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**A Study on the Interrelations of the Great Cormorant (*Phalacrocorax carbo*)
with Fish Populations and Aquatic Ecosystems - Facts, Conflicts and
Perspectives for the Keeping of Wildlife as an
Integral Part of Cultivated Landscapes**

- ABSTRACT -



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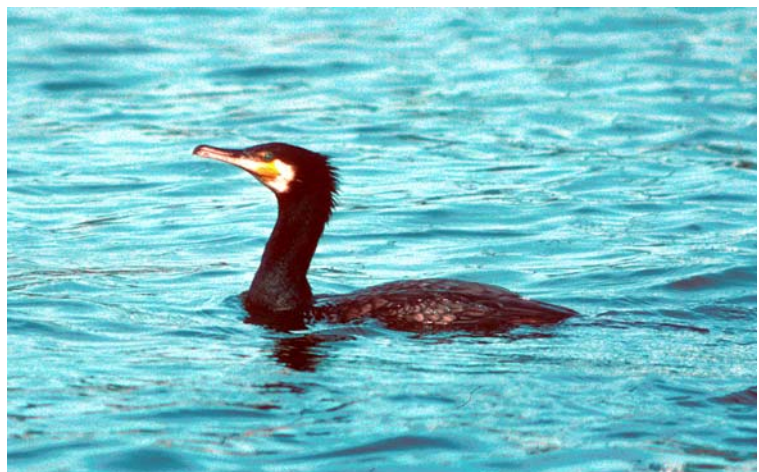
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A Study on the Interrelations of the Great Cormorant (*Phalacrocorax carbo*) with Fish Populations and Aquatic Ecosystems – Facts, Conflicts and Perspectives for the Keeping of Wildlife as an Integral Part of Cultivated Landscapes

- ABSTRACT -

0.1 Subject and study area

The main subject of this study is the compilation of scientific facts regarding the conflict between Cormorant and fisheries, aquatic ecosystems and species protection. Geographical syntheses are developed using an interdisciplinary approach and an integrated overall concept for the keeping of Cormorants in cultivated landscapes is presented.

The study focuses on the following areas: 1. Biogeographical distribution range of the Great Cormorant (*Phalacrocorax carbo*); 2. Western part of the Palaearctic distribution range of the semi-species *P. c. sinensis*; 3. European territories of the European Union and the neighbouring states; 4. Federal Republic of Germany; 5. State of Nordrhein-Westfalen.

0.2 Methods

The scientific literature on the biogeography and on the ecology of the Great Cormorant, summaries by several commissions addressing the problem sphere Cormorant-fishery-protection of endangered species in the cultivated landscape, as well as publications by various interest groups were analysed.

During an excursion in Nordrhein-Westfalen in October 2005 several of the “hot spot” sites were visited in order to assess the entire situation. The latest research results, which have not as yet been published in specialist journals, were incorporated in this study following our participation in scientific congresses.

0.3 General biology of the Great Cormorant

The general biology of the Great Cormorant has been scientifically well researched. A short overview on taxonomy, feeding, hunting techniques, reproductive biology and population ecology as well as the migratory behaviour of this fishing bird species is given. This is based on references to ornithological handbooks and relevant publications in specialist journals.

0.4 Feeding ecology of a fish hunter

The feeding ecology of the Great Cormorant has been particularly well researched over the last years because bird lovers and fishers had a strong difference of opinion on this matter. This brief overview regarding the feeding of the Cormorant is based on numerous scientific references.

0.5 Biogeographical range of a super-species

The latest scientific facts are presented regarding the biogeographical range of the super-species *Phalacrocorax carbo*, in particular relating to the forms *P. c. carbo* and *P. c. sinensis*. The originally continuous West Palaearctic population had been wiped out in many areas through human persecution; this has resulted in genetic, ecological and ethological differentiations of the remaining disjunct populations. The present Cormorant populations in the West Palaearctic Region once again form a mega-population; many fragmented populations are growing and becoming increasingly interrelated and their breeding and migratory areas are coalescing.

In the context of “Cormorant management” this means: local, regional and international measures should be linked with one another, because numerous biogeographical and population ecological aspects suggest that the European, or rather West Palaearctic Cormorant populations should be considered as a unit.

The postulate that the form *P. c. sinensis* is an exotic brought in from China into Europe (“Chinese Fisher Cormorant”) is discussed. It will be explained why *Phalacrocorax carbo sinensis* is undoubtedly an indigenous wild bird species.

The dispute regarding the keeping of Cormorants in cultivated landscapes is not about the fiction “natural distribution”, but it is about to what extent the current population densities as well as the virtual area-covering dispersion and range expansion into inland water areas (mountain streams, dams, aquacultures etc.) are helped along by humans, or rather are acceptable in a cultivated landscape.

0.6 Current population and range dynamics in the West Palaearctic Region

Population eruption and range expansion of the European populations of *Phalacrocorax carbo* during the second half of the 20th century are very well documented; this ongoing dynamic process is outlined.

Attention is drawn to the biogeographical-methodical problems with regard to an accurate recording of dispersion and population sizes of Cormorants. It must be emphasised that the “flattening of growth curves” observed in some places should not lead one to conclude that there is a decrease in the presence of Cormorants or, even worse, that the “habitat capacity has been reached”.

The last breeding population census covering Europe, which was carried out by Wetlands International, dates back to the beginning of the current decade: *P. c. carbo* (Northwest Europe, Iceland, Norway, British Isles) 120.000 breeding birds; *P. c. sinensis* (North and Central Europe) 275.000 – 340.000, (Black Sea and Mediterranean) 130.000 – 160.000; all the above mentioned populations are still increasing!

From the above one can see that a winter population in Europe of approximately 920.000 – 1.550.000 Cormorants is possible. The results of the first pan-European winter count (January 2003) undertaken by the Wetlands International Cormorant Research Group have not yet been published in their entirety; the data presented to date indicate that the populations are still increasing strongly: at this point in time probably 1,5 – 2 million specimens of the Great Cormorant live in the West Palaearctic Region.

