds

Introduction

Poland has the largest area of carp ponds in the European Union countries; estimated at about 87,000 hectares (GUS, 2021). Annual domestic carp production varies between 16,000 and 20,000 tons (Eurostat, 2022). Poland is the leading European market for fresh carp, with stable consumption exceeding 21,000 mt (Lasner et al., 2020). Carp farming retains its traditional character, with the low intensification of production (up to 1,500 kg/ha) and a high share of natural food from the pond in the fish's diet (Raftowicz & Le Gallic, 2020). In carp farming, multi-species stocks (polycultures) are usually used. The share of other fish species, mainly amur, silverfish, carp, tench, pikeperch, sturgeon, pike and trout, is about 13% (Lirski et al., 2022).

Pond carp farming is part of aquaculture, generally understood as the rearing, breeding and cultivation of aquatic organisms (FAO, 2022). It represents the world's fastest-growing food production sector (FAO, 2021). There are two main divisions of aquaculture in Poland: traditional, semi-intensive carp farming in earthen ponds and intensive trout farming in various production facilities, including concrete ponds and plastic tanks (Turkowski, 2018). In the case of intensive trout farming, as in most intensive forms of aquaculture worldwide, the ecosystem approach is primarily to minimise their negative environmental impacts. This impact is different in the case of traditional pond carp farming, which has been developing for centuries in Poland and other European countries (Adámek et al., 2012; Mathé & Rey-Valette, 2015).

The EU's Blue economy strategy identifies aquaculture as a high-potential sector that can boost economic growth and bring social benefits through new jobs (European Commission, 2022). Non-productive aspects of aquaculture are also important, especially in an ecosystem approach for aquaculture, which is defined as a strategy for integrating the activity into the broader ecosystem (Soto et al., 2008). The European Maritime and Fisheries Fund includes financial support to accelerate aquaculture development, thus providing ecosystem services (Regulation, 2014). The problem is that there is still little knowledge of fishpond ecosystem services, especially among people not professionally involved in fisheries.

Ecosystem services

The concept of ecosystem services emerged as early as 1981 as a joint initiative of economists and environmentalists. They stressed that valuing nature's services in economic decisions could correct the misjudgment of the relationship between humans and nature. The universal definition of ecosystem services was proposed by Costanza et al. (1997): "the benefits humanity

derives directly or indirectly from ecosystem services.” In Poland, research on mapping and assessing ecosystems and their services was also undertaken relatively quickly. Following Lupa and Stępniewska (2019), it is worth mentioning here the early studies by Ryszkowski (Bunce et al., 1993), and Żylicz (2000).

Initially, ecosystem services were attributed only to natural ecosystems. However, it was recognised fairly quickly that, in addition to producing food, feed and raw materials, agriculture could also provide ecosystem services just like natural ecosystems.

As defined by the Ramsar Convention (1971), earthen fish ponds are classified as wetlands and provide ecosystem services similar to those generated by natural wetlands and shallow lakes (Dobrowolski, 1995; Cižkova et al., 2013; Nyman, 2011). However, unlike natural water bodies, water and trophic conditions in ponds are controlled and modified by fish farmers. Therefore, the services mentioned above correspond more closely to the concept of non-productive values in multifunctional aquaculture (Békefi & Váradi, 2007; Popp et al., 2018). Given the widespread use of the term “ecosystem services” in the aquaculture literature (Mathé & Rey-Valette, 2015; Wietzman, 2019; Willot et al., 2019), as well as in Regulation (2014), this article also uses the term “ecosystem services”.

The article aims to identify and assess perceptions of ecosystem services provided by fishponds located on the outskirts of the city of Pasłęk in the Warmian-Masurian Province. The data used in the study came from surveys conducted with people who are not fish farmers, but owners and residents of properties near the ponds.

