Recommendation on Freshwater Aquaculture and Wildlife

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Justification

Inland fish farming has existed in Europe for the past 800 years. Carp pond farming takes place in the midst of nature and in harmony with it. Large pond areas are among the most ecologically valuable and species-rich cultural landscapes in our homeland due to sustainable and nature-friendly management. Development over long periods of time has led to very stable ecosystems without the need for any major alterations. Now, mostly with the best of intentions, numerous requirements and rules for the preservation of these areas are being enacted through EU regulations to protect individual species and simultaneously endangered complex ecosystems with numerous Red List plants and animals to supposedly promote biodiversity. Many ponds are subject to the EU Flora-Fauna-Habitats Directive and the EU Bird Protection Directive or are nature reserves. The existing regulations also mandate the protection of some animal species that cause devastating damage to the pond economy and thereby threaten both the ecology and economy of farming operations. These animal species primarily include cormorant species, otters and herons although only 15% of the existing stocks of the existing birds would be required for a stable stock. When cormorants invade a pond, they stay for days, often eating up to 80–90% of the harvest. The remaining fish are usually badly injured, cannot be sold and finally die in a long, agonising process. Added to this are the fish losses caused by the great egret and little egret, great crested grebe, goosander, and the North American mink. In recent years, the otter and pygmy cormorant populations have spread rapidly, causing dramatic losses in fish stocks. With all this damage, not only does the financial aspect need to be considered but also the welfare status of farmed fish. It must also be highlighted that increased numbers of great cormorants are not only leading to damages in fishponds but are also threatening more endangered fish species in natural waters, especially the wintering sturgeon populations.

Contrary to the promises made when introducing conservation programmes such as Natura 2000 and the European Cormorant Plan, the protection of cormorants (P. carbo carbo/P. carbo sinensis) and other predators (herons, otters) still has priority to this day. This intensive protection of a single animal species leads to the abandonment of extensive production of fish and thus removes the basis of the entire ecosystem. In individual areas, Member States (MS) have developed step-by-step plans for the solution, starting with the reimbursement of costs and ending in a fourth stage with the removal of individual predator animals within farms limits, but there is no coherence among MS. It is worth mentioning that the predator–fish farming conflict has two levels: the first is at the farm level considering the farmer's capabilities with regard to protecting his business and the second looks at population management tools.
For example, ornithologists estimated the total number of cormorants breeding pairs in the Western Palearctic area to be 406,000 to 421,000 in 2012–2013. Based upon the biological data, this means that a total of 1,600,000 individual of the species were present each year at that time. According to the latest data available with the European Environment Information and Observation Network, the total number of breeding pairs of the great cormorant species estimated to be present in 2013–2018 was between 222,000 and 267,000 pairs, a 14% increase compared with the previous period[1]. The total estimated cormorant population for 2020 in the Western Palearctic is around 3,000,000 individual birds.

The pygmy cormorant, whose numbers have surged in Central Europe in recent years, is an even more serious problem from a legal point of view. Further, this significant increase in numbers is causing unmanageable problems for the rearing of first-year fingerlings in pond farms.

[1] https://nature-art12.eionet.europa.eu/article12/summary?period=3&subject=Phalacrocorax+carbo&reported_name=

As the recovery of the great cormorant species due to the Birds Directive is presented as a success story of the restrictive legislation approved in 1979, the exponential population increase and territorial expansion should be assigned, using an ecosystem-based approach, to the lack of population management strategies that were applied before the '60s.

The development of the otter population is characterised by a continuous east-west expansion. Over the years, its population has expanded at a speed of around 5–10 km per year in the direction of Austria and Bavaria. Its innate territorial behaviour leads its territory to extend up to a length of 15 km in rivers. However, if the food supply is correspondingly large, as in fishponds, this changes and as a result, there are several otter families present in the smallest of spaces. Contrary to the prey behaviour of herons and cormorants who only catch fish they can swallow (but they frequently injure to death fish they are unable to seize), the otter is ready and able to catch and kill spawning fish typically weighing up to 4–5 kg or even heavier. Since this species of animal has a hunting instinct that is not limited to the prey that is required for daily needs, the otter kills far beyond this need (surplus killing). The degree of damage in ponds depends particularly on the size of the pond. The smaller the pond, the easier it is to track and kill the fish throughout the pond. Thus, in the case of countries that have pond farming, the areas with small-scale structures are particularly affected. The North-East Bavarian pond landscape is listed as an example. The average pond size here is <1ha. Breeding and spawning ponds are often only a few 100 m² in size. In these ponds, an otter kills up to 30 animals in one night, often the entire population and mostly spawning fish. Using very precise data in Austria, the development and impact on aquaculture is cited as an example. Europe's different carp areas have special strains with various EU and national quality labels, highlighting the creation of identity in rural areas that comes with carp pond farming.
The fish from regions such as Northern Bavaria were assigned the EU label "Protected Geographical Indication" (PGI) and since 2021, the Bavarian carp pond farming (Bayerische Karpfenteichwirtschaft) has the "Intangible Cultural Heritage" seal of UNESCO. As the otter is placed under protection without exception, the abandonment of these biotopes means that the basis of life for amphibians, insects and water birds is also lost. This is besides the fact that the feeding pressure from otters also has a direct effect on the bird populations.
The issue of predator threat associated with pond farms in the MS is almost ubiquitous. The regional differences are in the order of the threat. In large ponds, such as those in the Czech Republic, Hungary, Romania, and in northern and eastern Germany, the possibility of effective control of predator bird species is severely limited due to the large size of the area; while otters can cause more serious damage in the smaller ponds of about 1ha in Bavaria or Lower Austria. In the EU, various regulations translate into extremely stringent rules, providing some MS arguments in favour of doing nothing and making every step towards a common practicable solution impossible. In addition, the hurdles for defending the farmers' fish stocks are so high that they are only possible to overcome in exceptional cases. The pond owners give up beforehand. The common assessment of all interest groups with regard to the development of the population of predators and the results of the consensus-seeking process is described in the following pages. The demands of the pond economy to ensure the survival of pond fish farmers are formulated just as clearly as the lack of understanding why the protection of a single animal species is placed above the importance of the entire ecosystem. So, as local management solves only a local problem for a while and it has proven to be costly and conflictual, as well as ineffective at a large scale. Further, because it is a pan European problem, it needs a holistic and proactive European management approach.

Fish production in ponds has existed since the early Middle Ages and has shaped the landscape of large areas ever since. This status could be kept only by the continuous input of human work. On the contrary, abandoned ponds that were transformed over time into arable lands resulted in a diminished ecological value. Thus, the condition and preservation of the valuable areas is anthropogenic and not the result of untouched nature. During this time, a valuable cultural landscape with a high diversity of flora and fauna has developed through this use. This fact was last taken into account (in 2020) by the recognition of carp areas as world cultural heritage or registered RAMSAR sites. This condition can only be maintained with continuous, moderate human intervention.

Pond owners need to maintain traditional pond management in the future, and for this, the following actions are a prerequisite:

- A possibility to protect their stocks effectively. If this is associated with costs, this must be borne by the public purse, since it is also the public that intervenes in the private property of the pond owners by protecting the predators.
- A less bureaucratic framework of action for sustainable management, i.e., enabling economically, ecologically and socially successful management. This will also have to include stock management and killing, if necessary, for some problem species at appropriate regional scales, independent of national borders.
- Appropriate remuneration for the services rendered for the common good such as land support based on parameters of biodiversity would be an ideal option.