In the centres of the recent range expansion, namely the Netherlands and Denmark, the habitats are occupied almost to their maximum capacities and it is unlikely that the breeding populations there will continue to grow significantly; despite this, the number of winter birds in the above countries is still strongly increasing.

The numbers of breeding *and* winter populations in other West European countries such as for example Belgium, Germany, England and France are still growing; the breeding range in those countries is also still expanding considerably at present, in particular as far as the new establishment of breeding colonies in inland regions far from the coast is concerned.

Furthermore the still very dynamic breeding range expansion and population eruption in North, Central and East European countries must be taken into account: Norway, Sweden, Finland, Northwest Russia, White Russia, Ukraine, Poland, Czech Rep., Austria, Switzerland.

These expansive range dynamics as well as the continuous strong population growth in the recently inhabited new breeding areas, provide sufficient grounds to allow one to conclude that the exponential population growth of *Phalacrocorax carbo* is still well short of its peak in the West Palaearctic Region, or rather pan-European region.

Even in countries that have formed part of the breeding range of the Cormorants for some time, there is still significant potential for the new establishment of small breeding colonies

along inland water habitats, where previously only resting and sleeping places existed, and in particular along still waters and rivers that are important for recreational fishing based on their structure and fish populations – therefore, increasing conflict and no “all-clear” as far as Cormorant management is concerned!

0.7 Causes of the recent population eruption and range expansion

The Great Cormorant has been eradicated in many European countries, or rather large parts of its original range during the last decades of the 19th century and during the first half of the 20th century. This fishing wild bird was rigorously persecuted because it was regarded as a pest in fishing industries.

The recent population eruption and range expansion, however, cannot be explained only by close seasons, hunting restrictions and bird reserves – or even attributed to the so-called “EU Bird Protection Law” (Directive 79/409/EEG by the Council from 2.4.1979 for the conservation of bird species living in the wild).

Several staggered and other gradual environmental factors have turned the wild bird species *Phalacrocorax carbo* from “loser” to “winner” in the course of the 20th century within the context of changing cultivated landscapes in Europe. – Briefly:

Minimum protection since the 1930’s. / New aquatic habitats due to changes to the landscape by humans. / Additional close seasons since the 1950’s. / Nutrients carried into stretches of water and growing fish populations. / EU Bird Directive since 1979. / Decrease of environmental pollutants.

The population eruption and range expansion of the Cormorant began in Europe, North America and Japan in the mid-seventies with the ban of DDT and other chemically related pesticides. This trend continued during the 1980’s with the condemnation of heavy metals, PCB’s etc. This correlates significantly both spatially and temporally with reduced water pollution through lethal and reproduction damaging environmental pollutants; but it hardly correlates with a EU directive.

Additional favouring factors: Heavy fishing of the coastal waters whereby the abundance of species, size and biomass shifted in favour of smaller fish which are more suitable as prey for the Cormorants compared to larger predatory or culinary fish species. / Growing fish farming industry. / Increasing stocking of inland waters with fish by professional and leisure fishing. / The discharge of coolants and urban wastewaters have the effect that many stretches of water no longer freeze over. / Very few natural predators.

In addition the Cormorant benefits from climatic warming: In West and Central Europe winters are such that inland waters seldom freeze over any longer for long periods of time, in other words providing habitats for winter birds. The breeding range of the Great Cormorant is expanding towards North and East Europe.

The present range of *Phalacrocorax carbo* as well as the habitats, that are not yet but will probably soon be utilized, are with regard to population density, dispersal and territorial expansion strongly favoured by changes to landscapes by humans and they are significantly bigger than the original, natural range of this wild bird species!

0.8 “Damage-scenario” versus “Harmless-scenario” and need for political decisions

The opinions of anglers, fishers and fishing biologists on the one side and animal lovers, conservationists and ornithologists on the other side in the battle over Cormorant feeding and fish populations are quite well defined by the keywords “Damage-scenario” and “Harmless-scenario”. The above also influences scientific working hypotheses.

There is a lack of tolerance and trust, communication and networks to find possible solutions and to put them into practice. Apart from that, one can criticize this culture of arguing which

orientates itself on values and philosophical beliefs rather than on hard and fast facts and figures.

Social psychologists ask for a high degree of “communication among the disputing parties” in order to solve conflicts. However, a conflict as complex as the one surrounding the Cormorant will not be solved to the satisfaction of all involved parties.

A culture of consensus in the case of “Cormorants and fish” is inappropriate, if not dangerous for endangered fish populations and fishing businesses whose existence is threatened because laws governing nature and the economical imperative are not capable of consensus but are categorical.

It is therefore necessary to have political decision-making and strong leadership of the elected decision-makers. Sufficient research results are available with regard to all biological, economical and socio-cultural aspects surrounding the subject of Cormorant, fish, fishing and nature conservation. If one is *willing* to make decisions, it is definitely possible to distinguish between scientifically based facts and obscure nature and philosophical beliefs and to develop reasonable concepts regarding the keeping of Cormorants in the cultivated landscape.

0.9 Cormorants, fish and fishing: methodical problems

Although the Great Cormorant is one of the best researched wild birds there are ongoing problems regarding the question of the real impact of Cormorants on aquatic ecosystems, fish populations and fishing: Aquatic ecosystems are complex and unique local situations are difficult to generalize.

On the basis of this argument, not only from the scientific community but also from various Cormorant commissions, a need for further research is claimed; whereby the former is of course research orientated and the latter are supposed to be target orientated as well.

Because the relationship between the fish populations and the impact of Cormorants differs at every locality and with every situation, diverse methods of approach are necessary and generalisations are open to attack. However, general syntheses are nevertheless justified if certain phenomena occur repeatedly at many sites under similar conditions.