Material and methods

Study area

The survey was conducted among residents of Pasłęk, a small town (about 12,000 residents) in the Warmian-Masurian Voivodeship. The province is dominated by agricultural land (54%) and forests (32%). The Warmian-Masurian Voivodeship has the largest total area in the country of 115,361 hectares of inland waters (mainly lakes) and the lowest population density (59 people against the national average of 123 people per 1 km²). In Warmia-Mazury, there are 16 zones under area protection (national parks, nature reserves) and 44 special zones belonging to the Natura 2000 network. Commercial breeding ponds in the province cover a relatively small area of a total of 1850 ha. An additional 1,000 hectares are estimated for the remaining small ponds and other small water reservoirs used on farms for amateur fish farming and breeding.

38 hectares of fish ponds are located in the northeastern part of the town (Figure 1). The ponds are used for an incomplete breeding cycle to raise stocking material, mainly carp fry. The ponds are irrigated from the Wąska River. Two similar 14 hectares of recreational ponds are located on the other side of the ecological park and are irrigated from the same river (Figure 1).

Data collection and analysis

The survey was conducted in July and August 2019 among 94 people (Table 1) living near the ponds located in Pasłek (Figure 1). The structure of the random sample of respondents did not differ from that of the general population of the township, except for the much higher university education and the much lower primary education, which averaged 9.5% and 30%, respectively, for the whole town (Polska w liczbach, 2022).

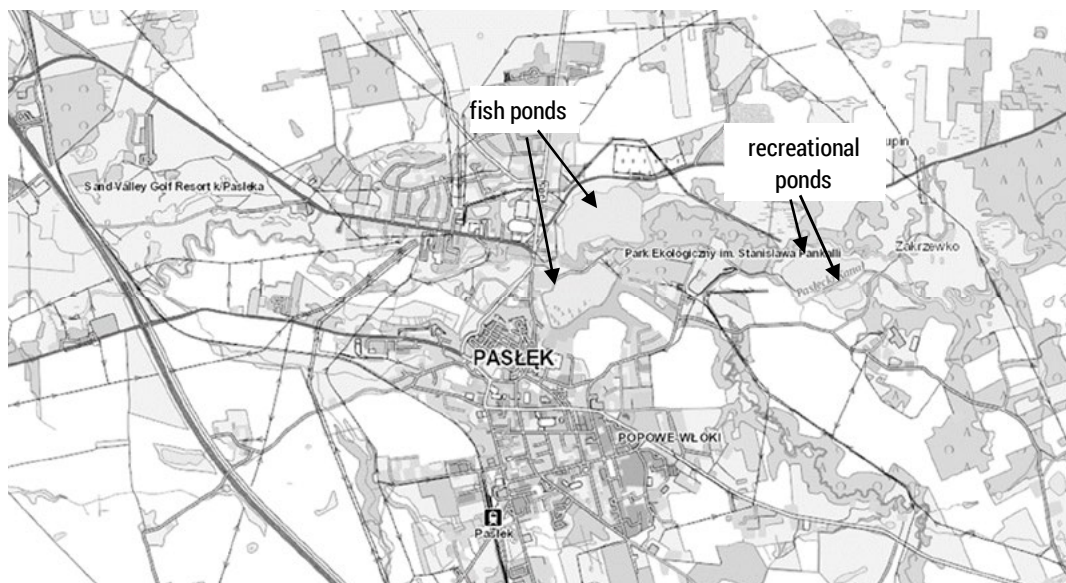


Figure 1. Location of earthen carp-type ponds in Pasłek

Source: authors' work based on Geoportal (2022).

The interviews were conducted face-to-face. They began with a brief general description of the study and its objectives. On average, the interview lasted about 45 minutes and was based on closed-ended questions aimed at revealing preferences in ranking selected potential pond ecosystem services.

Table 1. Characteristics of respondents

Specification	Number of people	%
Gender		
woman	40	43
man	54	57
Age		
18-30	6	7
31-40	18	19
41-50	21	22
51-60	20	21
61 and more	29	31
Education		
primary	3	3
basic vocational	23	25
secondary	36	38
higher	32	34

The study used a list of 28 possible ecosystem services presented alphabetically, including 6 productive services, 13 environmental services and 9 social services. They corresponded in principle to the classification of pond ecosystem services used by Mathé and Rey-Valette (2015). However, due to the fact that Paślęk ponds are located practically in an urban area, the social functions were complemented by the function of the ponds as a fire reservoir and a source of spiritual inspiration.