Fish farmers want to remain virtuous while offering us a product that is sustainable for our planet, creating man-made wetlands and giving a share to Nature—which they are used to doing. But if the regulations do not let them maintain this special production system and farming no longer remains profitable, it can no longer feed humans or the protected species!

Background

Whenever nature could not provide enough fish and other aquatic organisms to meet the needs of communities, humans developed aquaculture. Traditional aquaculture has always been associated with natural or semi-natural habitats and therefore presumes interactions with environmental factors.

One of the oldest known conflicts is that between carp farming and fish-eating birds. Already in the middle of the 13th century, Albertus Magnus described the cormorant, then called Morfex, in his book *De Animalibus*, as "a very voracious bird that causes damage to fish ponds"[2]. Not many years later, on October 12, 1377, the Roman Emperor Charles IV ordered the residents of Breslau (now Wrocław), where one of the oldest carp ponds in Europe (Milicz/Militsch) is located, to "kill and exterminate the water ravens" in the places where "they live and where they have their nests". This had become necessary "because the water ravens…cause great damage to the fish in the water"[3]. The great biologist Buffon described in the eighth volume of his nine-volume work on birds (1770–1783) the influence of the cormorants on the fish ponds[4]: "The cormorant is so skilful at fishing and so ravenous

[2] Stadler, H. 1916: Albertus Magnus. De animalibus libri XXVI. Nach der Cölner Urschrift. Erster Band. — Aschendorff, Münster. (In German and Latin)
[3] Beike, M. (2014). Phalacrocorax carbo sinensis in Europe-indigenous or introduced? (S. Ruuskanen, Ed.) *Ornis Fennica, 91*(1), pg. 48-56
[4] Buffon, G. L. L. 1792–1793. Natural history of birds. W. Smellie, translator. 9 volumes. A. Strahan, T. Cadell and J. Murray, London, UK.

that when he visits a pond, he will wreak more havoc on its own than a whole flock of other fish-eating birds. Fortunately, it is almost always on the coasts of the sea and is rarely found inland". Even so, in inland Europe, cormorants were present where there were carp ponds and hunting practices have always been used to protect fish farms without having a major impact on the bird population.

The real impact began in the 19th century when carp farming, after hundreds of years of development across Europe due to the industrial revolution (many ponds were also used as water mills) and the reclamation of more land for other forms of agriculture and livestock farming being considered more profitable, was abandoned. The intensification of agriculture, the use of pesticides and fertilisers, the conversion of wetlands into agricultural areas and the hunting of wild birds were the arguments underlying the Birds Directive in 1979. However, the number of cormorants in the 1970s was not as alarming as reflected by the data published by Franz Kohl in 2015 (summarized below):

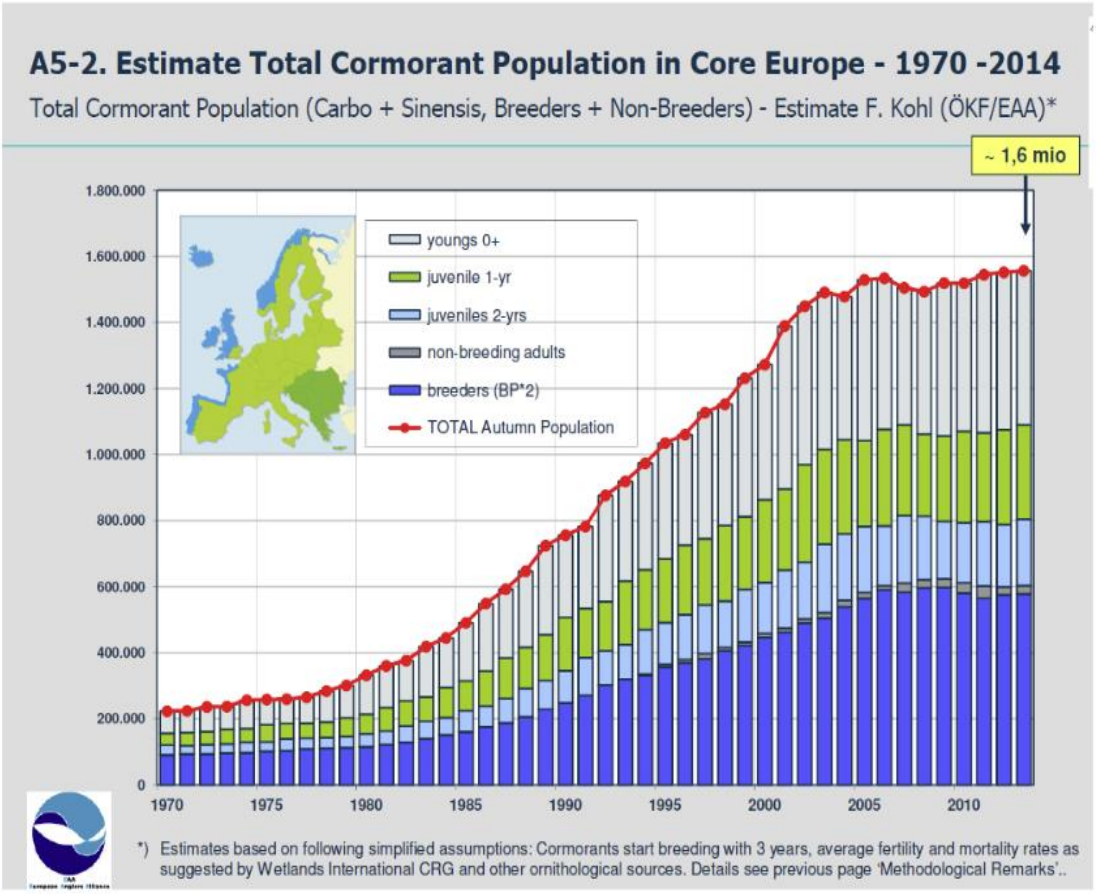


Figure 1. The cormorant population in Central Europe (1970–2014); assumption that cormorants start breeding at three years of age, average fertility and death rates (source: European Anglers Alliance)

The protection status for cormorants tripled the population within 15 years between 1979 and 1994. The numbers registered before 1994 prompted the conference of the parties to the Convention for the Conservation of Migratory Wildlife Species (Bonn Convention), at its fourth session (Nairobi, 7–11 June 1994) to adopt recommendation 4.1 of the Scientific Committee on the Conservation and Management of Cormorants in the African-Eurasian Region. The document acknowledges that "the increase in the populations of *Phalacrocorax carbo carbo* and *Phalacrocorax carbo sinensis* has created conflicts with human interests, particularly in fish farming areas, coastal inland waters and river systems" and that "the population trend of the subspecies of the great cormorant, *Phalacrocorax*

carbo sinensis, both in the number and in the area of distribution is increasing". Finally, the Convention recommends research on "assessing the damage caused by cormorants to fisheries", "the effectiveness of deterring techniques and the development of other techniques to protect fisheries" and "ensuring that cormorants are only killed under controlled conditions". Since June 1994, the number of cormorants, especially *P.c. sinensis*, in Europe, excluding Russia and Ukraine, has almost doubled in twenty years. In the meantime, in 1997, the European Commission decided to take off the great cormorant from Appendix I of the Birds Directive[5]. In 2008, Heinz Kindermann (MEP) drafted a "report on the adoption of a European cormorant management plan to minimise the increasing impact of cormorants on fish stocks, fisheries and aquaculture", which was later renamed the "European Cormorant Plan" by the European Parliament, and adopted.[6]

The European Parliament funded a study on the cormorant–aquaculture conflicts in 2013[7]. The European Commission also funded a number of studies on the effects of predators on fish farming, particularly cormorants, through various mechanisms and programmes, such as the "Framework for biodiversity Reconciliation Action Plans[8]" (FRAP, 2006), "Reducing the Conflicts between Cormorants and Fisheries on a pan-European Scale[9]", (REDCAFE, 2002), "Interdisciplinary Initiative to Reduce pan-European Cormorant-Fisheries Conflicts [10]" (INTERCAFE, 2008) and "Sustainable Management of Cormorant Populations[11]" (CorMan, 2013). Some MS funded research on the effects of other predators such as the otter on fish farming, e.g., "Effects of land use change on the population dynamic and distribution of the Eurasian otter (Lutra lutra) in Saxony and Germany"[12] (2013), "Human-wildlife conflicts at pond fisheries in eastern Poland: perceptions and management of wildlife damage"[13], and "Pilot Study 4: Environmental Data on Aquaculture – Austria (2020)[14]".

