



SUFISA FISH FARMING REPORT

CASE STUDY in GERMANY

AN EXTENDED SUMMARY

June 2018



“The term ‘aquaculture’ has a very bad connotation in the area due to negative impacts of intensive circular system fish production. For that reason, stakeholders avoid the term for the low-intensity fish farming in traditional earth ponds.”

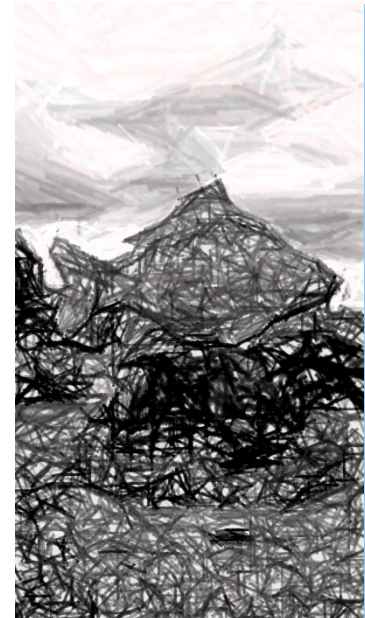
“Since the dams have a significant ecological value, the lengths of the dams with about 1,400 km in total is very important in respect to nature conservation and cultural landscape protection. But note: When comparing different regions, it is important to check if total pond areas cover only water surfaces as in Saxony or include dams as in Franconia!”

“Due to the high costs for investment, high operational costs and the particular professional qualification of the managing team needed, it is very difficult to realise profits with RAS in Germany!”

“Linking agricultural systems with aquaculture helps to establish a closed circular flow of nutrients. Both branches profit from synergies.”

Content

1	Introduction.....	
1.1	Three pillars of German aquaculture production.....	
1.2	Characteristics of the production systems and regions studied	
2	Methodology	
2.1	Data collection.....	
2.2	Two foci of the aquaculture case study	
3	Policy, regulatory and market conditions	
4	Vertical integration of fish farming and cooperation among producers	
5	Sustainability performances of fish farming	
5.1	Sustainability of traditional carp farming.....	
5.2	Sustainability issues of RAS	
6	Challenges, chances and underlying strategies of RAS farmers.....	



*“Fish farmers
have to be
business
people who
seek to add
value to their
products.”*

1 Introduction

SUFISA aims to identify practices and policies that support the sustainability of primary producers in a context of complex policy requirements, market imperfections and globalization. Knowledge on market conditions and other driving forces exists, but in a fragmented way: relevant producer groups and regions have not yet been analysed or framework conditions and driving forces have changed in the meantime. More information can be found on the SUFISA website.

Aquaculture is the global food industry's fastest growing sector. The 2015 dataset of the FAO contains records of 591 aquatic species and species groups ever farmed in inland freshwater, inland saline water, coastal brackish water and marine water. These four types are the different forms of aquaculture production systems. Approximately 90% of global aquaculture production is in Asia. International experts see further growth potential in many countries worldwide. In Europe, aquaculture is expanding only in Norway with salmon and salmonids production.

In Germany total fish consumptions accounts for 608,000 t. Thereof 140,000 t was fish from aquaculture, which was mainly imported (76.9%). Only, 23,000t (23.1%) were produced in Germany accounting for 3% of the total national consumption. The development of aquaculture in Germany has stagnated even though the country's water resources and technological capacity provide the foundation for a competitive sector. In Germany, fresh water aquaculture is the most common system, either in natural ponds or in artificial through-flow systems. Small fish farmers dominate. Most of them produce fish alongside with other agricultural or non-agricultural activities.

This summary report focuses in particular on the key market and regulatory conditions that potentially impact fish farming businesses, and the key strategies emerging to manage these risks and pressures. The report is part of the EU-funded Horizon 2020 project, SUFISA (Sustainable finance for sustainable agriculture and fisheries). This is an extended summary based on the full report, available [here](#).

1.1 Three pillars of German aquaculture production

Traditional aquaculture species cultivated in Germany are rainbow trout and common carp. In general, trout farming in freshwater flow-through-systems is the most profitable branch of production, both in terms of quantity and the revenue generated. Two thirds of the flow-through-systems for trout are located in the south of Germany, in particular in the region of Baden. In general, trout farming in freshwater flow-through-systems is the most profitable branch of production, both in terms of quantity and the revenue generated. Two thirds of the flow-through-systems for trout are located in the south of Germany, in particular in the region of Baden. The farming of carp in freshwater ponds is the second major type of German aquaculture practiced and has a long tradition.