Generalisations in ways appropriate to cultivated landscapes, drawing up of syntheses and options for political decision-makers and practical application must be allowed, because if it weren't then the “Cormorant commissions” and the research by specialised sciences on the topic Cormorant, fish and fishing would be pointless!

0.10 Cormorant, fish and fishing: Case examples and syntheses

The number of scientific and popular scientific publications about the importance of the Cormorant for fish, aquatic ecosystems, fishing and the protection of species in the cultivated landscape are almost unmanageable. It is therefore only possible to present a few case examples in this study. Numerous other papers were, however, taken into consideration when developing the syntheses and are listed as references.

Because the significance of the Cormorant for fish, fishing and surroundings is very dependant on the prevailing biogeographical, ecological and socio-economic conditions of the respective localities, it is appropriate to distinguish between different categories of waters:

Lagoons and large shallow lakes

Lagoons as well as large shallow lakes present ideal habitats for breeding, resting and overwintering Cormorants due to the extensive availability of food. In those habitats the birds form, unless they are prevented from doing so, huge colonies or concentrations with accordingly high predation pressure on the fish populations.

Because Cormorants are extremely mobile, the impact of the giant breeding colonies and resting populations, which are found along the lagoons and large shallow lakes in Europe, on aquatic ecosystems in areas close-by or more widely spread in Europe, is a major problem in the conflict between Cormorants, fish and fisheries.

Fjords

The impact on fish populations and fishing yields in such extensive and deep waters depends largely on the population density of the fishing birds. This must be taken into consideration when assessing the results of relevant literature.

The biotic carrying capacity of Nordic fjord waters as a food resource for the West Palaearctic mega-population of the Great Cormorant is significant. This is demonstrated by the numerous, large breeding colonies that are found there.

Thus the Cormorants that breed and grow up in Nordic fjord waters have not only regional but also pan-European significance for fishery and fish species protection as well as for the population and range dynamics of the Great Cormorant in the West Palaearctic Region because they make up a large part of the migratory and winter birds in Central, West and South Europe.

Fjord waters form part of migration areas of fish species such as the European salmon. It has been proven that severe Cormorant predation has a significant impact not only by harming fishery but also by threatening populations of migrating Salmon smolts and other migratory fish species such as the Eel; this despite the fact that Fjord waters and their tributary rivers aren't easy hunting grounds for the Cormorant because of their water depth and clarity.

These facts should be considered in connection with various programmes relating to the re-introduction and supporting of migratory fish species in West European rivers. Such rivers still offer a sub-optimal habitat for migrating fish with regard to artificial obstructions in waters and other man-made modifications of waters and water quality, but offer in some places good hunting opportunities for the Cormorant.

Deep lakes and barrage dams

The deeper lakes and barrage dams in the interior are characterised by fish populations that are relatively close to nature and that form part of ecosystems that have not yet been completely examined in terms of fish biology; conclusive scientific proof of a link between increasing Cormorant presence and decreasing yields in fishery is difficult.

Such oligo- to mesotrophic lakes are in principle less attractive hunting grounds for the Cormorant compared to the eutrophic lagoons and shallow lakes that are richer in fish. Hence, in the process of the recent range expansions of the Great Cormorant, the former lakes were at first only frequented as resting places during migration into the winter quarters but sometime later also frequented as overwintering habitats, and were only in the end populated by breeding colonies.

This now means predation pressure on the fish populations of the large inland waters all year round. The predation pressure in terms of population ecology is particularly severe in spring because the Cormorants effect the reproductive populations (spawn fish).

The damages to fishery by Cormorants at inland waters of several thousand hectares are largely density dependant, i.e. one can expect that a reduced presence of the fishing bird will reduce the competitive pressure on fisheries. From a fishery point of view it is therefore hardly an issue, if for the benefit of nature conservation and bird protection, and for reasons relating to national culture, *very small* (or much reduced) breeding colonies are maintained and a *reasonable* number of feeding visitors are tolerated.

Streams and large rivers

Streams and large rivers as feeding grounds are of interest to the Cormorant: fish are plenty because of the richness in nutrients; during winter most of the running waters seldom freeze over any longer due to wastewater and cooling water inductions; the bottom of the water body is easily accessible to the Cormorant, and due to man-made modifications (channelling, obstructions etc.) of streams and rivers and the conversion to waterways hardly any natural retreat areas are left for fish.

This leads to several bottleneck situations for the fish: If still waters freeze over, then all Cormorants of a particular region will congregate along the rivers. There are no secure resting places in winter in frozen still water river arms, other than would be the case in riverine meadows that are close to natural conditions. Instead, the pelagic fish are not able to withstand the current at low temperatures, they congregate in reservoirs and there they are concentrated prey for Cormorants.

Migratory fish congregate at the bottom of fish staircases – on the one hand an “eye of the needle” for fish populations that find themselves at a critical population low, on the other hand attractive food for fish hunters. At low water levels in summer, the fish are crowded together in extremely small pools or reservoirs of water, a concentrated food supply for the Cormorant, which is very critical for the fish populations with regard to predation.

Because streams and rivers in Europe can only be restored to near to natural conditions in the long-term, if at all, measures to alleviate acute damage to fishery as well as measures to solve species protection conflicts (migratory fish!) must begin with the Cormorant, because its strong presence and high density along European streams and rivers is just as “unnatural” as the waters, alongside which and of which he lives.

River dams, flooded gravel pits and natural ponds

Single natural ponds, flooded gravel pits, river dams and similar small to medium-sized still waters as well as this water category in its entirety only have minor importance with regard to feeding, or more precisely the population size of the West Palaearctic mega-population of *Phalacrocorax carbo*.

As a consequence of the shallowness and the small size of the water body in this category of waters the natural and/or introduced fish populations can be relatively easily and quickly exploited by the Cormorant, if they are found in the vicinity of a breeding colony or near a larger sleeping place, or when passing birds invade.