In fact, the European Parliament pointed out again, recently, the need for a change of paradigm on the predation impact on European pond farmers "as they are struggling with substantial losses affecting their entire stock due to predators like otters, herons and cormorants; underlines that those predators also kill the spawn of zander and carp and as a result limit significantly the breeding and reproduction of freshwater fish; calls, therefore, on the Member States to apply existing derogations in the case of herons and cormorants and calls on the Commission to carry out a review regarding the conservation status of the otter and to allow, where necessary, the removal and control of those predators"[15].

The 2011, 2013, 2015, 2017 and 2019 International Carp Conferences in their final resolutions called for the European Commission to provide more support and a coherent action plan for the relationship between predators and fish farming. European farmers' associations such as the Federation of European Aquaculture Producers (FEAP) and the Committee of Professional Agricultural Organisations & General Confederation of Agricultural Cooperatives (COPA-COGECA) have also repeatedly asked for a solution to ensure that fish farming is not given up due to the losses that carp farmers, in particular, suffer every year. This is becoming increasingly important as the carp pond

[5] https://ec.europa.eu/commission/presscorner/detail/en/IP_97_718
[6] Management plan to minimize the increasing effects of cormorants on fish stocks, fisheries and aquaculture (2008/2177 (INI)
[7] Cowx, I.G. – BETWEEN FISHERIES AND BIRD CONSERVATION: THE CORMORANT CONFLICT, Report for European Parliament's Committee on Fisheries (PECHE), IP/B/PECH/IC/2012-046 [2013];
[8] https://www.ufz.de/index.php?en=43183
[9] http://cormorants.freehostia.com/cormo_news/Redcafe_final_report.htm
[10] http://www.intercafeproject.net/COST.html
[11] https://ec.europa.eu/environment/nature/cormorants/management.htm
[12] https://www.ufz.de/index.php?en=37969
[13] Kloskowski, Janusz. (2011). Human-wildlife conflicts at pond fisheries in eastern Poland: Perceptions and management of wildlife damage. European Journal of Wildlife Research. 57. 295-304. 10.1007/s10344-010-0426-5.
[14] https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0715.pdf
[15] https://www.europarl.europa.eu/doceo/document/TA-8-2018-0248_EN.pdf

economy provides habitat conditions for a large number of protected birds and meets the requirements to be declared Natura 2000 areas. The cessation of fish farming in these areas leads to the loss of not only economic activity but also the associated biodiversity.

Conflicts

Existing situation

In Romania, deterring, shooting to scare or shooting to kill was forbidden, as the great cormorant was kept under a strict protection status under the national legislation. In 2019, the legislation was changed, and the cormorant could be controlled by lethal methods within fish farm limits, but no quota has been assigned yet as hunting associations are not interested in cormorants. There are no compensation rules for the losses and no objective calculation formula for these. Management plans for Natura 2000 sites do not include any form of compensation whatsoever for the restrictions which are established against traditional technological fish farming management. Non-lethal equipment bought by the farmers through EFF 2007–2013 were very shortly banned by environmental authorities. The consultative stage of the N2000 management plan elaboration seldom includes fish farmers and when it does, almost none of their arguments are considered. The distribution map of the *P.c. sinensis* in Romania always focuses on the Danube and Danube Delta albeit since the middle of the '90s, hundreds of individual birds are present all over the country in fish farms from North to South and from East to West.

In Germany, there are different regulations in federal states due to the federal structure.

The cormorant is found everywhere in Bavaria, as shown in the figure below. The winter and spring migrations of the cormorants are particularly problematic for pond management. Usually, there are large flocks from September to December, and again in spring, from the beginning of March to the beginning of May. The winter population in Bavaria is around 8,000 birds.

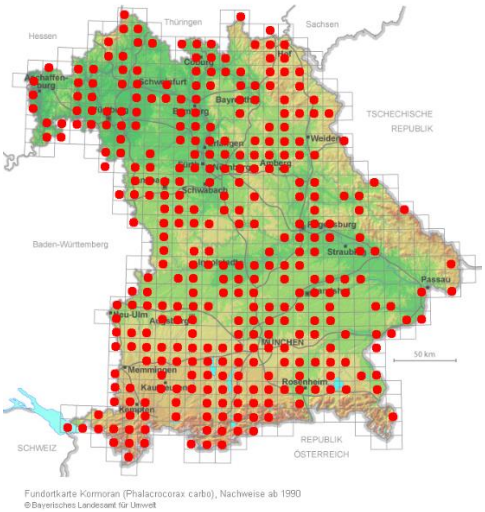


Figure 2. The distribution of cormorant population in Bavaria

Regarding the mitigation of economic losses due to fish-eating birds, the following rules apply in Bavaria:

(1) To avert considerable damage caused to the fishing industry and to protect the native fauna, the killing of cormorants (*Phalacrocorax carbo sinensis*) is carried out in accordance with Paragraphs 2 to 6, in deviation from Section 44 Paragraph 1 Nos. 1 and 2 of the Federal Nature Conservation Act (BNatSchG). Shooting is allowed within a radius of 200 m around water.

(2) The following areas are excluded from such permits:

1. Pacified districts according to Article 6, Paragraphs 1 and 2 of the Bavarian Hunting Act

2. Nature conservation areas according to Section 23 BNatSchG and national parks according to Section 24 Paragraphs 1 to 3 BNatSchG in conjunction with Article 13 of the Bavarian Nature Conservation Act (BayNatSchG)

3. European bird sanctuaries according to the Bavarian Natura 2000 regulation:

- Shooting is only permitted in the period from 16 August to 14 March
- In sanctuaries, according to Article 70 of the Bavarian Fisheries Act (BayFiG), and in closed waters according to Article 2 of BayFiG, shooting is permitted from 16 August to 31 March, subject to special protective regulations
- It is not permitted to shoot from one and a half hours after sunset to one and a half hours before sunrise
- Section 11 of the Ordinance on the Implementation of the Bavarian Hunting Act (AVBayJG) applies accordingly

4. Persons authorised to hunt are entitled to shoot.

5. The higher nature conservation authority can withdraw the authorisation if the rules stated in paragraphs 1 to 3 are violated.

6. Reporting obligations:

- The location of the shooting, such as the hunting ground, body of water or stretch of water, as well as the type of water and the date of shooting, the number of cormorants shot and, in the case of ringed birds, the ring number are to be given to the responsible hunting authority by 10 April each year.
- The hunting authority shall send the insert to the responsible higher nature conservation authority by 1 May of each year.