Typical carp pond landscapes are located in the north of Bavaria (Franconia), and in the eastern Federal States of Saxony and Brandenburg. The profitability of many carp farms faced economic challenges because carp consumption has been steadily shrinking over a long time and producers in the neighbouring countries such as the Czech Republic and Poland are strong competitors.

Recirculation aquaculture systems (RAS) are alternative 'high-tech' production systems that reuse the water from the fish tanks after purification. The national strategy for aquaculture, published in 2014, highlighted the objective to increase the German aquaculture production from RAS significantly. RAS can be warm- or cold-water plants. Most fish farms use freshwater but along the

coastline, inland salt water systems have been tested. RAS enterprises produce trout, catfish, carp, pikeperch (zander), and various other fish species, crustacean, or algae. Technical problems were key issues during the 1990s and early 2000s. Today, RAS use reliable technologies but the number of farms is still very limited. Technical expertise, high costs of production and the compliance with manifold legal requirements challenge existing and new fish farms.

1.2 Characteristics of the production systems and regions studied

The SUFISA case study on aquaculture in Germany has two foci, traditional carp production in Middle Franconia with its important role for nature and landscape conservation, and intensive fish production in Recircular Aquaculture Systems in northern Germany.

Focus 1 - Carp ponds in the Aischgrund: One of the key areas for traditional carp production is located in Middle Franconia, in the west of the city of Nürnberg (Aischgrund). Most pond farms in Bavaria are family owned, small size and operate at low levels of production. In contrast, specialized companies mainly operate pond farms in the Saxony and Brandenburg. The geographical area of the Aischgrund is situated along the river Aisch, and recognition outside of its region. However, the Aischgrund has national and international recognition among aquaculture experts due to the characteristic carp breeding line of the 'Aischgründer Spiegelkarpfen'. The carp represents the pond landscape and transmits regional identity and integration. Rural tourism has improved recently. Stakeholders from the Aischgrund region reflect on the opportunity to apply for registration as an UNESCO World Heritage site because the area has 7,000 ponds with a total pond area of 2 800 ha (including dams). Since the dams have a significant ecological value, the total length of which is about 1,400 km. They are very important in respect to nature conservation and cultural landscape protection. Some of the ponds or chains of ponds are classified as nature conservation or bird protected areas. The fertility of the agricultural soil is reduced due to clay layers in the soil and subsoil (depending on the site). Common arable crops are barley (for the well-known breweries in the area); maize (for bio-gas plants and animal feeds); oats and triticale-legume crop mixtures for carp farming. Due to the reduced soil fertility and unfavourable farm structures, framework conditions for agriculture are difficult. Many farmers cultivate vegetable crops such as horseradish, onions or beet.

The level of professional education in respect to aquaculture and/or the marketing of fish is relatively low. The good practical knowledge results from own experiences and the traditional knowledge of local families. Many farmers work part-time in agriculture and aquaculture. Usually, they earn their living in the industrial sector because several corporations are located in the area. Unemployment rate is very low. The majority of the typical small scaled farmers (<1 ha) gain nearly the total annual income (95%) from employment in other sectors. Access to the fish market is difficult for the large number of small producers. Most farmers depend on a few fish wholesalers who collect, grade, process and distribute the fish to restaurants in the closer and wider area as main sale channel.

The production cycle consists of three seasons. Breeding takes partly place in breeding tanks under protected conditions and partly under natural condition in small spawning ponds. Carp need warm water particular for breeding. In the third year, fish of around 1.5 kg/animal are harvested and sold for consumption. Most small farmers buy bigger young fish from professional farmers because their own opportunities to nurture fry and fingerlings are limited. The main production challenge is loss of small fish by predators, mainly the cormorant. Fish feed high value protein from natural sources (zoo- and phytoplankton). Instead of fishmeal or soy based nutrition, farmers only feed fish with a mix of cereals –sometimes only with legume crops (triticale, barley, lupines and peas). The fat

content of the slaughtered fish is of high importance for the quality of the end product. Harvest takes place in September/October when all ponds are emptied. After harvesting, carp are watered – put in clean water ponds or tanks – for 10-14 days. Young fish go back into the refilled ponds again while sufficiently large fish are held in clean water tanks. Fish for consumption remain in clean water storage tanks during the winter months. After Easter, farmers usually return unsold carp to the natural ponds. Compared to intensive aquaculture systems, traditional carp farming shows a variety of farm specific technical or organisational solutions. Due to this variety, input and output differ between farms and pond as well as years. Carp farming depends highly on natural conditions. Due to the losses caused by predators, the output from these low-intensity aquaculture systems vary considerably. The variety in size of carp, fat content of the meat, and taste is a challenge for a potential growth of over-regional marketing. Moreover, the product is strongly seasonal because sales are limited to September-April.