Respondents rated the importance of each service, assigning points from 1 (not important) to 5 (very important). The results were presented in percentage terms.

Results

Ponds as places of fish spawning and reproduction were seen as the most important pond services (74%). Fewer indications, by two percentage points, were given for the function of the ponds as a fire reservoir (72%). Fish and other aquatic organism production services were ranked only sixth with a score of 56% (Figure 2).

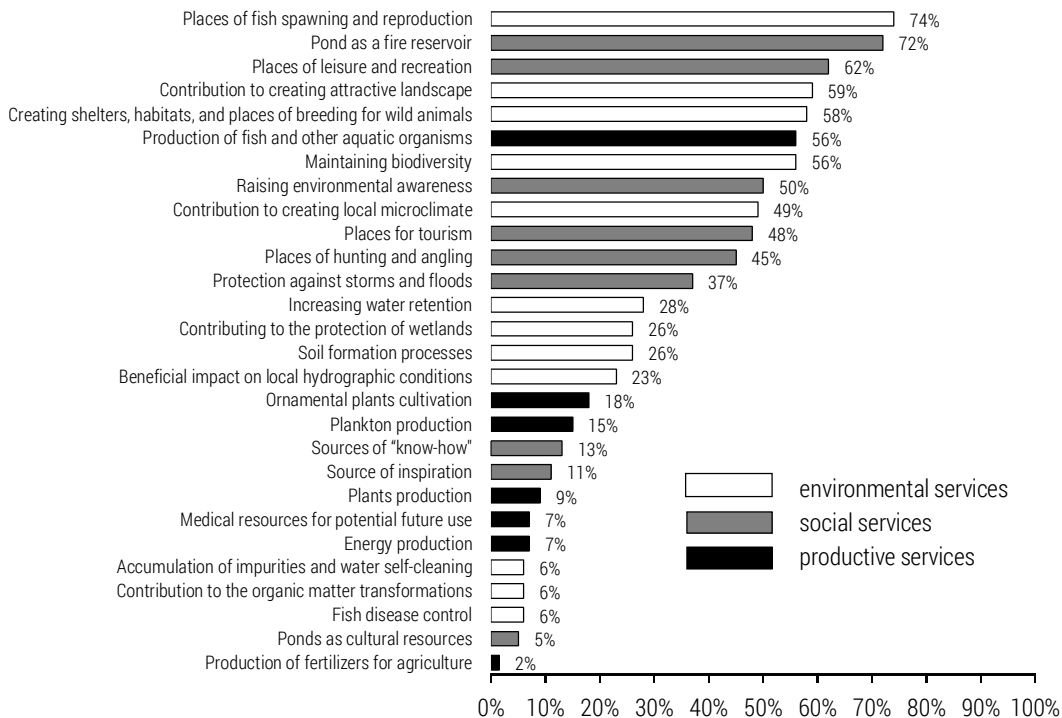


Figure 2. Preferences of ecosystem services of ponds in Pastek

In general, environmental services were indicated as the most important (48%), social services received slightly fewer indications (39%) and productive services were mentioned much less frequently (13%).

In addition to the dominant service of ponds as a place for fish spawning and breeding, among environmental services, the contribution of ponds to the creation of an attractive landscape (59%), shelter, residence and breeding sites for wildlife (58%), maintenance of biodiversity (56%) and creation of a local microclimate (49%) were considered important. The other environmental services: increasing water retention (28%), contribution to the protection of wetlands (26%), beneficial impact on local hydrographic conditions (23%) and soil formation processes (23%), were generally thought to be of little importance, whereas contribution to organic matter transformation, accumulation of impurities and water self-cleaning, as well as fish disease control (all 6% each) were considered less relevant (Figure 3).