The small still waters thus ended up in an ecological dilemma: they are always attractive hunting grounds for Cormorants that fly in, as long as they have considerable fish populations; but if they have become exploited, then the Cormorant population does not decrease as a result of that because there still are sufficient large water bodies with rich fish populations elsewhere. – And as soon as the fish populations have somewhat recovered, stray or migratory Cormorants, or Cormorants with good memory will visit and make a clean sweep of the fish.

Keeping of a Cormorant breeding colony and fish management, or rather utilization of fish by fisheries exclude each other in small water bodies; equally problematic are larger sleeping sites (roosts), if such small waters are positioned within the foraging radius of the fishing birds, as are the sporadic visits by larger Cormorant troops that are travelling through.

Smaller rivers, little streams and channels

It is only since humans changed landscapes that the trout, grayling and barbel regions in landlocked countries and mountains were included in the closer foraging circle of the Great Cormorant (e.g. breeding colonies at the numerous barrage dams in the interior).

The coincident events of sudden or strongly increasing Cormorant presence on the one hand and the drastic decline or disappearance of fish populations on the other hand has been observed over the past two decades at a large number of flowing waters in several European countries. This has become statistically significant and scientifically offers almost irrefutable proof of the causal relationship.

The grayling is one of those species in running waters that is particularly threatened. When in danger it does not seek refuge in potential hiding places at the shoreline or at the bottom of the water but it forms swarms in the open water. The swarms can easily be hunted by the Cormorant and are eaten up entirely.

But also the brown trout, barbel as well as other typical running water species are reduced by the Cormorant to population densities that are critical for survival when there is a lack of hiding places due to the lack of structural diversity; the population survives in waters that are structurally more diverse, but no longer in sufficient numbers that would allow utilisation for fishing.

The damages to fishery and the problems regarding protection of fish species caused by Cormorant predation in small running waters are to a large extent *density independent*, i.e. overall reduced population numbers or a regionally lower presence of the fishing bird do not necessarily mean that the problems become less.

Fishpond farming and other aquacultures

The impact of Cormorants on fish populations and on yields from fishpond farming is fairly obvious. From an ecological point of view these waters are artificial, relatively small and shallow still waters with unnaturally high fish populations. The Cormorant can, with minimal effort, make a big haul, which is why areas with numerous fishponds are attractive for the establishment of Cormorant colonies. It is no exception that the birds even fly in from sleeping places or breeding colonies to smaller or larger ponds from a distance of up to 50 km because their energy balance is positive.

Losses of fish stock caused by Cormorants are direct economical losses for fishpond farming and other aquacultures. And losses not only concern eaten fish that were ready for the market. But financial losses also occur from stress-related diminished growth rates in fish and the fact that injured fish can no longer be marketed. In addition the birds transmit parasites and fish diseases. Not least of all, the costs for deterring measures have to be carried too. Such consequential losses are on occasion even higher than direct losses. The biggest management problem is that because of the Cormorant it becomes impossible to optimise stock.

Fishpond farms are quite often run in underdeveloped rural areas. Fishpond farming instantly provides employment opportunities and additional jobs. Furthermore areas with semi-intense or extensive aquacultures are attractive for tourism. If pond farming is forced to stop as a result of intolerable damages by the Cormorant it will have direct but also indirect consequences for the socio-economic structure of the entire region.

Extensive and semi-intensive fishpond farms or other aquacultures offer structurally diverse habitats for many wild animal species that are rare or even threatened in Europe's landscapes that are intensely agro-industrially farmed. In contrast to formal nature reserves they create and preserve species diversity in the cultivated landscape not costing the general public anything. Cormorants threaten the existence of such fishpond farms that are quite often run as side jobs, but also threaten entire regions characterized by aquacultures. If fishpond farming has to be given up because of intolerable damages caused by Cormorants then this will have negative effects on the biodiversity.

0.11 Predation in cultivated landscapes

This chapter presents an overview of up-to-date ecological knowledge with regard to predator-prey relationships and with regard to the real significance of predation pressure for threatened wild species in artificial landscapes:

The animal predator has fundamental regulatory functions in natural landscapes; the predator performs by instinct. These natural functions of predation may, however, in the changed environment of a cultivated landscape turn into a serious threat to ecosystems, species diversity, agriculture, utilization of waters and/or to the regional culture as a whole.

In such cases the predation pressure needs to be controlled by means of selective intervention from rationally thinking people, either by using traditional or more efficient methods.

The paramount importance of predation for the development of small game, fish populations and entire species communities in today's cultivated landscape is not only considerably underestimated but is even deliberately and systematically denied by some ideologically fixated opponents of traditional hunting, angling and wildlife management (which includes predator control) – this is not only to the detriment of hunting and fishing, but also to the detriment of the classic species protection, biodiversity and the diversity of national culture.

0.12 Top regulator, prey opportunist and ecological catastrophes

The Great Cormorant is an efficient predator who exploits his food supply if the structure of the waters allows it. Only then he moves on or establishes new breeding places. In addition the long-lived bird remembers the old hunting grounds, revisits and raids them time after time once the fish populations have somewhat grown again. – The Cormorant is a tail end species in the food pyramid but also an ecological key species, a top regulator who is able to dominate his prey populations and entire water ecosystems, and not just locally.

On the other hand this bird is biologically highly specialised on fishing and completely dependant on fish as food resource. He is however extremely opportunistic with regard to hunting methods and prey fish species, and he is exceptionally mobile. The hunting grounds of this Great Cormorant are almost unlimited; the population size in total and medium-term is therefore not restricted by locally low fish populations, seasonally low food availability or various deterrents including shooting, but is restricted by regional and *supra-regional* food availability.