Soil and rock structure, as well as the PH-value affect the fertility of the ponds. Due to the high content of lime in the sub-soil, water is not leaching from the earth ponds. Since many ponds are connected in a row, the so-called 'pond-chain' ('Teichkette'), there is a significant interdependency of ponds, water and the potential spread of diseases.

Focus 2 - RAS in Northern Germany: Recirculation aquaculture systems (RAS) are alternative production systems that reuse the water from the fish tanks after purification. In the ideal situation, the water circulates continually and hardly any fresh water enters the system but even semi-circulating systems with a higher proportion of continuously in- and outgoing water are defined as RAS (as long as the maximum does not exceed 10% of the total water volume). RAS exist as either warm or cold water systems. RAS with cold freshwater produce eel, trout, zander (pikeperch), carp and some other species. In 2016, Germany had around 48 warm water plants stocked with around 2,200 tonnes of tropical fish species. Farm enterprises usually establish RAS in connection with the construction of a biogas plant because warm water fish system (23-28°C water temperature) can use the exhaust heat of the biogas plant efficiently. Costs for heating represent about 15% of the total costs of production. Policy and funding schemes are very important for the development of biogas plants in Germany.

While traditional fish farming systems are closely linked to site-specific conditions, RAS are independent from landscape, soils and surface water supply. Consequently, the selection of construction site depends on local rules for constructions and economic aspects such as the connection to relevant markets. The technical implementation of RAS differs between farms, which hinders standardised authorisation processes. Most of the enterprises are still pioneers in the field of intensive fish production. Production statistics show that the number of plants fell while the total production increased from 2013 to 2014.

2 Methodology

2.1 Data collection

Key to the approach taken has been to put the farmers themselves at the centre of the research, in order to get their perspectives on the key issues that need to be considered. In the first instance, a desk-based analysis of market conditions and regulations took place for both aquaculture case studies (sources reviewed included: academic publications; information for practitioners; international reports (FAO and OECD); national government and policy documents – namely the National Strategy and the DAFA Strategy etc.). In addition, we analysed documents from NGOs,

supplemented with expert interviews. Secondly, ground proofing of the outcome of the desk-based analysis was done through two focus groups with around twelve participants (farmers), additional interviews from the local, regional and national level, and a stakeholder workshop during a national conference.

We organised these activities in close cooperation and with support of regional stakeholders (Bavarian centre for fish production, Lower Saxony Chamber of Agriculture, Schleswig-Holstein Ministry for Agriculture and Fisheries) and in close cooperation with the Thünen Institute for Fisheries/Fish ecology.

2.2 Two foci of the aquaculture case study

In 2016, the SUFISA-team joined the case study work on traditional carp of the SUCCESS project, another H2020 Research and Innovation Project on fisheries and aquaculture. Due to this established relationship and the already existing work from the SUCCESS case study on carp, traditional carp pond farming in Middle Franconia represents the first focus of our aquaculture case study. Originally, the idea for the second case study focus was to run a focus group on trout production in the Black Forest area because the industry and the area are of particular economic relevance within the German aquaculture sector. However, the head of the local fisheries centre at Lake Konstanz, responsible for research and advice in the field of trout production, suggested to avoid the focus group in the area, for several good reasons, among them a lack of interest and support of potential participants. Due to this friendly refusal, we decided to cooperate with the Chamber of Agriculture Niedersachsen, and to redirect our emphasis on RAS in Northern Germany.

The organisation of the focus group in the centre of Niedersachsen took place on a farm with agricultural and aquaculture production including fish processing. It was again a joint event of the HNEE and the Thünen-Institute for Fish Ecology, this time organised by the SUFISA team supported by the Chamber of Agriculture Niedersachsen, Hannover. The main results were farmers' challenges related to public administration and authorisation, policy support measures and vertical cooperation issues. For the stakeholder workshop concept, it was therefore necessary to communicate and discuss these key results with key persons from the industry and from politics and administration on a higher level. However, it was not feasible to organise such a national (or northern German) workshop because the Thünen-Institute had organised a similar event in the summer of 2016, and stakeholders were tired of discussing hampering framework conditions. Instead, we decided to cooperate with the Ministry of Agriculture in the Federal State of Mecklenburg-Vorpommern for the stakeholder workshop. This workshop focused on horizontal cooperation for the production of young carp in RAS. It took place in the context of the national conference 'German Fisheries Day 2017' in Bonn.

3 Policy, regulatory and market conditions

The following paragraphs highlight the most relevant policy, regulatory and market conditions that fish farmers and stakeholders pointed out in interviews and during workshop events.