Currently, the population of the Eurasian otter (*Lutra lutra*) is almost widespread across **Austria**, with high densities especially in the two main pond-farming regions in the north of Lower Austria and in the east of Styria, where otters cause substantial losses affecting the entire stock of pond-farmed fish. Currently, Lower Austria has derogations for wildlife species with high densities regarding pond management (heron, cormorant, beaver and otter), while the second area of pond farming in Styria does not have any derogation, which distorts competition from the point of view of pond farmers. According to an Austrian data collection study funded by the European Maritime and Fisheries Fund (Environment Agency Austria 2020), the annual loss rate in fish production is, on average 30 percent caused by protected wildlife, especially by otters, but also by cormorants and herons (survey among fish producers of all sectors).

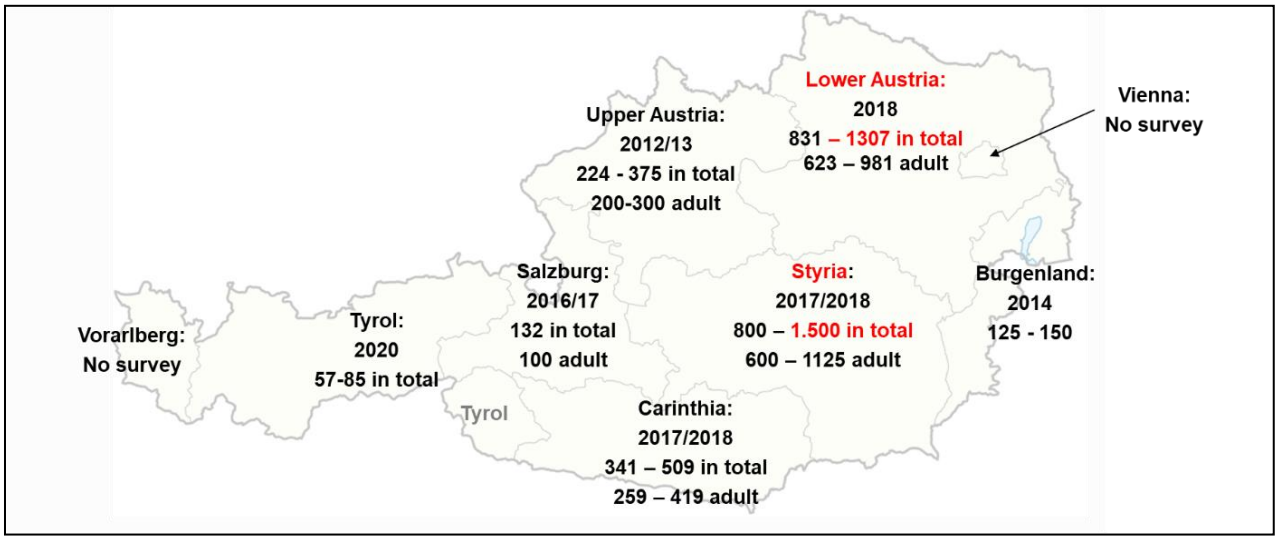
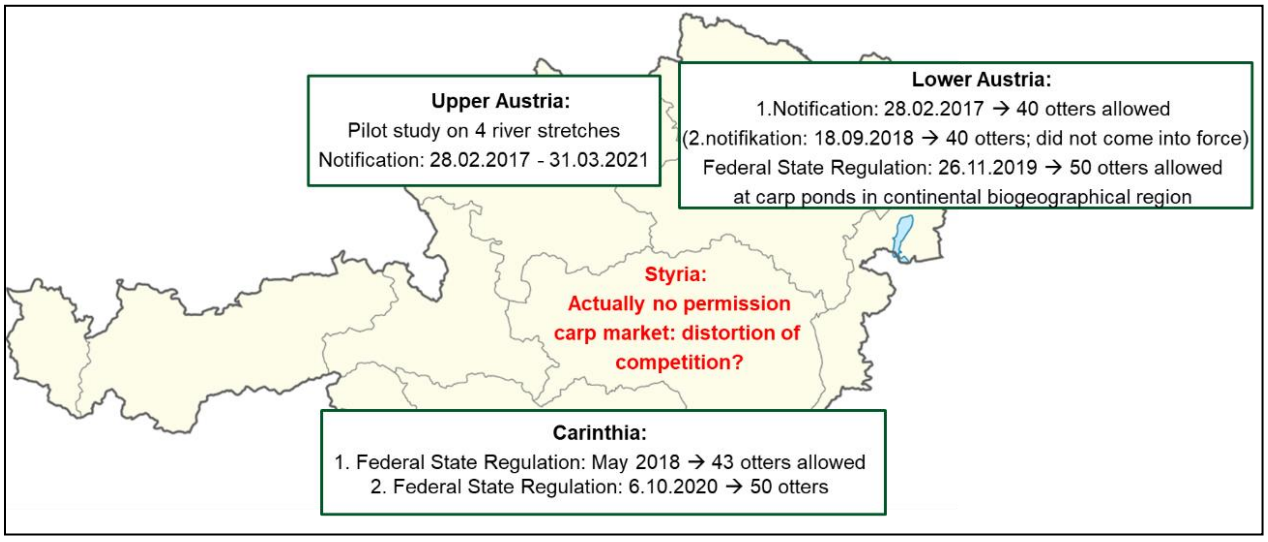


Figure 3. Otter population surveys of the nine Austrian Federal States (no uniform method for counting). High otter densities in carp pond regions (in Red). (© Leo Kirchmaier/LK NÖ)

Since 1984, it has been documented that otters cause severe economic damage to pond farms in Lower Austria. The most recent otter population survey in Lower Austria[16] showed a favourable conservation status for otters with a total population of around 1,300 individual otters and 980 adult otters. The study states, "The otter population is currently artificially supported by fishponds, as these ponds represent an additional unnaturally high, continuous food supply". This means that pond regions indicate a disproportionate density of otters. The otter population growth and increasing predation pressure fuel a human-wildlife conflict (for example, due to "surplus killing", a common behaviour exhibited by predators where they kill more prey than they can immediately eat[17]).



[16] Kofler H., Lampa S., Ludwig T. (2018): Fischotterverbreitung und Populationsgrößen in Niederösterreich 2018. Endbericht. ZT KOFLER Umweltmanagement im Auftrag des Amtes der Niederösterreichischen Landesregierung, 117 S (https://www.noe.gv.at/noe/Naturschutz/Fischotter_NOe_2018_fin.pdf)

[17] Kruuk H. (2006): Otters, Ecology, Behaviour and Conservation. Oxford University Press, Oxford, 1-265.

Figure 4. Local permissions and notifications regarding otters. Besides Lower Austria, Upper Austria and Carinthia have derogations regarding otters.

In February 2017, the Lower Austrian federal state government issued the first notification as a legal basis for the reduction of the otter population by a maximum of 20 otters with regard to pond farming (another 20 individuals regarding rivers). However, the notification-based approach has not proven effective in practice.

Taking into account the increasing challenges in the field of fish production, the government of the federal state of Lower Austria issued a regulation regarding otters on 26 November 2019. The regulation allows exceptions to the Europe-wide strict protection of the otter in Lower Austria at those pond sites where fencing is impossible. The regulation applies at pond sites (within a radius of 50 m) in the continental biogeographical region outside of nature reserves. Fifty otters may be taken per calendar year with otter contingents for each administrative district based on the number of ponds in the district. An online register indicates whether the further removal of an otter is permitted or if the quota has already been depleted. Trained and certified hunters conduct removals and report them to the conservation department within 24 hours. The federal state government conducts veterinary inspections of these otters to gain knowledge about their ecology. An accompanying monitoring of the otter population maintains the favourable conservation status according to the FFH Directive. The regulation results in a decrease in fish damage in hotspots outside of conservation areas.