The ongoing range expansion and the still growing populations of the Great Cormorant in almost all European countries prove that this boundary has not been reached yet. And should this ever happen in the future, then it is foreseeable that the long-living Cormorant will not suddenly decline in numbers, because on a fairly long-term basis his population size is regulated by the capacities of his *supra-regional* habitat, in particular via food availability and reproductive success. To the contrary, the West Palaearctic mega-population will find its levels at high numbers and exploit the fish productivity in all waters of the distribution range.

This means: Locally low fish populations have no chance to recover from a population low if the entire Cormorant population remains high – on the basis of high food availability elsewhere. Similarly fishers and anglers have little prospects of a significant share in biologically feasible fish production from coastal and inland waters, should the “levelling out” of the population densities of *Phalacrocorax carbo* exclusively be orientated on the biological habitat capacities of the European cultivated landscapes without effective human interference.

No local equilibrium will therefore develop between the predator Cormorant and the fish populations within the foraging radius of a breeding colony or a sleeping place, as is to be expected from a predator whose population size is *indeed* determined by the capacity of its habitat – because the food basis of the predator is in this case not restricted to the *local* food supply.

An intra- and supra-regional mosaic evolves due to the high mobility and flexibility of the Cormorant: Population collapses on a local to regional scale can be observed in some areas (fish populations and Cormorant populations), while newly established breeding colonies with eruptive growth are observed in other areas (until the food resources are exploited there) – the predator’s population eruptions, on a local to regional scale up to the point where its population collapses due to the lack of fish food, are thereby synonymous with the complete skimming of fishing productivity by the fishing bird at larger lakes and rivers as well as with extinction of entire fish populations in smaller waters.

Dynamic mosaic-like cycles with catastrophic population and ecosystem collapses are not unusual in natural landscapes; the widespread belief of “the ecological equilibrium” or “the equilibrium of nature” among ecological laypersons is thus nothing more but a nature lover’s “pipe dream” fiction. However, a dynamic-chaotic interplay between Cormorant and fish populations within the context of cultivated landscapes cannot be tolerated because it will make management of fish and sustainable utilization impossible.

0.13 Keeping of wildlife as an integral part of cultivated landscapes

Principally we understand by “wildlife” not only large animal species living in the wild but - in a broader biogeographical sense – all species living in the wild, including small animals, fish and plants as well as the wild habitats in the sense of the *conservation* of “wildlife”.

The term “keeping of wildlife” incorporates an aspect of *utilization*, namely the sustainable utilization of stock or populations of non- or barely domesticated wild species, in particular trees, hoofed game, small game and fish. On the other hand, “keeping of wildlife” also means *preservation* of habitats in the wild, of “wilderness” and “nature”, i.e. of landscapes that are close to natural conditions, ecosystems and biodiversity as a whole – namely by means of proactive management of landscape ecosystems and biodiversity.

The general objective of wildlife management in the cultivated landscape is always (sustainable) development, conservation, designing and utilization of geosynergetic-dynamic biodiversity for the benefit of humans in the landscape. Not only landscape ecological but also socio-economic, economic, cultural as well as political aspects are considered in this regard.

If such an integrated and dynamic system of wildlife management fits in with the prevailing physical, economical, social, political and cultural conditions in a landscape, then this is “keeping of wildlife as an integral part of cultivated landscapes” (phaenotypical, functional and cultural landscape in the geographical sense).

Wildlife management may mean “control management”, for example to prevent and reduce damages by game in the cultivated landscape. In this study this is a focal point with regard to the “problem species” Cormorant. Control management is not limited to population control of “pests” but there is also an attempt to reduce ecological and socio-economical susceptibility to damages. Sometimes predation control is only possible if predator populations are reduced in a well-directed manner and are kept at a level that agrees with regional/national culture and conservation of biodiversity – as is the case with the Cormorant.

0.14 Concepts for keeping Cormorants as an integral part of cultivated landscapes

Our concepts regarding the keeping of Cormorants in ways that are acceptable in a cultivated landscape environment range within the framework of the fundamental concept for keeping of wildlife as an integral part of cultivated landscapes, as outlined above. Thus socio-cultural realities, for example increasing alienation from nature in large circles of the population, combined with progressive *ecologistic* dogmatism of nature conservation politics past all political party boundaries, as well as legal norms have to be taken into consideration.

We nevertheless don’t abandon the foundations of classical natural-scientific ecology, the foundations that are anchored in the laws of nature. Where laws, guidelines or regulations

collide with laws of nature or stand in the way of acceptable options to act, this will be pointed out and proposals for modifications or removals will be made.

0.15 Main targets and crucial points with respect to keeping Cormorants as an integral part of cultivated landscapes

The Great Cormorant (*Phalacrocorax carbo*) is an indigenous wildlife species in all European countries. Required control management ought not to threaten the existence of the Cormorant at waters that occur within the natural range of this bird species.

Breeding colonies, sleeping roosts and other congregations of this magnificent bird are enrichment to the landscape picture. Therefore Cormorants should be preserved and managed even at waters that are clearly not part of the natural range of this bird species – so long as it is compatible with the protection of fish species and fish farming.

There is no expert reason not to generally release the Great Cormorant as waterfowl that can be shot legally and not to allow for a sustainable utilization by means of hunting, as it is customary with other common bird species living in the wild. Liability for wildlife damages in accordance with the “*polluter pay principle*” should, however, be dependant on the extent to which the Cormorant receives supporting management.

Rare wildlife species, in particular prey fish of the Cormorant, but also other birds living in the wild, threatened plants or sensitive aquatic ecosystems ought not to be threatened by Cormorant management. Conservation of the biodiversity takes priority, namely according to the precautionary and plausibility principles because the Cormorant is very clearly no longer a threatened wildlife species.

Economical livelihood and attractive investment capital returns from aquacultures, fishpond farms and commercial fishery ought not be threatened by the Cormorant, especially as extensive fishpond farming and commercial fishery besides the socio-economical positive functions as free business entities also offer cultural values (on a regional level) and last but not least have nature conservation functions. The precautionary and plausibility principles also apply here.