Boosting the EU's aquaculture industry is one of the key elements of the reformed Common Fisheries Policy (CFP). This is no surprise, as farmed seafood is becoming widely recognised as a vital part of our future food supply. On a global level, the Food and Agriculture Organization (FAO) estimates that about half of the fish consumed today comes from aquaculture. In the EU, imported seafood accounts for 65% of consumption, and the gap between seafood production and demand

continues to grow. There are limits on how much capture fisheries can sustainably produce, so it is up to Europe's aquaculture sector to fill the gap. While European aquaculture is at the forefront of technical expertise and environmental regulation compliance, its growth is stagnating. The reformed CFP aims to reverse this trend and unlock the industry's considerable potential.

Aquaculture and the reform of the Common Fisheries Policy

Bureaucracy has been identified as one of the main inhibitors of aquaculture investment and development in the EU. The administrative barriers to securing a licence needs to be reduced in order to encourage entrepreneurship and private funding, without jeopardising the high level of consumer and environmental protection enshrined in EU law. Parallel to this, spatial planning in coastal areas and river basins will help guarantee aquaculture producers adequate access to the space and water they require, whilst minimising impact on the environment and related sectors, such as tourism (EU Commission, 2016). The European Maritime and Fisheries Fund (EMFF) provides financial support for the development of the aquaculture sector during the European funding period of 2014-2020 (EU Commission, 2016). The Commission intends to boost aquaculture through the Common Fisheries Policy (CFP) reform, which has the same premise as the Common Agriculture Policy (CAP); but it has no first and a second pillar. Fish farmers have access to measures of the rural development programme depending on the plan of the particular federal state in Germany.

Common Organisation of the Markets for fish

The EU policy for managing the market in fishery and aquaculture products is one of the pillars of the Common Fisheries Policy (CFP). The Common Organisation of the Markets (COM) strengthens the role of the actors on the ground: producers are responsible for ensuring the sustainable exploitation of natural resources and equipped with schemes to better market their products. The COM supports measures that inform consumers about the fish products sold on the EU market, which, regardless of their origin, must comply with the same rules. The EU Commission claims The Common Organisation of the Markets has developed into a flexible instrument that ensures the environmental sustainability and economic viability of the market for fishery and aquaculture products.

Support for carp farmers in Bavaria

EU area payment for agricultural land (CAP): payments are only available for arable and grassland, not for pond area. The European Rural Development Programme encompasses the opportunity for national/Federal Rural Development Programmes to include support for fish farmers under the related articles of e.g. farm investment, agri-environmental schemes, farmers' cooperation, farm advice, conversion to organic farming.

Rural Development Plan in Bavaria (KULAP): The compensation payment for less-favourable areas in Bavaria does not include pond areas. The participation in an agri-environmental measure requires a maximum stocking rate of 600 fish/ha in the Aischgrund area. LEADER and Local Action Groups related to carp farming contribute to regional development. Support provided by the European Fishery Fund (EFF) has been used in the context of several projects. Thanks to European funds (EFF and RDP) and other sponsors (local institutions, firms), local stakeholders founded the regional tourist (and regional management) office 'Karpfenland Aischgrund' in 2013. The main objective of the office was to promote the Aischgrund region for tourism based on its positive image and the offers of 'carp kitchens'.

Vertical cooperation through cooperatives and associations

Pond cooperatives ('Teichgenossenschaften') are legally registered public unions. The cooperative has been responsible for the administration of the official grants to rebuild and maintain the ponds since the Second World War. The maintenance of field roads ensuring access to the ponds and sometimes the organisation of sales are important activities. Cooperatives nowadays aim to enhance farmers' framework conditions for a sustainable use of ponds. Cooperatives are responsible for the representation of its members' interests in all areas of concern. Local pond cooperatives help to define standards (e.g. for the marketing of the Aichgründer association) and supported registration of e.g. Protected Geographical Indication (PGI). A close cooperation between organizations is crucial for the success of the regional development strategies focusing on the maintenance of ponds and fish production. The integration and participation of fish farmers has been a success factor for the regional development activities. Trust has been built up in recent years. Group ownership of ponds ('Teichgemeinschaften'), are another type of producers' union. When large ponds were sold in the past, single farmers were not able to buy them on their own. Instead, a group of, e.g. 20, small farmers purchased the pond under the concept of multiple-ownership. Each member of the group is a registered owner in the land title register and holds a share of the pond. Farmers share revenue and costs. This concept has existed for the past since 200 years; thus, no formal cooperation as an association or cooperative is needed.

Legal framework for operators of recirculation systems

The Renewable Energy Act (EEG) offered the opportunity for operators of bioenergy plants to receive a higher price for energy fed into the grid if the exhaust heat is used efficiently. The production of warm water fish sometimes uses this exhaust heat. In addition, operators of RAS need to take into account a variety of laws, which are irrelevant for aquaculture in earthen ponds.