Among social services (Figures 2 and 4), the pond's role as a fire reservoir got the highest rate of 72%. Other social services, such as ponds as a place of leisure and recreation (62%), source of raising environmental

awareness (50%), and place for tourism (49%), as well as hunting and angling (48%), received slightly lower ratings, as did the role of ponds in protection against storms and floods, which was perceived as also somewhat important (32%). Ponds as a source of “know-how” (13%) and a source of inspiration (11%) were assessed significantly lower. The lack of historical devices was probably the main reason for the poor assessment of ponds as cultural resources (5%).

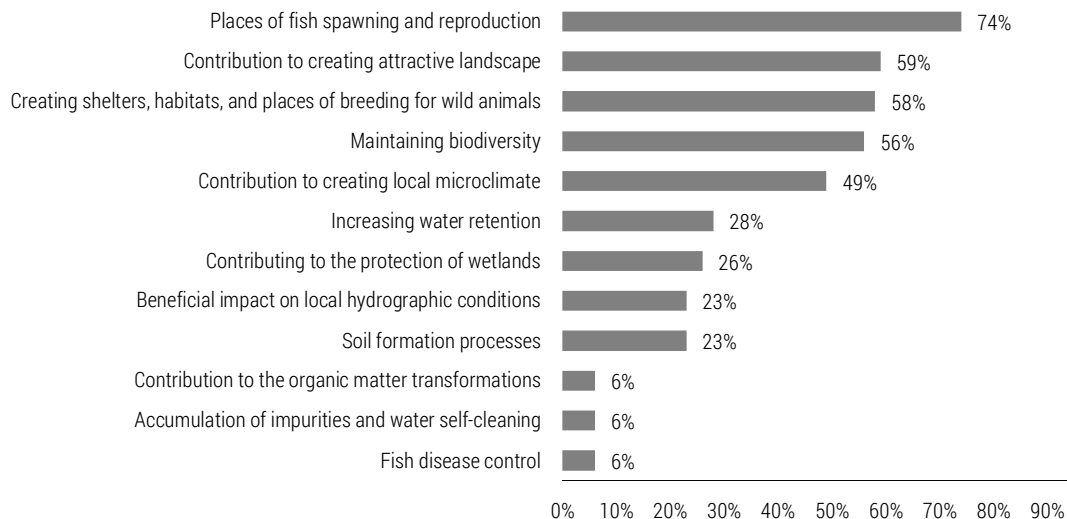


Figure 3. Preferences for environmental ecosystem services of ponds in Pasłęk

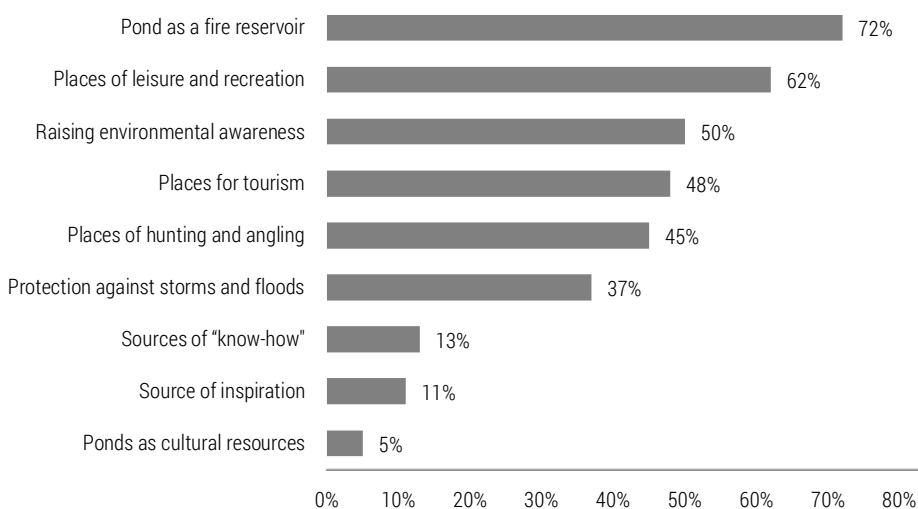


Figure 4. Preferences of social ecosystem services of ponds in Pasłęk

As has already been mentioned, fish and other aquatic organism production were rated the highest (56%). Other productive services, including ornamental plants cultivation (18%) and plankton production (15%), were generally thought to be of little importance, whereas medical resources for potential future use (e.g., medicinal plants) (7%), production of energy (7%) and of fertilisers for agriculture (2%) were regarded as irrelevant (Figure 5).