Fish-eating birds are involved in the spread of viral (spring viraemia of carp, viral haemorrhagic septicaemia virus), bacterial (Aeromonas sp., Pseudomonas sp. and their antimicrobial resistant variants) and parasitic (about 3000 worm species) diseases not only to farmed fish but also to other animal farms and to humans. The recent establishment of great cormorant as a new and very abundant species. Moreover, the expansion of great cormorant colonies is documented as one of the determining factors for introduction of new parasite species in different areas. Birds behave either as intermediate hosts (penetration of including digestive worms through gills, skin lacerations, droppings and so on) or as passive vectors (transport of germs in feathers, on legs and beak or by regurgitation of infected prey). Wounds fetched by piscivorous birds or mammals are liable to develop pathological consequences. Diseases spread in this way cause untold suffering and even death to entire batches of farmed and wild fish also increasing the costs for treatment or waste neutralisation.

Figure 5. Fountain salmon (left) and rainbow trout (right) injured by herons, complicated by a subsequent Saprolegniosis, in a little Belgian fish farm in the Ardennes (©Alain Schonbrodt)

A recent analysis of the wildlife of fishponds **in Hungary** and its consequences[18] highlighted that besides contributing to the sustainability of aquatic and wetland habitats, fishponds ensure the maintenance of numerous natural values of European importance. Their most significant impact is the support of waterfowls connected to wetland habitats; they provide nesting, resting and feeding habitats for these bird species. At Hortobágy fishponds, the largest pond system in Hungary with ca. 5,500 ha pond surface, more than 300 bird species were observed. Two hundred and twenty-two species were detected in the Rétszilas Fishponds, about 200 in the Biharugra fishpond system, and 274 in the Lake Fehér in Szeged[19]. One third of the species observed in the ponds of the Hortobágy Fish Farm were nesting. These numbers indicate the importance of fishponds for both nesting and migratory bird species[20].

Birds are the most abundant and thus the most influential animal group in fishponds (Figure 2). The degree of economic significance of bird species is not constant; it is determined by their number, the duration of their stay in the ponds, the number of fish and feed they consume, and the species and size of the fish they eat. Based on the literature, there are 62 proven fish-eating bird species in

[18] HAKI 2020. Role of freshwater pond aquaculture in the maintenance of natural values of wetland habitats in Hungary. Manuscript. Pp. 21
[19] AQUASPACE (2016) Policy-Management issues of freshwater aquaculture. D2.1. Ed by É. Kerepeczki. Pp. 1-26
[20] Halasi-Kovács, B. (2005) The nature conservational importance of the fishponds of Hortobágy Fishfarm Co. and their natural values. Manuscript. Pp. 1-19. (in Hungarian)

Hungary[21]. Taking into account the feeding habits and number of individuals of these species, eight can be considered fish consumers with relevant economic impact. These are the great cormorant (*Phalacrocorax carbo*), the pygmy cormorant (*Micropterus pygmaeus*), the grey heron (*Ardea cinerea*), the great white egret (*Egretta alba*), the black-crowned night heron (*Nycticorax nycticorax*), the great crested grebe (*Podiceps cristatus*), black-headed gull (*Larus ridibundus*) and the Caspian gull (*Larus cachinnans*). The economic influence caused by fish consumers is extensive. The first is the direct effect of fish consumption, while the second is the loss of yield resulting from fish consumption. Among birds that potentially consume fish feed (mallard, eurasian teal, gadwall, eurasian wigeon, northern pintail, northern shoveler, garganey, common pochard, ferruginous duck, common coot), considering their quantitative conditions, mallard (*Anas platyrhynchos*), common pochard (*Aythia ferina*) and common coot (*Fulica atra*) can be considered to exert significant influence. The number of individuals of other species lags far behind them. Species – including bird species – that do not directly contribute to revenue loss or increased costs are indirect influencers. This category includes all species that during their nesting and migration period, inhibit normal operations for a certain period of time due to their needs – water level adjustment, reed production – and thus reduce the predictability of farming. For these species, the number of individuals is not determinative in the damage. The indifferent category includes species that do not affect production due to either their consumption or small numbers.

Figure 6. Some fish-eating predatory bird species in fishponds (©László Csiszár)

[21] Halasi-Kovács, B. (1998) Report on the ornithological status of the fishponds of Hortobágy Fishfarms Co. Manuscript. (in Hungarian)

The environmental perspective also reveals the impact of large cormorant colonies on the terrestrial vegetation and on the water and soil quality. The tree breeding species (e.g. P.c. sinensis) are mechanical destroying and devastating the trees and are altering, through the deposition of faeces and various kinds of debris, the soil and the groundwater quality. Multitudinous research papers are documenting this complex impact. "The decreased health status of trees may induce pest invasion and further exacerbate unfavourable changes of vegetation within the colony". High nutrient deposits in cormorant colonies reach concentrations of ammonium, nitrates, organic N and total P which are 45 to over 60-fold greater then in areas unaffected by birds nesting and resting. Contrary to surface runoff, the nutrient concentrations of groundwater are constantly increased throughout the year, even in periods when birds are absent. Moreover, few years after the birds have ceased to nest or roost at such a site, the levels of chemical compounds in groundwater may still remain elevated.

Figure 7. Cormorants destroyed the trees on the banks of a Romanian carp farm (©Romfish)

Figure 8. Perched here on the trees of Île Hent-Tenn, cormorants are responsible for the death of many trees on Île de la Jument. (Photo Daniel Baude, published in Le Télégramme, 09 septembre 2016)

Damage assessment

In Romania, the number of autumn cormorants is around 170,000, and they are not only present in the Danube Delta or along the Danube, but also in places where they have never been seen before, such as in the northern part of the country. The losses caused by the predators and reported by fish farmers in a conservative calculation are estimated to stand at around EUR 35,000,000 per year.

Some situations a Romanian fish farmer deals with on a regular basis are shown below.

Figure 7. Impact of fish-eating birds on carp fish farming (©ROMFISH)

There are about 8000 autumn and spring cormorants in Bavaria. Their food requirement is approximately 700 per bird per day, which causes immense damages to the fishponds.

In Hungary, the damage assessment[22] resulting from the studies performed during the last decade revealed not only the direct losses because of wildlife interactions with the carp farms, but also the indirect losses. Among the species that cause a direct economic influence, the great cormorant and pygmy cormorant are preeminent. The size of the domestic nesting population of the Great Cormorant can be estimated at 3,000–4,000 pairs, while the number of immature roaming individuals is approximately the same amount (3,000–6,000). The migratory population is low in the spring and peaks in the autumn. Taking all this into account, the number of great cormorants in Hungary reaches 29,000 individual birds. The average daily food requirement of the species is 0.5 kg of fish. The bird can effectively capture its food up to a weight of 500 g, so the first two age groups produced in fishponds are most at risk. The great cormorant exhibits a preference for the common carp[23]. The resulting damage can only be limited by the currently most widely used gas cannon scarer. Based on this, a significant and long-term reduction cannot be achieved by shooting the domestic population. Currently, there is no coordinated strategy for the reduction of these populations in EU countries and – despite the existing demand – this does not seem to be expected in the near future. Therefore, appropriate coordination or at least national-level derogation measures in Central and Eastern European countries are necessary.