The EU regulation for organic farming does not allow organic fish production in RAS. Only breeding, the production of seedlings of organic fish systems and the cultivation of organisms for the feeding of organic fish are allowed to take place in tanks of RAS. Fish production in tanks is in legal terms not classified as farming but as a commercial operation ('Gewerbebetrieb'). Obtaining official permission for the construction of a RAS is often very protracted and complex. RAS usually need permission for wastewater disposal, and operators have to pay wastewater fees, which are irrelevant for other fish farmers.

National level institutional framework for the aquaculture industry

The national policy for aquaculture has two main objectives: the increase of fish production in Germany and the maintenance or establishment of the sustainable production of healthy products that are traded internationally.

Germany has a three-tiered system of government with the national level, the Federal States (i.e. regional level) and the local level (district/county): Federal States are responsible for nature conservation and aquaculture legislation; and they have administrative control. Consequently, legal and administrative rules and regulation for fisheries and aquaculture may differ between regions. National authorities can only have a very limited impact on the industry's development. On the regional level, several authorities are concerned with aquaculture matters, which is water management, nature protection or construction. The most important authorities are local water authorities.

In the past, legal conditions in respect to nature conservation issues have been subject of legal disputes between individual carp farmers and nature conservation agencies. The Department for Carp Farming and farmers' organisations cooperate with the Bavarian agency for water aiming to

develop new guidelines for the use of carp ponds in the area. Such guidelines will help to avoid legal conflicts and individual negotiations between fish farmers and the administrative agencies.

Market conditions

Driving forces on the market of aquaculture products in Germany are complex. Statistics on market structures, contractual agreements, and prices do not exist. Many marketing channels represent niche markets due to small volumes and specificity of product qualities. For that reason, fish farmers' information on demand, prices or emerging new trends depend on the individual engagement and the work time available for sales and marketing. Moreover, personal contacts to key persons in the specific economic cluster or network are highly relevant.

Value chain for carp in the Aischgrund

Most fish farmers in the Aischgrund produce small volumes. For that reason, they sell either to fish wholesale companies or directly to restaurants. Prices are relatively low per kilogramme fish. They are higher in direct marketing but this is a challenging business. Since carp is always served freshly slaughtered, the fish is kept in tanks until consumption. The wholesalers in the area buy fish from the farmers and store it.

One dish consists of half a fried fish with supplements and has a price of around 10 Euro. The producer's revenue of 2 Euro per fish represents 10% of the value paid by the end-consumer for two half fish dishes (20 Euro) in the restaurant. Bigger fish, which is too large, will enter processing, go into direct marketing, or leave the area through the wholesaler. In the Aischgrund, local stakeholders have been aiming for years to help farmers to increase sales revenue and to realise a producer price of 3.50 Euro/kg; without success.

Joint marketing of Aischgründer Karpfenland

Carp farming is a low-intensity system with mainly positive impacts on the natural environment. For that reason, the World Wide Fund for Nature (WWF) presents the carp as the most sustainably farmed or caught fish. Since 2013, the Aischgründer carp is certified via Geographical Protected Indication (GPI). Linked to this branding, the marketing agency 'Karpfenland Aischgrund' has started to promote the carp within the Aischgrund area and beyond its borders. A small but growing network of restaurants aims to foster carp sales outside Franconia. These partner restaurants are labelled as a special gastronomy for the typical Aischgrund carp dishes.

Two different organisations foster the regional marketing of the typical carp product. The 'Aischgründer Karpfenland' (carp land Aischgrund) association, a marketing and tourism organisation, started around the year 2000. It provides member restaurants with special designation that distinguishes them as supporters of local fish. So far, it enhances together with the 'Teichgenossenschaft Aischgrund' (pond cooperative) mainly the marketing of the fish in the area. However, over-regional marketing has started only recently. Steady funding of the association and the continuation of marketing activities are challenging. Currently, inhabitants pay a very small fee for the support of the organisation. Voluntary support of the local industry helps too. Restaurants pay a fee for the use of the logo but receive support for their marketing in turn. This cross-regional market is expected to steadily grow. However, the main effort focuses on the acceptance and the local knowledge of carp marketing.

4 Vertical integration of fish farming and cooperation among producers

Fish farmer, who use RAS, cannot cooperate on the local level because the location of fish farms is widely spread with long distances between production sites. Moreover, the farms produce different type of fish or seafood. Therefore, they are not able to cooperate for joint procurement of inputs or marketing of output as practiced in the Aischgrund area. However, some farmers with RAS cooperate by sharing knowledge and experiences in respect to the use of (new) technologies or the procurement of fingerlings for restocking. Some farms even cooperate in joint marketing activities.