Although fishing clubs are not profit orientated, they nevertheless contribute to economical added value and creation of jobs. Leisure fishing has important social and economical functions in urban and rural areas. Fishing clubs and leisure fishing form part of the culture of a region. Fundamental functions of leisure fishing are equal in value to bird conservation and should not be threatened by the Cormorant.

A colony of large wild birds at a water close to an urban centre can be equally attractive for the local community with respect to leisure and recreational values as a fishing pond. A bird conservation club could possibly also exercise the economical, socio-cultural and ecological activities of a fishing club. For this, however, the public keeping of wild birds in the cultivated landscape would have to be economised in a similar fashion as the keeping of wild fish by angling clubs. Although the latter are charitable organisations and therefore enjoying tax relief, they are at the same time businesses that have to calculate sharply and can only survive if they don't ignore economical imperatives. Where nature conservation associations and/or paying birders are not able to adequately replace the ecological, economical, social and cultural functions of the leisure fishing, one needs to adapt the keeping of Cormorants to the requirements of aquatic habitat management and optimal fish stocks for leisure fishing.

Efficient control management involves financial investments and constant expenses. The currently still growing West Palaearctic mega-population of the Cormorant is favoured by human factors that cannot be attributed to a single cause. Thus the public, in other words the state, as well as, on a European scale, the countries in which the important breeding colonies occur, are financially responsible for the supra-regional population control.

In areas where Cormorant management is carried out exclusively or predominantly in the interest of fishery it is necessary to involve anglers and fishers in a pecuniary way in order to guarantee a sensible relationship between expenditure for control measures and economic value to fishery. In areas where the expenditure for Cormorant control is mainly caused by protection and support of the bird, the institutionalised bird conservation should pay for it.

Fishing damages that are not the result of the generally high Cormorant population in the West Palaearctic Region and that are also not provoked by the attraction of aquaculture to the passing Cormorants but are caused by breeding colonies and/or sleeping communities that are protected or supported along important fish waters, those damages should always fall under the liability for damages caused by wildlife.

Regulations in conservation law regarding damages caused by wildlife are urgently needed for keeping and management of problem species in the cultivated landscape – analogous to liability for damages caused by game within the hunting law. To what extent one should involve the state, private persons, bird conservation clubs or nature conservation associations, depends on the current position of interests. Principle: Involvement in the protection or the support of Cormorants at sites that are critical to fishery must be linked to pecuniary input.

Cormorant control is relevant in the context of animal welfare. Ethical hunting complies with principles of animal welfare; any other restrictive interference with the Cormorant requires a sensible reason. Such a reason exists when such measures are necessary within the framework of keeping of wildlife as an integral part of a cultivated landscape. Cruelties, unnecessary pain and suffering have to be avoided at all costs.

Concrete targets and measures may but do not necessarily have to be fixed in management plans. Landscape ecosystems and pluralistic societies are dynamic and open ended. Bearing that in mind control management can only be performed in a manner that is acceptable in the cultivated landscape environment and be successful on a sustainable basis if it is not rigidly formalised and laid down in bureaucratic regulations but instead is proactively-adaptively orientated and if it allows as much room for manoeuvre as possible for the affected parties.

No principal decision is needed, if one wants to control the total number of Cormorants or the damage at specific sites by keeping the birds away from certain places. Both strategies and any further options should be integrated in a manner that is ecologically efficient and acceptable in the cultivated landscape environment. Furthermore management concepts should be concerted in different spatial dimensions, ranging from a single site to district and regional state level as far as into national and pan-European dimensions.

At a local level numerous non-lethal protection techniques and options to deter Cormorants, habitat modification as well as shooting are available methods to reduce problems. All these measures are, however, very time consuming and cost intensive, they have to be constantly sustained. And at supra-local level they still don't mean more than a mere shifting of the problem to other waters because the problem birds don't dwindle away in total due to the high mobility of the Cormorant.

The total population of Cormorants needs to be reduced to complement all local efforts, *de facto* this means: strong, concerted interventions on size and dispersal of breeding colonies at pan-European level, if possible. It also means continuously high shooting figures in the migration areas. – This, if done efficiently, is also very time consuming and expensive control management: long-term it can only be sustained if it is proportional to the economical damages that are indeed caused by Cormorants, and if both, the damaged parties as well as bird conservationists, are forced to be involved in a pecuniary way and/or through actions.

Biologically efficient and humane control of the Great Cormorant solves the scientifically and economically tangible problems for fishery and the conservation of wild species, without ignoring the viewpoints of bird lovers and animal welfare which are, though understandable, rather based on psychic and ideological grounds than on facts. And most importantly, at the

very end there are vital fish *and* Cormorant populations in a cultural landscape that is alive – surely THAT represents the fundamental consensus of all involved parties.

0.16 Legal aspects of keeping Cormorants

Numerous aspects relating to management of problem birds in the cultivated landscape touch upon more or less meaningful legal norms – not least of all this is the reason that supra-locally coordinated keeping of Cormorants or pan-European concerted management of the West Palearctic mega-population of *Phalacrocorax carbo* do not exist yet.

The Great Cormorant for example still enjoys the general protection under the EU Bird Directive (Directive 79/409/EEG by the Council from 2.4.1979 on the conservation of bird species living in the wild, the so called “EU bird protection law”). This means that a member state may permit population control only if there is proof of significant damages in fishing areas or negative effects on species protection. In this regard it is sufficient if one member state announces to the EU commission that such damages exist and if this member state reports every year on the control shootings.

The implementation of the EU Bird Directive took place in Germany under the Nature Conservation Act (BNatSchG). – Germany took a step further than actually required and put all European bird species under special protection apart from a few exceptions. *P. c. sinensis* enjoys general species protection and also belongs to the specially protected species.