According to calculations[24], the total fish consumption of the Hungarian great cormorant population is 2,427,700 kg per year. From population data, it can be assumed that at least 50% of the consumption affects fishponds. According to nutritional data, 85% of the fish consumed here are common carp[25]. The pygmy cormorant was essentially a migratory species in Hungary until the early 1990s. The first nesting specimens were registered in 1991 in Hortobágy. Both its nesting and migratory populations are rising sharply. Its nesting population is currently 1000-1350 pairs, while its

[22] HAKI 2020. Role of freshwater pond aquaculture in the maintenance of natural values of wetland habitats in Hungary. Manuscript. Pp. 21

[23] Dudás, M., Halasi-Kovács, B. (2000) Investigation of the growth and feeding of the Great Cormorant (Pahalcrocorax carbo) population in the protected fishponds of the area of Hortobágy National Park. Manuscript. Pp. 1–12. (in Hungarian)

[24] Faragó, S. (2012) A kárókatona európai és magyarországi helyzete, a fajjal kapcsolatos konfliktusok. Előadás. A magyarországi kárókatona (Phalacrocorax carbo) állományhoz kapcsolódó problémák kezelésére létrehozott szakértői munkacsoport első ülése. 2012. március 13. Földművelésügyi Minisztérium.

[25] idem

migratory population exceeds 5,000 specimens[26]. Its diet consists of smaller fish, and it can effectively catch fish weighing up to about 150 g, depending on their body shape, so fingerling production is primarily exposed to them. According to domestic estimates, their daily fish consumption is 300 g/day. The species is strictly protected in Hungary, so neither bird alert nor shooting is allowed. The domestic distribution of the species shows that the entire population is strongly dependent on the fishponds. As calculated from the population data, the amount of fish consumed by Hungarian Pygmy Cormorant population per day is 1,439 kg. The damage caused by the otter is also becoming more significant. This is confirmed by the fact that during the increasingly frequent extreme low-water periods due to climate change, the majority of the otter population is located at fishponds in Hungary.

Unfortunately, there is no generally accepted method to estimate the population size. However, the estimated population size approached 250 individuals in the area of Hortobágy Fish Farm based on a previous survey. Calculations made in Hungary based on a conservative approach of the losses, which took into account only two bird species and the otter, showed that the loss per pond hectare is 177 kg of common carp, which at a price of 2.4 EUR/kg at farm gate makes it 425 EUR/pond ha. This loss is actually higher if the indirect losses caused by regular management practices such as filling and drainage of the ponds, reeds and pond weed management, rules for scaring and shooting predators and so on, are taken into account.

It is important to highlight that adopting only compensatory models will transform the fish farmers from fish producers for human consumption into producers of fish for feeding birds. That is why it is important to have a well-balanced mix of solutions covering not just compensations but also a range of solutions to mitigate the losses.

Mitigation

Method inventory and effectiveness

The methods used in Romania have not been effective, as the cormorant learns very quickly. The only method reported by farmers to have some success is shooting to scare them away, combined with the extraction of some individuals in order to associate the noise with a real danger and keeping the cormorants off the farm for several days, a method which is mentioned also by *BirdLife* "Shooting cormorants as an aid to scaring can work, but its effectiveness varies". In this way the cormorant's learning ability should make it avoid the farms.

The great learning ability of the cormorant can also be observed in Bavaria. Fish farmers, who deal daily with cormorant attacks as well as instances of attacks by other fish-eating birds, report that only shooting is effective. Protective cages, claps of thunder or similar measures only help briefly.

Reports by Hungarian farmers also strongly confirm the above-mentioned measures. Only scaring without shooting is not sufficient to keep cormorants away from ponds. Over the past few years, farmers used several scaring methods besides gas cannons (e.g., laser beams, predatory bird imitations, falconry), but experience shows that the effectiveness of these methods is questionable. In Hungary, scaring and shooting are only allowed with the permission of the Environmental Authority on NATURA 2000 sites, which affects two-thirds of Hungary's fishpond area. The operation must always be coordinated with the National Park for only a limited number and period specimens can be shot in a year. The use of gas cannons is also allowed, subject to certain restrictions, depending on the area.

[26] Oláh, J. (2014) A Kis kárókatona és természetvédelmi kezelésének javaslatai. In. Haraszthy, L. (Ed). Natura 2000 fajok és élőhelyek Magyarországon. Pp. 498-501. Pro Vértes Közalapítvány, Csákvár

The guidance document on hunting under Council Directive 79/409/EEC on the conservation of wild birds[27] published by the EC notes that: "It is generally accepted that some huntable bird species can jeopardise the interests referred to in Article 9(1)(a) outside of the hunting season allowed under Article 7. It is also generally accepted that, in order to safeguard these interests, there may sometimes be no satisfactory solution other than destruction of birds. In this context, it would seem reasonable that the use of hunting is a legitimate means of safeguarding the interests mentioned in Article 9(1)(a). Of course, in this instance, hunting serves a non-recreational objective (i.e., damage prevention). The species for which Article 9(1)(a) is invoked are sometimes referred to as 'pest species'. The justifications for their control include 'to prevent serious damage to crops, livestock, forests, fisheries and water' as well as 'for the protection of flora and fauna'".

Farmers' approach

Often, spatially extensive open carp ponds, integrated with local water systems, are landscape components of great environmental importance. Unless fish production is highly intensified, carp pond-complexes can function as wetlands supporting rich animal biodiversity. Further, traditional pond farming technology is an indispensable element in maintaining these man-made shallow waterbodies. However, wildlife attracted to farm ponds by abundant food supplies and specific habitats may generate conflicts between animal conservation and economic interests by causing stock losses and physical destruction at aquaculture facilities. Increases in some wildlife populations and their spread into human-dominated landscapes are a growing concern limited not only to CEE countries. Wildlife-related conflicts may have serious consequences both for the profitability of aquaculture enterprises, due to lost production and costs associated with implementing damage prevention method, and for wildlife populations due to fish farmers losing interest in supporting the maintenance of production operations by themselves and their increasing proclivity to abandon fish farming and shift to other forms of agriculture that have various forms of direct payments in place.

Over the past few years, experience has shown that (for example) valid otter management requires three measures that complement each other:

1. Fencing of small ponds (0.65 ha) to protect fish stock. However, this does not offer hundred percent protection and many special cases make fencing impossible even for small ponds (e.g., uneven terrain, ponds situated next to road).
2. Financial compensation (subsidies) of fish damage where fencing is not applicable. An independent authority verifies the damage (compensation only for carps, not for other secondary fish produced in pond farming, for e.g., pike-perch). However, it is only a partial compensation; the rest is "paid" by the pond farmers.
3. Measures regarding otter population: Local permission to reduce population at hotspots to minimise fish losses as claims continue to increase but compensation is insufficient. The objectives are to reduce the damage caused by otters in terms of production costs (main cost factor), prevent ponds from being abandoned and turned into arable land, preserve ponds and their multiple ecosystem services as wetland structures and improve the low self-sufficiency of domestic fish.