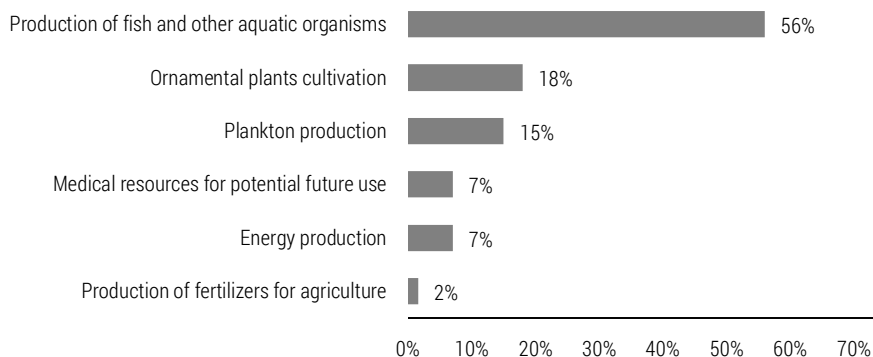


Figure 5. Preferences of productive ecosystem services of ponds in Pasłęk

Discussion

In the ichthyological literature, the non-productive benefits provided by fishery-used carp ponds received attention in Poland as early as the 1970s (Leopold, 1983). In this and later studies (Guziur, 2000; Guziur, 2018; Turkowski & Lirski, 2011), the issues are presented from the point of view of knowledge and experience of experts involved in fisheries as a scientific discipline. On the other hand, the first studies of the perception of ecosystem services by fish farmers themselves were conducted in 2019 (Turkowski, 2021a; Turkowski, 2021b). However, from the point of view of identifying and economically capturing ecosystem services, more important is their perception and evaluation by their beneficiaries, including owners of properties near ponds, tourists, nature lovers and others who are not fish farmers.

This article presents the results of a pilot study conducted for the first time in Poland among people not professionally involved in fisheries and fish farming. Previously, similar studies in Europe were conducted only in France. The study also aimed to address perceptions of ecosystem services of carp-type ponds by people outside fisheries. However, they focused on two large clusters of ponds of 7,000 hectares and 8,800 hectares each, located in undeveloped, ecologically valuable areas (Mathé & Rey-Valette, 2015). The size of

the ponds and, above all, their location did not fail to influence the results. Nevertheless, it is worth comparing them with the results obtained in Pasłęk, taking into account the above differences.

In both surveys, the order in which the main types of ecosystem services were evaluated was the same. Environmental services were indicated as the most important, followed by social and productive services.

However, there were already significant differences within service groups. Among ecological functions, French respondents placed far greater importance on the contribution of ponds to sustaining biodiversity (90% of indications vs 56% in Pasłęk), creating shelter, habitat and breeding sites for wild animals (71% vs 58%), their role in shaping local water relations (58% vs 23%), and in the accumulation of pollutants and self-purification of water (47% vs 6%), as well as the contribution of ponds to wetland protection (58% vs 26%), soil-forming processes (31% vs 23%), and the transformation of organic matter (22% vs 6%). The French survey (Mathé & Rey-Valette, 2015) also highlighted the positive impact of the presence of ponds on the control of fish diseases (39% vs 6%). In contrast, respondents from Pasłęk gave more importance to the role of ponds in creating spawning sites and fish reproduction (71% vs 46%), creation of attractive landscapes (59% vs 36%), and local microclimate (49% vs 32%). The retention functions of the ponds were rated at the same level of 23% in both studies.