Provisions are made for special exemptions from the killing prohibition in article 9 of the EU Bird Directive. It would make sense if those were applied to the Great Cormorant, for example with regard to cooperation between the states (within the Federal Republic of Germany) in Cormorant management as there is a close link between the breeding areas in North Germany and the damages right through to the South and because the problem cannot be solved regionally. Such exceptional cases are, however, restricted in the BNatSchG beyond the intention of the EU Directive.

In accordance with article 9 clause 1 lit. a) of the EU Bird Directive it is proposed to convert the exemptions from the killing prohibition 1 to 1 in the Nature Conservation Act in order to quickly eliminate the legal inconsistencies that currently exist in Germany.

It would also be useful to list *Phalacrocorax carbo* in the appendix II (bird species that are allowed to be shot legally) of the EU Bird Directive and to include the Great Cormorant in the list of game animals under the Federal Hunting Act (BJG).

A practical and legal problem is the question of property damages as a result of Cormorant protection.

As fish populations damaged by Cormorants in rivers and, as a rule, in lakes are ownerless, even if the fish originate from stock that the holder of the fishing rights has put in and financed, the Cormorant causes as ownerless animal in the wild *de jure* only damages on the population of other ownerless animals living in the wild. It is therefore not a matter of personalised agricultural damages like those that fishpond farms can claim for.

Nevertheless one has to take into consideration that the fishing rights – irrespective whether it is about independent fishing rights or owner’s fishing rights – represent a right *in rem*, similar to property rights, and they fall under the protection of article 14 GG. Those rights can be undermined if the state does not allow measures to be taken for the reduction of Cormorants, or if the state fails to provide effective protection of fishing and appropriation rights.

State compensation payments in the case of fishpond farming are customary in some countries, provided appropriate proof of “disproportionate” damage is produced. In some states proven damages were financially compensated for in total or in part, whereby, however, pecuniary replacement relates to “eaten up” property only and not to the lost profit and turnover opportunities as well as costs that are incurred by measures to deter Cormorants. In other states as a principle no compensation payments are made. Instead, on the basis of paragraph

48 subparagraph 8 clause 4 BnatSchG, general regulations with exemption clauses from the killing prohibition have been issued for Cormorants. These, at least, render the ruling of individual cases invalid.

But the Cormorant regulations that exist to date are no substitute for efficient control within the sustainable concept of managing wildlife in ways that are acceptable in a cultivated landscape environment resp. keeping Cormorants as an integral part of cultivated landscapes. The existing and exponentially growing problems therefore cannot really be solved for fishery and fish species protection, for value adding businesses in the private sector as well as for fishing clubs which are active in wildlife management and which are important socio-economically and with respect to the regional culture.

A global solution would probably be most meaningful because the Great Cormorant is not the only problematic species living in the wild where a set of legal rules and regulations is missing with regard to its management and control in the cultivated landscape; a set of rules and regulations that does justice to the dynamics of landscape ecosystems as well as to the biogeographical and wildlife ecological insights gained over the last decades.

0.17 Management strategies: West Palaearctic and European dimensions

If sterilisation of clutches of eggs is the only control measure applied then it takes many years until the parent bird population gradually decreases and until declining reproduction has an effect on the total population; and in view of the strong migration pressure only really in case that such measures are not just regionally restricted to a few small countries but are carried out in all breeding colonies over the entire range of the West Palaearctic mega-population of the Great Cormorant, and are kept up for years.

In order to efficiently reduce the critically high predation pressure (that exists in all European shore and inland waters) on the fish populations that are economically utilized by fishery and/or are threatened by the West Palaearctic mega-population of the Great Cormorant, it will be necessary to significantly reduce the entire population far more quickly.

At least 50.000 Cormorants are currently shot in Europe every year. This does not take into account the illegal killings that are possibly not insignificant. This has, however, not held up the growth of the West Palaearctic mega-population of *Phalacrocorax carbo* as is shown by the still high and even increasing figures from the synchronized counts that were carried out in autumn and winter, and as shown by the ongoing range expansion in many places in the form of new and growing breeding colonies.

All experts who are organised in the Wetlands International Cormorant Research Group and who are by no means suspected of being particularly friendly towards fishery agree in what way efficient population management within the West Palaearctic and European dimensions (but also at secondary regional levels) needs to be applied provided that maximum or minimum numbers are defined and which should be kept:

Every year, adult breeding birds should be killed where they are easiest reached and where they can be most precisely counted, i.e. in spring at breeding places. For reasons of animal welfare as well as out of consideration for a sensitive public this should happen before the hatching of chicks, should be performed by experts and be offensively-informatively accompanied by communication experts, but shielded from direct observation. – And because protest campaigns by extremist animal rightists, despite that, cannot be avoided, steadfastness by the political decision-makers is essential.

From a biological-pragmatic point of view as well as within the context of sensible keeping of wildlife with clear objectives, such a control of breeding parent birds in spring has anyhow one rare advantage with respect to monitoring of the population development and with respect to the preservation of this wild bird species:

Sustainable population control of the Great Cormorant, whose reproductive specimens congregate in spring at easily visible breeding places and who breed in colonies, is much easier than control of problem species that live secluded.

Only if index numbers are exceeded at the start of the breeding season, excess parent birds have to be killed selectively and breeding places to be dissolved. – It is not the intention to ruthlessly fight the bird as happened in the past, but the breeding populations are supposed to be selectively limited supra-regionally, regionally and locally in their range and dispersal as well as in maximum numbers (breeding pairs).

If one takes into account, however, that, according to the German delegation in the Bonn convention for the conservation of migratory wild species, the total population of the Great Cormorant was already in 1979 considered too high by about 25 % and has significantly grown since, then the present breeding population in the West Palaearctic Region ought to be reduced by about 50%, in order to conform with a level that is acceptable to fishery.