Vertical integration: from the producer to the consumer

Linked with an excellent handling of the technological system of aquaculture is the establishment of a reputation for providing quality fish, including quantities and time of delivery up to the buyers' expectation. The development of personal relationships with individual buyers, such as head chefs or fish merchants who have a clear understanding of high quality fish, is crucial. Due to the large number of primary producers and manifold import options, downstream chain partners can stick to or change the supplying farmer. Well-established business partnerships with fish traders, processors or restaurants help producers to realise elevated prices. Usually these partnerships represent niches within the strongly differentiated market of quality fish from regional/national production.

This is true for both carp farming and sales in local fish restaurants and for high-quality fish or fish/shellfish products from RAS.

Different types of vertical integration take place as the following examples highlight. 1) A family business has two business units, the farm and the processing Ltd, which sells the product to traders, customer enterprises or end-consumers internationally. 2) A marketing cooperative offers the output of its member farms to different sales channels. 3) An intermediate Ltd has the function of a 'spider in the web' when it delivers fingerlings to the farmer and sells slaughtered fish to processors or wholesalers. Larger producer enterprises can establish their own marketing channels with local/regional gastronomy partners, or sell to a wholesaler. However, the vertical integration with large-scale processors and wholesale enterprises is always challenging because sales of producer organisations or large producer enterprises are still small volumes offered usually based on the production cycle or season.

The establishment of a value chain together with end-consumers is very difficult because fish dishes are not important elements of the culinary culture in German families anymore. Domestic demand for locally or nationally produced fish has stabilised after years of a slow but steady decline. As such, there is an opportunity and a need to develop more local markets and ensure public interest and understanding for this business.

Organic certification is not an issue because the technology of RAS is not yet sufficiently mature to receive organic certification (organic certifying bodies do not accept indoor fish production as a potentially organic system). Breeding does not comply with organic principles yet. A strategic and fundamental debate is currently on going on the national and European level highlighting pros and cons of organic certification for RAS. Some characteristics of RAS reach high environmental and animal welfare standards.

Cooperation among fish farmers

Fish farmer, who use RAS, cannot cooperate on the local level because the location of fish farms is widely spread with long distances between production sites. Moreover, the farms produce different

type of fish or seafood. Therefore, they are not be able to cooperate for e.g. joint procurement of inputs or marketing of output. However, they cooperate by sharing knowledge and experiences in respect to the use of technology or the procurement of fingerlings for the restocking of ponds. In a few cases, farms even cooperate for joint marketing. It is unclear if competitiveness and cooperativeness will affect the emergence of new partnerships. Since the group of intensive fish producers is small, fish farmers know each other and have their network. It is obvious that many persons have known each other for a long-time.

5 Sustainability performances of fish farming

Although encompassing scientific research results are not (yet) at hand, the German board of aquaculture research concludes that the sustainability performance of the German aquaculture system is – depending on the particular system – comparable to or even better than systems in other countries. However, there is a risk of negative impacts.

5.1 Sustainability of traditional carp farming

Economic dimension

Economic sustainability of traditional carp farming is a problem for many small and elderly fish farmers. However, examples show that some farm business have good economic results so that the younger generation is willing to take over and invest in carp farming. The positive contribution of carp farming to the regional economy (traditional fish restaurants, rural tourism, regional image etc.) is significant.

Environmental dimension

In general, carp production in tradition earth ponds is seen as ecologically sustainable system. The pond landscape is of very high ecological value providing habitats for a large variety of water related flora and fauna, in particular for birds. Most ecological requirements of the ecosystems in and around carp ponds are in line with current farming practices. Carp is important for the maintenance of ponds because they feed on grasses and keep the ponds clean. The carp population keeps the nutrient level in the ponds in balance because it consumes nearly all nutrients from cereals added to the ponds.

The main challenge for carp farmers is the significant risk of losses, which can be up to 60 or 80% of stocked fish per pond. Losses of small carp (K1) are sometimes replaced but not always due to relatively high costs of fingerlings. Without replacement fish, years of high losses of fish of the farm result in reduced harvests in subsequent years. Mainly, predators such as cormorants and otters cause these significant losses. Increasing number of beavers damage pond facilities. These species are protected under conservation law. The conflict of interest between farmers and representatives of policy and the society is growing. Recently, rules have slightly changed and farmers are allowed to shoot – under restrictions – cormorants, which are seen as a significant improvement. The reduction of cormorant numbers is seen as key factor for the future of the fish farming.