This experience-based data was also confirmed by the conclusions of some wider scientific studies:

[27] https://ec.europa.eu/environment/nature/conservation/wildbirds/hunting/docs/hunting_guide_en.pdf

- Many preventive measures were tested. Hardly anything works to reduce damage, except the above-mentioned measures (1–3);
- The regulatory framework is narrow: pond farmers are not permitted to reduce otter population in special protected areas, e.g., Natura 2000 areas (otters are individual subjects of protection in these areas);
- Reducing otter population is not an easy task. Building expertise (trapping of otters vs direct shooting) in cooperation with hunters at the local level is essential;
- One of the biggest challenges faced by carp pond farmers is fish losses caused by otters and other predators. They are under massive financial pressure due to predation damage and massively afraid of negative press/media because media coverage is highly emotional when it comes to wild fauna;
- Reduction in otter population still more due to them becoming roadkill than because of national or regional restrictive regulations;
- Predators are one of the main obstacles hindering the expansion of carp production, which is evidenced by the stagnation of EU carp production for the past 20 years[28];
- The density of otter populations is not regulated according to the number of prey in carp pond regions anymore, as food is always present.

Pond fish farmers work close to wildlife and spend up to 30% of their workforce for deterrent measures,[29] making them a potential source of information about wild populations. In fact, traditional carp production technology acknowledges a certain percentage of losses caused by predators, but when these losses become significant and affect the existence of the economical enterprise then it is more likely that the affected farmers would employ lethal control of these species than farmers with losses that could be accommodated.

A fundamental question of whether the traditional, area-bound carp pond management should be preserved has arisen among carp farmers. Increasingly, the impression is that this is no longer the goal, taking into account that it has been a long time since they have publicly exposed the menace and lack of public interest in offering reasonable measure responses.

However, if carp pond management is to be maintained, a significant reduction in the number of predators (birds and mammals) is necessary according to the Birds or Habitat Directives. Financial compensations and a change in the status of huntable species within farm limits can help in the short and medium term to ensure economic viability for fish farming. However, this is not a viable, long-term approach, else ponds will be abandoned and local aquaculture activities, regional food, regional identity, an intangible cultural heritage and ecologically highly significant landscapes with outstanding biodiversity will all disappear.

There are also differences among MS in addressing the predation problem in fish farms, which is making some farmers more resilient than others. The Guidance on Aquaculture and Natura 2000 should be revised to properly address the predation problem in a unitary manner as the preventive measures considered (fencing, netting, disturbance) are not targeted and affect many other protected species that are not fish predators, diminish the landscape value or affect nearby inhabitants.

[28] https://ec.europa.eu/eurostat/databrowser/view/FISH_AQ2A__custom_1700503/default/table?lang=en
[29] https://www.eaa-europe.org/european-parliament-forum/ep-recfishing-forum-2014-2019/09-october-2018-cormorant-management.html

As declared recently[30], the European Commission does not plan to change the legal protection status of some predators, e.g., *Phalacrocorax carbo sinensis*, by making them huntable species considering there is enough flexibility in managing the issues by removing the targeted species from Annex I of the Birds Directive[31]. All the same, even though local management practices were allowed since 1997, the problem has not diminished but instead increased in magnitude. Amelioration of this situation requires, in addition to the solutions already in place (compensations, downgrading protection status, etc.), a more focused and consistent action at an EU level, because it is obvious that continuing with the present measures is not enough. As the expansion of the *Phalacrocorax carbo sinensis* population concurred with the high-protection-status-related measures, it should be possible that downgrading the protection level again and easing the bureaucratic red tape associated with the derogation system will provide more tangible results.

As derogation measures are "not intended to reduce the population, but just to prevent serious damage or to protect fauna and flora"[32] but on the other hand the predators population should be maintained to a "level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level"[33] and for some species such as cormorants that level was presumable achieved in the first half of the '90s when both the conference of the parties to the Convention for the Conservation of Migratory Wildlife Species (Bonn Convention), at its fourth session (Nairobi, 7–11 June 1994) and the European Commission in 1997 decided that the cormorants population has been restored. Since then, the numbers of cormorants increased at least twice causing conflicts all over EU. In this respect it is unconceivable the strong and constant opposition of the European Commission to measures for reducing population to the level indicated by the Directive.

The quota management system allowed by art. 7 of Directive 2009/147/EC of the European Parliament and of the Council allowed for species listed in Annex II is also a science-based tool in-hand of Member States but with less bureaucracy on the fish farmers.

The restrictions imposed on freshwater fish farming in terms of predator control are intensively disproportionate, especially if it is acknowledged that pond fish farming offers a high degree of conservation for hundreds of species (plants and animals), besides its main contribution towards producing fish for human consumption.

Farmers should be entitled to defend their business from predators, as is the case with any other agricultural activity, and ensure a higher degree of fish welfare during the production cycle using any effective combination of methods without prejudicing the conservation status of the targeted species.

Welfarists' and conservationists' approaches

Animal welfarists are supportive of extensive pond fish culture, which has the potential to have a positive impact on both the environment and fish welfare. They share concerns about the impact of predation on fish welfare and on the viability of fish production systems that can be friendly to the environment as well as animals.

[30] https://multimedia.europarl.europa.eu/en/committee-on-fisheries_20211129-1645-COMMITTEE-PECH_vd
[31] https://ec.europa.eu/commission/presscorner/detail/en/IP_97_718
[32] https://ec.europa.eu/environment/nature/pdf/guidance_cormorants.pdf
[33] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147

They favour non-lethal methods of reducing predation and ensuring suitable support for farmers and environmental managers in using these methods for the benefit of prey, predators and the ecosystem. Similarly, they support subsidies for the maintenance of these freshwater food-producing ecosystems, since they provide a clear public good, both in terms of the environment and animal welfare. They also support the funding of research into new alternative non-lethal methods of reducing levels of fish predation, which is endorsed by animal welfare supporters. Where alternative methods are not effective, they also support the provision of suitable compensation.

Among animal welfare specialists, there is a strong consensus on supporting the use of lethal methods at all, based on the concerns that lethal control of animals often results in the animals killed being replaced by others in neighbouring territories, and they firmly oppose any policy designed generally to reduce population levels through lethal means.

In terms of the solutions considered by animal welfare organisations represented in AAC, it has been highlighted that a range of non-lethal methods for controlling cormorants are the only ones to be considered. Solutions, which allegedly are practically effective in reducing fish mortality in pond-based systems without causing undue environmental damage, include methods of scaring the birds. These involve various forms of human disturbance including "shooting to scare" (as opposed to shooting to kill), as well as other forms of mild harassment; auditory scares such as gas cannons and pyrotechnics; bioacoustics (e.g., playing killer whale calls in the water has proved effective with cormorants); automated scarecrows; balloons, kites and radio-controlled drones made to look like falcons, etc. New higher tech methods include the use of lasers. Methods need to be unpredictable to counter the birds' considerable ability to learn when a threat isn't real. Netting or enclosing ponds may be effective where they are appropriate and affordable.

However, for cormorants, management tools are already described by the EU Cormorant Platform, a website through which DG Environment disseminates information about cormorants, cormorant numbers, management and conflicts related to cormorants, fish, fisheries and aquaculture. The results of the *Cormorant Management Toolbox*[34] were provided by an interdisciplinary team involving the collaboration of biological and social scientific expertise, economic and political interest, and practical local experience. The same common solutions described in *Protecting your fishery from cormorants*[35] emerged from dialogue between governmental, non-governmental and fisheries associations in the UK.