For ecological, logistical, infrastructural, administrative, personal and financial reasons and in terms of social politics this can only be realised, if at all, with great difficulties. The fears of some bird conservationists that the population of the Great Cormorant could be threatened by control management are in any event unrealistic if one considers the huge practical difficulties and the continuously high costs of a pan-European concerted breeding population control programme including monitoring.

The approximately 10 year old idea of a concerted control of the breeding populations in all countries of the West Palaearctic-African range of *Phalacrocorax carbo* has remained untested but not for practical reasons. The implementation has and still is prevented by eco-political curiosities that will be outlined in this study.

0.18 National dimensions: Federal Republic of Germany

A pan-European concerted control management of the Great Cormorant can hardly be reckoned with in the near future, although renewed political attempts at European level on the part of Germany seem urgent: but in the face of the quarrelling about national autonomy even concerted actions by a “core group of willing people” should be feasible as a sub-optimal solution. – But irrespective of whether such an international cooperation succeeds or not, a national concept for Germany for a lasting solution in the conflict surrounding Cormorant, fish, fishing, and preservation of the biodiversity in aquatic habitats will need to be based on two main biogeographical pillars:

1. Reduction and regulation of the size of the national breeding population of *Phalacrocorax carbo* to approximately 50% of the habitat capacity, in order to efficiently shrink the critically high total predation pressure on the fish populations that are utilized by fishery and/or on the threatened fish populations in almost all coastal and inland waters of Germany.
2. Protection, deterrent and dispersion control measures on a local to supra-regional scale; this has to be habitat adapted for damage prevention or reduction in those places and regions that are particularly attractive to the fishing bird or that are very sensitive with regard to predation on threatened species of fish.

An integration of both control strategies is required at national level, as well as at West Palaearctic and regional levels. Those control strategies appear to be conflicting only in the political discussion about a pan-European control management:

Both, supra-local control of the population density of the Great Cormorant, or rather of the total predation pressure, *and* local fishery and Cormorant management or rather handling of the habitat-specific situation.

The core points of a control management in the Federal Republic of Germany are compiled in this study and legal obstructions are discussed. Furthermore reasons are presented why the currently planned inclusion of the Great Cormorant in the list of the game species (that are

allowed to be shot legally) in the Federal Hunting Act (BJG) won't lead to a significant reduction of the predation pressure and why it won't lead to a relief for prey fish species that are threatened in their existence, for fishery businesses and fishing clubs. Perspectives are shown for future lawmakers who are perhaps willing and capable to carry out real reforms.

0.19 Regional level: Nordrhein-Westfalen

Bearing in mind the unfavourable prospects for pan-European or national concerted management, a concept for keeping Cormorants as an integral part of cultivated landscapes is immediately burdened in a small country like Nordrhein-Westfalen by the immensely high migration and dispersion pressure in the West Palaearctic range of *Phalacrocorax carbo*:

Since the European mega-population of the Great Cormorant is still growing exponentially and since its breeding dispersal and also the migrating and overwintering areas are expanding purely territorially as well as into new habitats, it has to be reckoned with that the total numbers of breeding, summer, flocking, migratory and winter birds in Nordrhein-Westfalen will continue to grow, that the number of sleeping places will increase accordingly, that the existing breeding colonies will still grow strongly and that new breeding places will form at all fish waters in the state – unless efficient counter-measures are taken and are kept going long-term.

The desired conservation of the Great Cormorant as breeding, summer, flocking, migratory and winter bird in Nordrhein-Westfalen has to be reconciled with the fact that all protection measures for this bird, may they relate to undisturbed refuges in bird and nature reserves or relate to limited deterring measures at some pacified places, will immediately lead to local concentrations of the feathered fisher. This again will mean increased pressure on fish populations that are commercially utilized and/or threatened fish species as well as on other wildlife species in such habitats as well as within the foraging circle of such places of refuge.

If after all control of the Cormorant presence and the predation pressure on fish populations is desired in Nordrhein-Westfalen – and this is certainly indispensable in the interest of the conservation of fish species as well in the interest of the preservation of commercial and leisure fishing – then a control concept has to take effect that is area covering. Compromises with regard to exempting formally established nature reserves from control management would undoubtedly result in a concentration of Cormorant problems at exactly those locations as well as in the foraging range of the respective breeding and sleeping places. If one was to draw circles with a radius of 30 km around all of Nordrhein-Westfalen's bird and nature reserves that represent actual or potential sites for Cormorant sleeping places, then there is no fishing water in Nordrhein-Westfalen that is not located within the fishing range of such protected Cormorant settlements.

Crucial points of Cormorant control management in Nordrhein-Westfalen are summarized in this study. In this context it will be commented in detail on the draft (dated: 29.9.05) for a regulation regarding the admission of exemptions from protection directives for specially protected animal species (Cormorant-VO) for the state of Nordrhein-Westfalen, including reasoning (dated: 30.9.05):

If no further necessary regulations are issued, then this Cormorant-VO for Nordrhein-Westfalen will treat the ultimately lethal effects of uncontrolled Cormorant predation on fish species conservation, fishpond farming, commercial and leisure fishery including supporting businesses only symptomatically-sedative instead of systematically-curatively and won't be able to avert the unpleasant final result with regard to the countless economical, social and cultural functions of fishery.

0.20 Protection from Cormorant damages: technical, economical and practical aspects

Many deterrents have been developed which are supposed to protect fishing waters from Cormorant feeding. In this study these are not described in detail because this has already been done elsewhere. What is, however, missing from the relevant studies and summaries, because they are mostly from Ornithologists, is the insight into business constraints and economical relationships. Fishpond farming businesses and the option “spanning of nets across ponds” are discussed here as examples. In addition technical, economical and practical aspects of “lethal deterrents”, of the laser rifle and of the population regulation in breeding colonies are presented. Lastly the subject “disturbances” of other wild animals brought about by Cormorant control is treated in more detail.

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