Contribution to the social and cultural context of the Aischgrund

The local acceptance of carp meals is high, which is a significant difference to other German areas. For the public, aquaculture in general tends to have a bad image, mainly because of feeding practices based on fishmeal, fish oil and antibiotics. For that reason, it is important to inform the consumer that carp farmers only feed locally grown cereals and legume crop mixtures. They do not

use any fishmeal or other concentrate. Due to the long tradition of carp farming, the local identity is (even today) closely connected with carp farming. Traditional signs or names of roads or places remind inhabitants as well as travellers of the traditional role and economic importance of the carp for the public and private life in the area. The carp museum plays a particular role for tourists and for local dwellers because it offers information and events related to the Aischgründer carp.

5.2 Sustainability issues of RAS

German consumers are very critical about fish quality and fish production systems. Television documentaries and newspaper articles show negative effects of intensive fish farming such as high stocking rates, suffering fish in small ponds, poor water quality conditions, poor quality feed etc.. Consumer studies show that the aquaculture systems lost the trust of several consumer groups. The connotation of the term 'aquaculture' even hampers the marketing of the products. For this reason, experts emphasise that fish has to be a high quality product that should promote human health, meet the highest food safety standards and come from sustainable production based on high animal welfare standards. In the case of RAS, many consumers lack knowledge and detailed information. As a result, these systems are often seen as animal mass production.

Economic sustainability

The system is very capital and knowledge intensive: Initial financial investment and operational costs are high. Expertise and qualified personal is essential and difficult to find. Constructions/buildings and facilities are needed which ensured independence from the natural environment. However, access to water and the legal framework related to water use drives operational costs. The optimization of fish keeping systems is possible with the available high-tech systems but technical reliability and performance of plants has been a problem for several enterprises. Since consumers are not used to buying certain fish species from aquaculture, excellent sales and marketing strategies are crucial for the economic success. The economic risk is – compared to traditional systems – still high.

Environmental effects

Recirculating aquaculture systems (RAS) have positive environmental effects because recirculating systems conserve more water than other intensive aquaculture systems. Furthermore, nitrogen effluents can be minimized by filtration, so the pollution of natural water bodies should (theoretically) not be an issue (Wedekind, 2008). Unlike open water systems, fish cannot escape and mix with wild species; the separation of bred and wild species is not an issue in indoors aquaculture systems (Gaye-Siessegger, 2009) Furthermore, the debate about the protection of predators is not a problem like in pond production where a profitable production is hardly possible due to predation (mainly cormorants and otters). Circulation systems, which are closed, ensure protection from predators in an optimum way.

Animal welfare and ethics

Animal welfare in recirculating systems is a much discussed issue. In general, appropriate technology enables better control of the fresh water within these systems, thus enabling optimum water conditions for the animals. The disadvantage is that diseases not detected early enough can have fatal consequences in closed systems because the entire population can become infected. Furthermore, RAS allow for high stocking rates due to the continual treatment of the water. Strong economic pressure means that companies opt for high stocking rates, which leads to stress, aggression and injuries among the animals, and thus affects health negatively.

The structure of the habitat in the tanks are usually very poor. Experts discuss whether the lack of plants, stones etc. has an influence on the animals' wellbeing.

According to Stamer, most killing techniques in fish breeding are not compliant with animal welfare. This issue is of particular relevance for river fisheries where minimum standards differ from the requirements for the slaughter processes of fish from aquaculture. The only techniques considered acceptable are mechanic and electric techniques, which are widely spread in modern aquaculture systems. However, since the morphology of eels and African catfish, both prevalent in RAS, results in their robustness, an immediate death is not guaranteed even when using mechanic and electric killing.

6 Challenges, chances and underlying strategies of RAS farmers

It is a challenge to manage a demanding technology such as RAS and to be an excellent sales person. Often, a team of two to three key persons who have different competences runs the RAS. An enterprise with RAS technology, sales and sometimes with processing requires professional management that encompasses compliance on various levels with the related bureaucratic requirements.

Strict legal interpretation of EU legislation in Germany

EU law covers all Member States. In practice however, the rules apply differently, according to the opinion of the fish farmers. Relevant are environmental, veterinary and hygiene regulations, e.g. for slaughtering and fish processing. Fish farmers reckon that the German interpretation of the EU law is more stringent than in the neighbouring countries. Moreover, the interpretation at the state or district level seems to be inconsistent which leads to site-specific conditions that differ between regions in Germany. In addition, fish farmers pointed out that administrative staff have less training and professional knowledge in fish production than in the past. This makes communication and approval processes difficult. Instead of good cooperation on eyes-level and an attitude of joint solution finding in case of an issue, the farmers have to feel to depend on whatever administrative agent who is in charge. Former staff with training in the industry have retired, and younger employees have received thorough training and qualification in administration but not in farming, animal husbandry or water related sectors. Farmers point out that entrepreneurs, who aim to invest in fish production plants have to study the law, seek for potential flexibility in its interpretation and discuss potential solutions with the authorities. This local problem is seen as a key hampering factor for the development of the sector on the national level.