In the French study, two social services of ponds were by far the most dominant: cultural, related to tradition, and the recognition of ponds as national heritage (59%), and the role of ponds as a source of specific traditional knowledge (know-how) (37%) (Mathé & Rey-Valette, 2015). Respondents in Pasłęk did not place much importance on these functions, rating them at 5% and 13%, respectively. In this case, the difference seems obvious. In France, fishponds were built next to monasteries as early as the Middle Ages. This was associated with the religious custom of eating fish on Good Friday. Until the French Revolution, the aristocracy and clergy owned 90% of the country's ponds (Mathé & Rey-Valette, 2015). The ponds in Pasłęk, which were put into operation in 1985, do not have such a long history. Their location near the Pasłęk castle was not a significantly contributing factor. On the other hand, their function as fire reservoirs was highly rated (72%). In the case of French ponds, located in extensive wetlands, the question of the possibility of the above role was completely unfounded and was not even asked.

In both studies, similar indications were given for services related to the implementation of hunting and fishing in ponds, as well as the contribution of ponds to stormwater and flood protection. In contrast, the possibility of leisure and recreation based on ponds was rated significantly higher in Pasłęk (62% vs 31% in the French study).

Significant differences emerged when assessing ponds as a place for the production of fish and other organisms, which was rated at a very high level of 90% in the French study. Only the contribution of ponds to maintaining biodiversity was rated as high (Mathé & Rey-Valette, 2015). In Pasłek, this function was rated relatively lower, at 56%. Such a result may have been due to the fact that during the study period, the Pasłek ponds, unlike the French ponds, mainly grew stocking material, and the fish farm did not operate a fish store or fish bar.

It is worth noting that in both countries, carp is subject to political odium. Carp in France was identified with the aristocracy and the clergy, and after the French Revolution, the tradition of eating this fish at Christmas disappeared. In Poland, on the other hand, where the tradition is still strong, the Christmas consumption of carp is often attributed to the communist time (Kowalski, 2022), forgetting the centuries-old tradition.

Conclusions

The non-productive values of carp fish ponds have already been recognised by ecologists (Dobrowolski, 1995), fisheries experts (Leopold, 1983) and fishermen (Turkowski, 2021a). The presented pilot research suggests that people not involved in fish farming are also fully aware of the importance of the ecosystem services of the ponds.

Environmental services were identified as the most important, followed by social services and productive services. The most important environmental services of fishponds were considered to be the function of ponds as a spawning and breeding ground for fish, their contribution to the creation of an attractive landscape, but also their function as a place of shelter, residence and reproduction of wild animals, and their contribution to the maintenance of biodiversity. Among the most important social services of fishponds were their function as fire reservoirs, a place for rest and recreation, and their role in raising environmental awareness. The production of fish and other aquatic organisms has been identified as the most important productive service of fishponds.

A number of conditions can cause differences in the perception of ecosystem services in local studies. Their evaluation depends on the knowledge and needs of the various stakeholders, the mutual and dynamic relationship between them and the services, but also on the nature and location of the fishponds. The reasons for differences in the perception of ecosystem services of Pasłek's and French fishponds should be sought in their different sizes and locations rather than in the attitudes and characteristics of the respondent groups surveyed.

The results, both presented and cited in the discussion, showed that non-fishermen are aware of the wide range of ecosystem services provided by fishponds. This can be taken as a positive social recommendation for a European fisheries policy that aims to develop aquaculture without deteriorating the environment, creating a sustainable relationship between producers and broader consumers of production and non-production aquaculture products. The research was a pilot study, and the broader application of the results requires further research. In practice, it may contribute to correcting the water-environmental compensation paid to fishpond users for ecosystem services, which is currently discretionary in nature and not supported by adequate research. Another aspect concerns water-environmental permits for fishponds. Permit decisions consider only the production aspects of the ponds, completely ignoring the ecosystem services they provide.

Acknowledgements

The research was co-financed by the European Union under the National Technical Assistance of the Rural Development Program for 2014-2020 (Poland).

The contribution of the authors

Konrad Turkowski – development of survey template, data analysis, literature review, preparation of article content – 50%.

Michał Dubrowski – development of survey template, data collection, data analysis, preparation of article content – 50%.

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