On the other hand, bird protectionists are acknowledging[36] that "Cormorant impact is likely to be most significant in artificial situations, such as where fish are farmed or stocked at high densities in shallow ponds. Relatively large losses of fish to cormorants at individual fisheries have been demonstrated in a number of countries, mainly at fish-farms and around fishing gear in lakes and coastal bays" and that "cormorant predation is best managed at a local level". They are considering that there is no evidence to support Europe-wide action and, instead, alternatives to scaring and shooting should also be considered, such as incentives for preventive measures, compensation for affected farmers and industry-wide cost-sharing. Shooting should be carried out only where serious damage can be proven (the burden of proof being with the farming or fishing interest) and other methods have been tested and shown to fail. The basic principle is that shooting should be limited to site-specific scaring and should not be used to cull populations. Shooting cormorants as an aid to scaring can work, but its effectiveness varies. At some sites, shooting to kill or to scare, appears to

[34] https://ec.europa.eu/environment/nature/cormorants/files/Page_12-31_from_Cormorant_Toolbox_web_version.pdf
[35] http://twaps.co.uk/wp-content/uploads/Protecting-Your-Fishery-From-Cormorants.pdf
[36] http://cormorants.freehostia.com/WI%20-%20CRSG/carbo_statement.htm

make little difference to the number of cormorants present. At others, birds leave for a short while, but return after several weeks. Removing cormorants without reducing the attractiveness of a water body for the birds is a never-ending task.

Anyway, bird conservationists do admit that "as a last resort, where non-lethal measures are not effective alone, shooting a small number of cormorants as an aid to scaring may be appropriate. This should be under a licence administered by the relevant authorities, following an assessment to demonstrate that serious damage to the fishery is occurring as a result of predation by cormorants". Also, in their opinion, guidelines or criteria should be applied to decide whether serious damage to fisheries has occurred or is likely to occur. They also observe that several European countries (or regions within Member States) permit the shooting of an unlimited number of cormorants and/or the destruction/discouragement of new breeding colonies. For example, fishermen in Denmark are permitted to shoot cormorants within 1 km of coastal fishing gear and there is a policy to prevent the establishment of new colonies. In Bavaria, a state regulation permits the shooting of all cormorants within 100 m of any waterbody (with certain restrictions in nature reserves, national parks, etc), whereas in Saxony, fish pond owners can claim compensation from the Länder government for damage caused by cormorants. In France, where cormorants have been protected since 1972, licences have been issued for shooting at fish farms since 1992 and, more recently, large-scale shooting has been permitted in many departments.

Compromise attempt

After much discussion during the focus group meetings that the activity of some predators is affecting not only the life of farmed fish species, but also fish welfare caused by daily stress, wounds and subsequent pathological episodes, a compromise was arrived at with welfare-oriented NGOs on the following principles:

C1. Farmers are entitled to a regular compensation for their losses

C2. Farmers are entitled to defend their business from predators, as any other agricultural activity, and ensure a higher degree of fish welfare during the production cycle using any effective combination of methods

C3. Research should be intensified and financed to determine effective non-lethal methods in predator management around pond fish farms

C4. For an accurate and objective assessment on the efficiency of wildlife impact mitigation measures and the development of new mitigation measures a coordination centre on European level is essential towards ameliorating these issues.

The focus group debated on the appropriate measures to address the negative impact caused by the activity of some bird predators. Representatives of the aquaculture sector, based on their long-standing experience argued that a mixture of lethal (for a small number of individuals predators) and non-lethal methods will provide results at the farm management level. Representatives of welfare NGOs do not support lethal methods at all and highlighted the lack of scientific evidence on the long-term effectiveness of these measures.

Common Solutions to the Effects of Wildlife on Aquaculture

A compromise regarding the solutions was agreed upon, as follows:

A. Man-made ponds are essential not only for supplying an important source of high-quality food but also for providing ecosystem services to the society, out of which biodiversity creation and maintenance is essential

B. The important role of pond fish farming as a net provider of biodiversity and climate change adaptation support should be properly and publicly recognised at the decision-making levels and be consistently underpinned by aqua-environmental direct payments

C. There is a need for accurate and objective data on the impact of predation at the farm level as the data collected to far has not sufficiently documented damages

D. There is a need for an accurate and objective assessment on the efficiency of wildlife impact mitigation measures on fish farms in order to accommodate the social and economic functionality of an enterprise with its environmental role

E. There is a need to follow the aim of the Birds Directive, which is maintaining or adapting the bird population to a "level which corresponds in particular to ecological, scientific and cultural requirements, taking into account economic and leisure-related requirements"

F. Farmers should be entitled to a regular and total compensation for their losses, including higher fish prices for carp spawners or other species like pike-perch, pike or tench

G. Research should be intensified and financed to determine effective non-lethal methods in predator management around pond fish farms

H. For such an accurate and objective assessment on the efficiency of wildlife impact mitigation measures and the development of new mitigation measures such as population regulations or other management actions, a coordination centre at European level that takes into account the expertise and knowledge of fish farmers, should be considered

I. There should be support for actions aiming at reducing nesting areas and the decrease of hatching success (oiling the eggs, nest destruction, pyrotechnics, etc.) and for the introduction and financing of these methods within or close to the Natura 2000 sites

J. Based on the documentation presented to the focus group it is agreed that the activity of some predators is seriously affecting not only the life of farmed fish species, but also fish welfare, due to the daily stress, wounds, and subsequent pathological episodes

K. The focus group also recognized that the increased populations of predatory birds and mammals can cause serious damage not only in reared fish stocks in ponds and lagoons, but also threatens numerous endangered fish species populations in natural waters

Recommendations

For the reasons analysed above, the AAC, with the exceptions mentioned below, is strongly recommending the following points to the European Commission, mainly DG MARE and DG ENVI, the EU Member States and the European Parliament:

1. To introduce a coherent, regular and affective economic compensation scheme to aid freshwater fish farms maintaining their good economic and ecological functionality;

2. To improve the communication of effective practices on predator management in freshwater farms;

3. To support the development of research programmes for farmers and conservationists' partnerships on the above-mentioned issues;
4. To relax, by simplifying the derogation procedures, the restrictions in the Natura 2000 areas within the freshwater farms limits and put in place selective methods for some predators that are affecting the viability of the pond ecosystem. As the scientific data, presented above, indicate that further steps should be considered, the AAC strongly recommends the European Commission and the Member States to take effective measures leading to tangible results in order to protect wetlands such as pond aquaculture and ease the hampering bureaucracy on farmers expense;
5. To provide a report of the application of the provisions of paragraph 4 of article 7 in the Birds Directive" "Member States shall send the Commission all relevant information on the practical application of their hunting regulations" regarding *P.c. carbo* and *P.c. sinensis* and other relevant above-mentioned species;
6. To consider a European Coordination Centre to protect Europe's carp pond farming and other freshwater or estuarine/lagoons aquaculture forms, in order to objectively propose effective measures, optimum population levels and other management solutions for predatory species and so on, to meet the economic, social and environmental criteria which would equally benefit fish famers and society;
7. Further investigate the scientific data related to population management of the Phalacrocorax carbo sinensis in relation to its invasiveness and spread and in relation to any positive or negative impact upon biodiversity and related ecosystem services.

Dissenting Opinion

The following AAC members: **Foundation for the Protection of Fish** (Stichting Vissenbescherming), **Compassion in world of Farming** and **Eurogroup for Animals**, support non-harmful methods of protecting fish and compensation for farmers as requested. Stichting Vissenbescherming and Compassion in world of Farming do not agree with the use of lethal methods. Eurogroup for Animals wishes to promote coexistence and investment in non-lethal management effective methods. All policy and practical objectives and efforts should be towards non-lethal effective management.

These groups do not support recommendation 4.

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