Discrepancies in local and national policy strategies

Stakeholders and researchers observe a bias between political arguments and strategies on the different levels of responsibility. The national Strategy aims to encourage aquaculture production for economic and global sustainability reasons but the regional and local level policy and administration often have no interest, or even fear, the dispute with civil society initiatives when they approve new constructions.

When taking a glance at Germany, it is important to note the diverging policies in the different Federal States. The southern states Bayern and Baden-Württemberg, established support structure for all farmers (agricultural and aquaculture), which serve well generally but lack measures specifically focussed on fish farmers' needs. Rural development plans address landscape protection and the conservation of the natural environment provided by agriculture. Agri-environmental

measures for traditional fishpond farming are not available. The northern states Schleswig-Holstein and Mecklenburg-Vorpommern proclaim strong support for aquaculture enterprises to locate in rural areas. The other Federal States, namely Niedersachsen and Brandenburg, do not pay particular attention to the enhancement of aquaculture, according to the practitioners. Hessen and other state in the centre of Germany do not offer specific support for fish producers

Role of technological innovations

Technological innovations have been playing a key role in the development of and the potential of RAS. In particular, innovations in the context of water purification are very important for authorisation processes for new plants. Sometimes technological solutions are at hand but local water authorities do not know them. In this case, investors have to argue carefully with water agency representative. Apart from the efficient use and treatment of in- and outgoing water, innovations in respect to the feeding regime are important and drive farm economics through daily growth rates of fish and health of fish and ponds. For several species used in RAS, breeding technologies depend significantly on innovations. In particular, the organic sector aims for new hormone-free methods because limitations in breeding methods hamper any certification of RAS fish production.

Aquaculture and agriculture

Linking agricultural systems with aquaculture can help to establish a closed circular flow of nutrients. Farmers highlight that both branches can profit from potential synergies by e.g. the use or re-use of phosphates and nitrates. Aquaponic production is one approach but it remains behind producers' expectations.

Final consideration

As a final consideration, it is important to emphasise the variety of systems that aim to produce fish. Depending on the structure and intensity of the production system, related challenges and sustainability performances of fish farming in traditional earth ponds or high-tech RAS differ significantly. For that reason, it is not possible to present a consistent conclusion. However, there are some communalities, which the case study report on German Aquaculture highlights. These are the legal framework and its interpretation on the level of the federal state, the (lacking) consumption patterns for fish produced in Germany, a very limited marketing and policy power of a nice industry, very few young fish farming, positive as well as negative environmental impacts and the bad recommendation of the term 'aquaculture' throughout Germany.

Most producers and stakeholders agree on the key issues and their causalities that hamper the development of the sector. It is remarkable that knowledge about them is wide spread. Taking into account the different arguments and the situation of the (German) market, it is not clear if the stagnation of the industry is a curse or a blessing.

“The German interpretation of the EU law is more stringent than in other countries, we think. Rules at the state or district level differs as well. For us, legal frameworks drives conditions of production.”

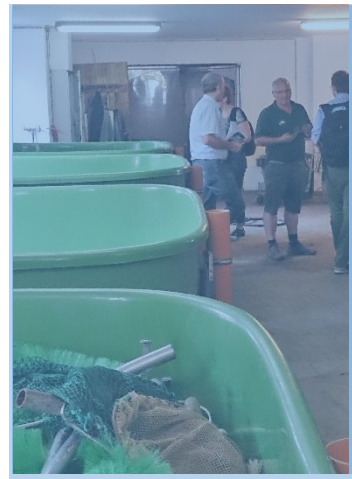


“You need to know the key persons. Otherwise, you will not be able to sell your premium products.”

“It is risky to neglect local sales and only develop markets outside the region, because those farmers may have a problem in ensuring the awareness of people around them. But this awareness for fish production as a viable local industry is very important for their acceptance in the community or county.

“Maybe, fish producers should put more effort in the cooperation with other fish farmers. They should aim for more market power!”

“It is hard to find strong and reliable business partners for long term cooperation. The network of engaged people and enterprises is very small. Everybody knows each other.”



*"Crop farming
and carp
production fit
well together.
We close
nutrient cycles
and protect
the high-value
landscape."*

*Linking
traditional
pond farming
and rural
tourism works
well for us. But
it doesn't work
for the small
part-time
farmers."*





“Taking into account the different arguments and the situation of the (German) market, it is not clear if the stagnation of the industry is a curse or a blessing.”



All photos in this report: Susanne v. Münchhausen (HNEE)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 635577.